MECHANIZE

INTERNATIONAL CONFERENCE ON
"ADVANCED MECHANICAL ENGINEERING
2020-2021" (ICAME 2021)

7TH & 8th February 2021

Souvenir

Department of Mechanical Engineering
K L University
Greenfields, Vaddeswaram, Guntur District, Andhra Pradesh-522 502

INTERNATIONAL CONFERENCE ON
"ADVANCED MECHANICAL ENGINEERING 2020-2021"

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Organized by

Department of Mechanical Engineering
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About Department of Mechanical Engineering, K L University

Koneru Lakshmaiah Charities was established as a trust in the year 1980 and started KL College of Engineering in the Academic year 1980-81. The trust was converted into a Society by the name Koneru Lakshmaiah Education Foundation in the year 1996. The KL College of Engineering has attained autonomous status in the year 2006 and in February 2009, the KoneruLakshmaiah Education Foundation was recognized as Deemed to be University.

The University is situated in a spacious 100-acre campus on the banks of Buckingham Canal of river Krishna, eight kilometers from Vijayawada city. Built within a rural setting of lush green fields, the institute is a virtual paradise of pristine nature and idyllic beauty. The campus has been aptly named as "Green Fields" and the splendid avenue of trees and gardens bear testimony to the importance of ecology and environment. The campus ambience is most befitting for scholastic pursuits. The University has been situated on a built up area of around 15, 00, 000 Sq.ft.

The Department of mechanical engineering at K L University was established in the year 1980-81 with an aim to provide scientific and technical solutions to mankind. Mechanical Engineering is a congregation of science and technology which embeds basic principles of Physics, Mathematics and Chemistry. The Department went for accreditation by NBA of AICTE for the first time in 1986, and was accredited for three years. The department also attracts foreign students from Nepal and Bhutan.

The Department offers a four year undergraduate engineering degree in Mechanical Engineering with specializations in computational fluid dynamics, Robotics and design and Manufacturing. The department offers a post graduate course in Thermal engineering.Robotics and Machine Design which is embedded a one year project in an industry/research organization. The Department offers PhD programs in vivid specializations on a full time and part time basis.

The strength of the department is its very rich treasure of faculty who were drawn from reputed National and International Academic and research organizations. Faculty with good industrial experience and exposure are also a part of our team at the Department of Mechanical Engineering. Faculty with post doctoral research experience and faculty with more than 15 years of experience are feathers in the cap of our department.

The faculty of the department is extensively involved in quality Research and Development. The Department over the last three years has acquired projects worth more than 3 crores in the areas of MR dampers,Roborics and Bio medical applications in vivid fields of mechanical engineering funded by prestigious research organizations like DST, UGC and SERB. The Department has filed patents with IPO in collaboration with industry and a few from sponsored projects.

The Department has 5 well furnished and fully equipped state of the art laboratories along with 3 research centres. The department also has its own computer center with latest ANSAYS,CATIA &PROE software purchased from Adroitech.

As a part of student centric learning various measures and initiatives are taken to improve the skills of students.These include exposure to guest lectures, industrial training and tours, communication and soft skills, Mini Projects, paper presentations in national level paper contests, class room seminars, placement opportunities, academic and career counseling, certificate courses, live projects in industry, exposure to journals and so on.

Another area of concentration for the faculty is Research consultancy. The department has signed MoU's with Liners India, Vijayawada and Kumar Pumps, Kusalava International, for faculty and student training and collaborative research. The department of Mechanical Engineering is collaborating with Indian Institute of Science, Bengaluru and University of Singapore, UK for initiating collaborative research in Mechanical Engineering.

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Er.Koneru Sathyanarayana
President, K L E F

Message

Warm and Happy greetings to all.

I am immensely happy that Department of Mechanical Engineering of our K L University is organizing an ***International Conference On Advanced Mechanical Engineering 2020-2021*** **(ICAME-2021)** during 7th & 8th February, 2021 and is going to discuss on a collection of technical papers in the proceedings.

Department of Mechanical Engineering, K L University continues to march on the way of success with confidence. On this occasion, I wish all the very best.

I congratulate HOD, staff members, students of Department of Mechanical Engineering, Delegates and Participants from different parts of the country and nations for their efforts in participating in this conference and wish the conference all the success.

K. Sathyanarayana

Sri Koneru Raja Hareen
Vice-President

Message

I am glad to learn that Department of Mechanical Engineering, K L University in collaboration with Association of Biotechnology and Pharmacy is organizing a ***International Conference On Advanced Mechanical Engineering 2020-2021*** **(ICAME-2021)** during 7th & *8th February 2021*.

It is heartening to know that the International national Conference-ICAME-2021 is being organized with the objectives to strengthen the current national and international scenario of Biopharmaceuticals; scaling up from research to production and their usage; thereby prevention and protection from many deadly diseases/ disorders.

I wish the conference all success.

K. Raja Hareen

Dr.L.S.S.Reddy
Vice-Chancellor

Message

I am delighted to know that the Department of Mechanical Engineering of our K L University in collaboration with Association of Biotechnology and Pharmacy is organizing a ***International Conference On Advanced Mechanical Engineering 2020-2021*** **(ICAME-2021)** during 7th & 8th February, 2021. It gives me an immense pleasure that a souvenir is also being brought out.

I am sure that it will provide a platform to discuss the research in Mechanical Engineering happening throughout the world. I hope that the participants from all over the country and abroad would interact on the subject for upgrading their knowledge and skills to enhance their utility to the Biotechnology sector.

My best wishes for the success of the conference.

L.S.S. Reddy

Dr.D.V.A.Rama Sasthry
Head, Department of Mechanical Engineering
Convener, ***ICAME-2020***

Message

I, on behalf of the Faculty of Mechanical Engineering feel proud in organizing a International Conference On Advanced Mechanical Engineering 2020-2021 (ICAME-2020) during 7th and 8th February, 2020. During the conference, participation of people from different disciplines is expected to take place on common platform and hence there would be sharing of views with eminent speakers from all over the world wherein exchange of their knowledge and skills in Biotechnology will happen. This conference will help the students, researchers and academicians to interact with professionals.

I hope the conference a grand success.

A. Srinath

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POWER FRAMEWORK RECONFIGURATION AND MISFORTUNE MINIMIZATION FOR A CIRCULATION FRAMEWORKS UTILIZING BACTERIAL RUMMAGING IMPROVEMENT CALCULATION

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ABSTRACT

In this paper, a method based on bacterial foraging optimization algorithm (BFOA) is proposed for distribution network reconfiguration with the objective of loss minimization. A novel model to simplify a distribution network is presented. The feeder reconfiguration problem is formulated as a non-linear optimization problem, and BFOA is used to find the optimal solution. According to the characteristics of distribution network, some modifications are done to retain the radial structure and reduce the searching requirement. Test results of a 33 bus sample network have shown that the proposed feeder reconfiguration method can effectively ensure the loss minimization, and the BFOA technique is efficient in searching for the optimal solution.

Key words : Methods,BFO, Networks, Problem,etc.

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STUFFED BED SEGMENT THINKS ABOUT FOR THE EXPULSION OF MANUFACTURED COLORS FROM MATERIAL WASTEWATER UTILIZING IMMOBILIZED DEAD C. TROPICALIS

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ABSTRACT

An efficient dye bio sorbent was developed for the treatment of textile wastewater by entrapping dead cells of C. Tropicalis, within sodium alginate matrix. The bio sorbent performance was evaluated in packed bed column with different pH (3 to 6), wastewater strength (25%, 50% 75%), bed height (5cm-15cm) and flow rate (0.5mLmin -1 to 1mLmin -1). pH 5, undiluted wastewater, bed height 15cm and flow rate 0.5mLmin -1 were found to be optimum for dye bio sorption. The linearized form of the modified Thomas model equation fitted well with the experimental data and described the dynamic adsorption of synthetic dyes from textile wastewater. The Bed depth service time model was used to express the effect of bed height on breakthrough curves. Dye laden immobilised dead C. Tropicalis was regenerated using 0.01molL -1 NaOH at an elutant flow rate of 1mLmin -1. The reusability of the immobilised biomass was tested in consecutive adsorption-desorption cycles. The FT-IR spectral analysis showed the involvement of amine, hydroxyl, carbonyl, amide and phosphoryl groups in biosorption of dyes from wastewater. The analysis of treated samples showed almost zero colour and a significant decrease in Total Dissolved Solids (TDS).

Keywords:TDS,NaOH,FT-IT,etc.

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Y.V.S.S.S.V.Prasad Rao, Bandreddi Rajiv Kumar, B Venkata Sree Hari Charan

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ABSTRACT

Use of various plant materials for the biosynthesis of nanoparticles is considered a green technology, as it does not involve any harmful chemicals. The present study reports that silver nanoparticles (Ag NPs) were synthesized from a silver nitrate solution by commercially available plant powders, such as Solanum tricobatum, Syzygium cumini, Centella asiatica and Citrus sinensis. Ag NPs were characterized by UV-vis spectrophotometer, X-Ray Diffractometer (XRD), Atomic Force Microscopy (AFM) and fourier transform infrared (FTIR) spectroscopy. The formation and stability of the reduced silver nanoparticles in the colloidal solution were monitored by UV-vis spectrophotometer analysis. The mean particle diameter of silver nanoparticles was calculated from the XRD pattern, according to the line width of the plane, and the refraction peak, using Scherrer's equation. AFM showed the irregular shapes of Ag NPs, and the formation of silver nanoparticles was found to be 53, 41, 52 and 42 nm, corresponding to Syzygium cumini, Citrus sinensis, Solanum tricobatum and Centella asiatica, respectively. FTIR spectroscopy confirmed the presence of protein as the stabilizing agent surrounding the Ag NPs. Antimicrobial activity of the silver bio-nanoparticles was performed by a well diffusion method. The highest antimicrobial activity of Ag NPs synthesized by C. sinensis and C. asiatica was found against Pseudomonas aeruginosa (16 mm). The Ag NPs synthesized in this process were found to have efficient antimicrobial activity against pathogenic bacteria.

Key words : Nano particles, FTIR, AFM, XRD, etc.

TORSEMIDE AND FUROSEMIDE AS GREEN INHIBITORS FOR THE CONSUMPTION OF GENTLE STEEL IN HYDROCHLORIC CORROSIVE MEDIUM

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ABSTRACT

The performance of torsemide and furosemide drugs as corrosion inhibitors for mild steel in 1 N HCl was thoroughly investigated by weight loss and electrochemical methods. The inhibition efficiencies of drugs obtained by all methods were in good agreement with each other. Torsemide exhibited higher inhibition efficiencies than furosemide in all the experimental studies. Polarization studies revealed that the inhibiting action of the compounds is under mixed control. The free energy of adsorption and the influence of temperature on the adsorption of inhibitors onto a mild steel surface have been reported. The adsorption of the compounds was found to obey the Langmuir adsorption isotherm. The mechanism of inhibition and formation of the Fe-inhibitor complex were confirmed by FT-IR and UV-visible absorption spectral analysis. The scanning electron microscopy (SEM) and atomic force microscopy (AFM) results established the formation of a protective layer on the mild steel surface. Quantum chemical calculations were applied to correlate the inhibition performance of inhibitors with their electronic structural parameters. © 2013 American Chemical Society.

Key words:HCL,performance,methods,agreement,etc

IDEAL VALUE MARKING DOWN AND PARCEL ESTIMATING ARRANGEMENTS FOR PERISHABLE THINGS IN A PRODUCTION NETWORK UNDER PROPEL INSTALLMENT PLAN AND TWO-ECHELON EXCHANGE CREDITS

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ABSTRACT

In this paper, an effective approach, Taguchi grey relational analysis, has been applied to experimental results of wire cut electrical discharge machining (WEDM) on Inconel 825 with consideration of multiple response measures. The approach combines the orthogonal array design of experiment with grey relational analysis. The main objective of this study is to obtain improved material removal rate, surface roughness, and spark gap. Grey relational theory is adopted to determine the best process parameters that optimize the response measures. The experiment has been done by using Taguchi's orthogonal array L36 (21 × 37). Each experiment was conducted under different conditions of input parameters. The response table and the grey relational grade for each level of the machining parameters have been established. From 36 experiments, the best combination of parameters was found. The experimental results confirm that the proposed method in this study effectively improves the machining performance of WEDM process.

Key words: Taguchi,SR,MRR,WEDM,etc

LASER ENGINEERED NET SHAPING PROCESS IN IMPROVEMENT OF BIO-COMPATIBLE IMPLANTS

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ABSTRACT

Additive manufacturing or Rapid Prototyping (RP) is an advanced manufacturing technology emerging as key player in both industrial and medical fields. Dissimilar to traditional manufacturing processes, in additive manufacturing process material is added as sequential thin layer to achieve the build parts with minimal post processing and it requires less time to fabricate prototypes with high accuracy. Additive manufacturing shows desired results for fabricating the customized medical implants. As there is a large variation to part structure from patient to patient, it is difficult to make implants from conventional manufacturing processes. So, rapid prototyping is most advanced and convenient to fabricate a medical implant that suits the patient's requirements. The present paper reviews the works produced by Laser Engineered Net Shaping (LENS) technique to fabricate the medical implants from bio-materials.

Key words: prototyping, fields, manufacturing,etc.

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CONDITION MONITORING AND DIAGNOSTIC ANALYSIS OF INDUCED DRAUGHT FAN ROTOR SYSTEM

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ABSTRACT

Today's machines are more complex as they have to meet more stringent functional and operational requirements. Growing demand on reliability and performance of these machines and maintaining high productivity without sacrificing product quality have made it imperative for maintenance engineers to device newer strategies in maintenance of plant and machines. One of such strategies is condition monitoring, which has emerged as the most powerful tool in maintenance engineering to prevent uneconomical, unreliable, unhealthy, unsafe and even lethal conditions. In this paper an attempt has been made to monitor the condition of induced draught fan rotor system of a large utility thermal power plant. The data has been logged for a period of 6 months and has been rationalized for ease of investigation. The values are plotted on time-domain for velocity to facilitate trend monitoring. Fault diagnosis of the rotor.

Keyword: complex, demand, engineering, etc.

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RESEARCH ARTICLE DESIGN OPTIMIZATION OF A MICRO AIR VEHICLE (MAV) FIXED WING

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ABSTRACT

Micro air vehicles are gaining attention due to their wide range of applications in civilian and defense fields. The wings of these vehicles generate a particular flow regime which is to be explored further. Since the theories on the aerodynamics of all affects are still to be investigated, simulation based computational fluid dynamics is a good approach rather than wind tunnel experiments which involves cost and long periods of experimentation. This study mainly emphasize on the lift, lift coefficient, drag and drag coefficient with respect to Reynold's number and angle of attack, by modelling and analyzing the fixed wing of a micro air vehicle. The analysis has been done selecting NACA25411 air foil. Modelling has been done in Gambit and analysis is taken up using Fluent. Angle of attack and Reynold's number have been optimized to increase the lift and decrease the drag.

Key words: vehicles, aerodynamics, air, angle, etc.

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DESCRIPTION AND WEAR PROPERTIES OF CO-CR-W ALLOY DEPOSITED WITH LASER ENGINEERED NET SHAPING

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ABSTRACT

Commercially available Co-Cr-W alloy, known as Stellite 6, samples are deposited using Laser Engineered Net Shaping process using L9 orthogonal array of Taguchi method with three different process parameters, each at three levels. All the samples are tested for the microstructure analysis with ESEM and wear resistance. The EPMA mapping is also presented for analysis. The wear testing results reveal that the samples fabricated with 350W laser power, 7.5 g/min powder feed rate and 15mm/s laser scan speed have exhibited highest wear resistance at 30N load and 300rpm.

Key words: satellite, samples, EPMA, ESEM, etc.

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VALID ARE SUGIYAMA′ S EXPERIMENTS ON FOLLOWER FORCES

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ABSTRACT

This paper is inspired by the review articles of Langthjem and Sugiyama, and Elishakoff on the dynamic stability of non-conservative elastic systems. It examines Sugiyama′s experimental results on a cantilever column subjected to the weight and thrust of a small rocket motor mounted at the tip end. The test results cannot be utilized directly for comparison with estimated critical loads of the column but they demonstrate the stabilization of the system due to rocket thrust.

Key words: force,end,estimate,loads,etc

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ELECTRO CHEMICAL BEHAVIOUR OF LENSTM DEPOSITED CO-CR-W ALLOY FOR BIO-MEDICAL APPLICATIONS

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ABSTRACT

In additive manufacturing processes, Laser Engineered Net Shaping (LENS) is the promising technology in developing medical implants with minimal material wastage and high accuracy in shape and size. It enables the custom design of implants that vary from patient to patient. In the present work, the LENS process has been used to fabricate and test Co-Cr-W alloy for its corrosion resistance. The process parameters selected for fabricating the samples are laser power; powder feed rate and laser scan speed, each at three levels. Samples are fabricated as per the Taguchi L-9 orthogonal array and analysis is carried out through the ANOVA and Grey Relational Grade Analysis. Through this methodology, the primary process parameters viz. Laser power (LP), Powder feed rate (PFR) and scan speeds (SS) can be optimized simultaneously for achieving a better combination of multiple performance characteristics. From the experimental results, the multiple performance characteristics of the corrosion potential (Ecorr) and corrosion current (Icorr) of Co-Cr-W alloy are evaluated. The combination of high Laser Power (350W), high Powder Feed Rate (20 g/s) and low scan speed (10 mm/s) are most influencing process parameters to achieve the best corrosion resistance samples.

Key words: ANOVA,SS, samples, etc

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A REVIEW ON DEVELOPMENT OF MEDICAL IMPLANTS BY RAPID PROTOTYPINGTECHNOLOGY

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ABSTRACT

Rapid prototyping/manufacturing is computer operated manufacturing technique, builds parts directly from CAD data by additive sequence layerby-layer, unlike traditional manufacturing process where material is removed in sequence to obtain a desired part. Rapid prototype plays a crucial role in development of medical implants. As medical implants have complex design and vary from patient to patient. It is easy to make custom made medical implants by rapid prototyping at very less cost and time, compared to conventional manufacturing techniques. The present article showcases the significance of rapid prototyping applications in medical industry with suitable bio-compatible materials and manufacturing techniques used to fabricate the complex medical models.

Key words: prototyping, CAD ,rapid, techniques, etc

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EFFECTS OF LASER PARAMETERS ON MORPHOLOGICAL CHANGE AND SURFACE PROPERTIES OF ALUMINUM IN MASKED LASER SURFACE TEXTURING

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ABSTRACT

The masked laser surface texturing process was used to produce micro-pattern arrays. Using mesh grids as masks, the surface of the workpieces were selectively ablated and hundreds of micro-patterns were simultaneously generated by a single laser irradiation. The effects of laser energy intensity and number of laser pulses on surface morphologies and properties were investigated. It was found that it is more efficient to control the number of laser pulses than the laser energy intensity to form a uniform micro pattern array and to control the pattern shape. In addition, hardness values of the material surface can be selectively increased by adjusting laser parameters. When the laser energy intensity increased, the hardness of the hole region which was directly affected by the laser irradiation increased. When the surface was irradiated repeatedly by the multiple laser pulses, however, the increase in hardness was much pronounced in the masked bar region adjacent to the ablation zone. The structural changes of the patterned surface and the work hardening effect due to laser shock loading were superimposed to increase the hardness of the masked region. The contact angle decreased with increasing laser energy intensity and number of laser pulses. This is mainly due to an increase in surface heterogeneity at high laser energy intensities and an increase in bar width at multiple laser pulses condition.

Keywords:Masked, laser, surface, texturing,etc.

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AN EVALUATION FOR MECHANICAL AND MICROSTRUCTURE BEHAVIOR OF DISSIMILAR MATERIAL WELDED JOINT BETWEEN NUCLEAR GRADE MARTENSITIC P91 AND AUSTENITIC SS304 L

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ABSTRACT

The microstructural evolution and mechanical properties of gas tungsten arc welded creep might enhanced martensitic (CSEM) and austenitic stainless steel (SS) dissimilar welded joint is explored in the as welded (AW) and post weld heat treated (PWHT) conditions. The as received normalized and tempered P91 steel has been welded with SS304 L by preparing a conventional groove and employing a P91 GTAW filler wire. The welded plate is subjected to PWHT at 760 °C for 120 min followed by air cooling. The P91 steel in as received condition exhibited fully martensitic (tempered) structure with lathe morphology and prior austenite grain boundaries while SS304 L have austenitic structure with twins. The heterogeneity (as-welded condition) across the welded joint were produced in terms of microstructure and mechanical properties (hardness, Charpy toughness and tensile strength). The variation in mechanical properties has been minimized after the PWHT. PWHT has experimental a drastic influence on mechanical properties and microstructure of weld fusion zone and HAZ of P91 side however, remain unaffected for the SS304 L side HAZ. The strength of the welded joint have been measured 1016 ± 2.5 MPa and 906 ± 6.5 in as-welded and PWHT condition with joint efficiency of 140 % and 125 %, respectively.

Keywords:SS304 L,Dissimilar welded joint,Microstructure,Mechanical properties

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A EVALUATION OF THE WIRE ARC ADDITIVE MANUFACTURING OF METALS: PROPERTIES, DEFECTS AND QUALITY IMPROVEMENT

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ABSTRACT

Due to the feasibility of economically producing large-scale metal components with relatively high deposition rates, significant progress has been made in the understanding of the wire arc additive manufacturing (waam) process, as well as the microstructure and mechanical properties of the fabricated components. as waam has evolved, a wide range of materials have become associated with the process and its applications.this article reviews the emerging research on waam techniques and the commonly used metallic feedstock materials, and also provides a comprehensive over view of the metallurgical and material properties of the deposited parts. common defects produced in waam components using different alloys are described, including deformation, porosity, and cracking. methods for improving the fabrication quality of the additively manufactured components are discussed, taking into account the requirements of the various alloys. this paper concludes that the wide application of waam still presents many challenges, and these may need to be addressed in specific ways for different materials in order to achieve an operational system in an acceptable time frame. the integration of materials and manufacturing process to produce defect-free and structurally-sound deposited parts remains a crucial effort into the future.

Keywords: WAAM,Materials, Defects,Quality improvement.

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TRANSIENT LIQUID PHASE BONDING OF AZ31 MAGNESIUM ALLOY: METALLURGICAL STRUCTURE AND MECHANICAL PROPERTIES

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ABSTRACT

In the present paper, AZ31 magnesium alloy was transient liquid phase bonded using aluminum interlayers (with two different thicknesses of 9 and 14 μm), two bonding temperature of 440˚and 455℃ and different holding times. Optical and scanning electron microscopies were employed to determine the progression of isothermal solidification. In addition, X-ray diffraction method was used to determine the formation of the brittle $Al_{12}Mg_{17}$ compound. The hardness was found to be higher at the joint center compared to the joint sides, which can be related to the eutectic structure and high amount of intermetallic compounds at the center. The results showed that the 9 μm-interlayer led to greater shear strength, elongation and failure energy than the 14 μm interlayer, and the highest shear strength of ~35 MPa was obtained for 75 min bonding time and 9 μm interlayer. The fracture surface evaluation revealed the presence of more plastic deformation for the joints made by the thinner interlayer.

Keywords:TLP, bonding,AZ31, magnesium alloy,Metallurgy, characterization

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EFFECT OF LASER BEAM WELDING PARAMETERS ON MORPHOLOGY AND STRENGTH OF DISSIMILAR AA2024/AA7075 T-JOINTS

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ABSTRACT

This paper investigates the effect of laser welding parameters, such as beam power, welding speed, incident beam angle, incident beam position and beam diameter, on the weld geometry, microstructure, porosity and mechanical properties of successive double-sided laser beam welded AA2024-AA7075 T-joints using 4047 filler wire. A change in the welding parameters influences the weld geometry and porosity, but does not cause significant variations in the weld microstructures, though some liquation cracking was observed in the heat-affected zone of alloys AA7075 and AA2024. The macroporosity occurs more in the second weld seam than in the first one. The pull-out test results presented higher values than those obtained by other authors. The ultimate tensile load in pull-out test is influenced by the laser power, laser beam diameter and incident beam position. Macroporosity plays a relevant role in fracture initiation during pull-out tests. Porosity and liquation cracking influenced the fracture mode of the pull-out test specimens, but they do not significantly affect the results.

Keywords:Laser, welding,parameters,T-joints,Defects,

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EFFECT OF METAL TRANSFER MODE ON SPATTER AND ARC STABILITY IN UNDERWATER FLUX-CORED WIRE WET WELDING

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ABSTRACT

The effect of metal transfer mode on spatter and arc stability during underwater flux-cored wire wet welding at different process parameters are investigated adopting the synchronous acquisition system of X-ray image and electric signal. Two spatter modes i.e. the local droplet repelled spatter and the droplet explosion spatter were observed for the first time. The generation of the local droplet repelled spatter is attributed to the excessive and unstable repulsive forces, while the droplet explosion spatter is caused by the unstable repulsive forces and gas dynamic force. Welding spatters and arc stability depend on the metal transfer mode. During wide-angle globular repelled transfer mode, the droplet repelled spatter mode is observed and the forming frequencies of the local droplet repelled spatter and droplet explosion spatter are higher than other transfer modes. The short-circuit explosions are observed in short-circuit explosive transfer mode, causing numerous short-circuit explosive spatters. With the increase of arc voltage, both the spatter loss coefficient and voltage variation coefficient decrease firstly to the minimum at the arc voltage of 32 V and then increases gradually, attributed to the type and proportion of metal transfer mode.

Keywords: wet welding, Welding spatter, Arc stability, Metal transfer mode,etc

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INVESTIGATION OF EXPLOSIVE WELDING THROUGH WHOLE PROCESS MODELING USING A DENSITY ADAPTIVE SPH METHOD

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ABSTRACT

Explosive welding (EXW) involves processes like the detonation of explosive charge, impact of metal structures and strong fluid-structure interaction with complex features such as interfacial waves and jet generation. The whole EXW process has not been well modeled before due to the large deformation and moving interfaces while the associated mechanisms inherent in EXW are also not well understood. In this paper, the whole EXW process is simulated using a density adaptive smoothed particle hydrodynamics (SPH) model, in which a density adaptive algorithm is used to treat variable large density ratio in EXW and the kernel gradient correction (KGC) is used to improve computational accuracy of SPH. The mechanisms in EXW are investigated, and typical phenomena including the wavy interface, jet formation, interfacial temperature and pressure distribution as well as melting voids are examined. The mechanisms of wave formation are studied while two existing mechanisms, namely, the Jet Indentation Mechanism and the Vortex Shedding Mechanism are revealed with the present SPH simulations. It is demonstrated that with proper amount of explosive charge and initial welding angle, the present SPH method can well reproduce the morphology evolution of the welding interface from straight to wavy and further to wavy with vortex shedding. Furthermore, based on comprehensive numerical data from SPH simulations, two types of numerical weldability windows for EXW are presented together with discussions about different welding limits and effective explosive charge.

Keywords:Smoothed, particle, hydrodynamics,etc

INVESTIGATION ON THE FRACTURE BEHAVIOR OF TITANIUM GRADE 2 SHEETS BY USING THE SINGLE POINT INCREMENTAL FORMING PROCESS

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ABSTRACT

The objective of the present research work is to study the fracture behaviour (void coalescence) of titanium grade 2 sheets using the Single Point Incremental Forming (SPIF) process and its dependence on various process parameters. The importance of tool diameter on the fracture behavior of the titanium grade 2 was investigated and it was found that the maximum deformation fracture strain was observed for the highest (12 mm) tool diameter. The Forming Limit Diagram (FLD) is plotted for each speed of titanium grade 2 sheets. The variation of fracture behaviour with respect to speed was examined and it showed that this was the maximum for higher speed of 600 rpm spindle speed. The void coalescence analysis was carried out using AutoCAD software, and the strain triaxiality was determined. The Energy Dispersive X-ray Spectroscopy (EDS) analysis was investigated to confirm the elemental composition of titanium grade 2 sheets.

Keywords: Ti.tanium,SPIF,FLC,etc

METAL PROTOTYPING THE FUTURE OF AUTOMOBILE INDUSTRY: A REVIEW

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ABSTRACT

Metal prototyping an advanced rapid prototyping technique has shown a very high potential to reduce the time of manufacture and cost of product effectively. Implementation of metal prototyping to the extent of 4d printing improves the future of small, medium and large-scale enterprises of automobile industry. This paper gives a glance of metal prototyping to automobile industry. The implementation of future metal prototyping automobile industry involves 1. Re- engineering model generation for spare parts of two, three, four-wheeler automobiles, 2. Mathematical and software simulation by using fem techniques, 3.3d printing, 4. Metal prototyping though 3d/ 4d printing, 5. Prototype testing and research labs are described in detail. Finally this review gives a glance on future automobile industry through metal prototyping

Keywords: FEM,Metal prototyping,Automobile, scrap,etc.

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STUDY ON COLD METAL TRANSFER WELDING–BRAZING OF TITANIUM TO COPPER

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Abstract

3 mm Pure titanium TA2 was joined to 3 mm pure copper T2 by Cold Metal Transfer (CMT) welding–brazing process in the form of butt joint with a 1.2 mm diameter ERCuNiAl copper wire. The welding–brazing joint between Ti and Cu base metals is composed of Cu–Cu welding joint and Cu–Ti brazing joint. Cu–Cu welding joint can be formed between the Cu weld metal and the Cu groove surface, and the Cu–Ti brazing interface can be formed between Cu weld metal and Ti groove surface. The microstructure and the intermetallic compounds distribution were observed and analyzed in details. Interfacial reaction layers of brazing joint were composed of Ti_2Cu, TiCu and $AlCu_2Ti$. Furthermore, crystallization behavior of welding joint and bonding mechanism of brazing interfacial reaction were also discussed. The effects of wire feed speed and groove angle on the joint features and mechanical properties of the joints were investigated. Three different fracture modes were observed: at the Cu interface, the Ti interface, and the Cu heat affected zone (HAZ). The joints fractured at the Cu HAZ had higher tensile load than the others. The lower tensile load fractured at the Cu interface or Ti interface was attributed to the weaker bonding degree at the Cu interface or Ti interface.

Keywords: Titanium, Copper, Cold metal transfer, Welding–brazing,etc

EFFECT OF STRAIN RATE AND TEMPERATURE ON STRAIN HARDENING BEHAVIOR OF A DISSIMILAR JOINT BETWEEN TI–6AL–4V AND TI17 ALLOYS

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ABSTRACT

The aim of this study was to evaluate the influence of strain rate and temperature on the tensile properties, strain hardening behavior, strain rate sensitivity, and fracture characteristics of electron beam welded (EBWed) dissimilar joints between Ti–6Al–4V and Ti17 (Ti–5Al–4Mo–4Cr–2Sn–2Zr) titanium alloys. The welding led to significant microstructural changes across the joint, with hexagonal close-packed martensite (α') and orthorhombic martensite (α'') in the fusion zone (FZ), α' in the heat-affected zone (HAZ) on the Ti–6Al–4V side, and coarse β in the HAZ on the Ti17 side. A distinctive asymmetrical hardness profile across the dissimilar joint was observed with the highest hardness in the FZ and a lower hardness on the Ti–6Al–4V side than on the Ti17 side, where a soft zone was present. Despite a slight reduction in ductility, the yield strength (YS) and ultimate tensile strength (UTS) of the joints lay in-between the two base metals (BMs) of Ti–6Al–4V and Ti17, with the Ti17 alloy having a higher strength. While the YS, UTS, and Voce stress of the joints increased, both hardening capacity and strain hardening exponent decreased with increasing strain rate or decreasing temperature. Stage III hardening occurred in the joints after yielding. The hardening rate was strongly dependent on the strain rate and temperature. As the strain rate increased or temperature decreased, the strain hardening rate increased at a given true stress. The strain rate sensitivity evaluated via both common approach and Lindholm approach was observed to decrease with increasing true strain. The welded joints basically failed in the Ti–6Al–4V BM near the HAZ, and the fracture surfaces exhibited dimple fracture characteristics at different temperatures.

Keywords: Titanium alloy,Electron beam welding,Strain , hardening behavior,etc

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FRICTION STIR WELDING OF DISSIMILAR MATERIALS BETWEEN AA6061 AND AA7075 AL ALLOYS EFFECTS OF PROCESS PARAMETERS

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Abstract

Dissimilar AA6061 and AA7075 alloy have been friction stir welded with a variety of different process parameters. In particular, the effects of materials position and welding speed on the material flow, microstructure, microhardness distribution and tensile property of the joints were investigated. It was revealed that the material mixing is much more effective when AA6061 alloy was located on the advancing side and multiple vortexes centers formed vertically in the nugget. Three distinct zones with different extents of materials intercalations were identified and the formation mechanism of the three zones was then discussed. Grain refinement was observed in all three layers across the nugget zone with smaller grains in AA7075 Al layers. All the obtained joints fractured in the heat-affected zone on the AA6061 Al side during tensile testing, which corresponds very well to the minimum values in microhardness profiles. It was found that the tensile strength of the dissimilar joints increases with decreasing heat input. The highest joint strength was obtained when welding was conducted with highest welding speed and AA6061 Al plates were fixed on the advancing side. To facilitate the interpretation, the temperature history profiles in the HAZ and at zones close to TMAZ were also measured using thermocouple and simulated using a three-dimensional computational model.

Keywords: Dissimilar, materials, joining,etc

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TENSILE PROPERTIES OF FIBER LASER WELDED JOINTS OF HIGH STRENGTH LOW ALLOY AND DUAL-PHASE STEELS AT WARM AND LOW TEMPERATURES

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ABSTRACT

High strength low alloy (HSLA) and dual-phase DP980 (UTS ⩾ 980 MPa) steels were joined using fiber laser welding in similar and dissimilar materials combinations. The welded joints were characterized with respect to microhardness and tensile properties at three different temperatures: −40 °C, 25 °C, and 180 °C. Tensile properties of the welded joints were compared to those of the base metal (BM) obtained under similar conditions. A good correlation was found between the welded joints and the BM in relation to the tensile properties obtained at the different temperatures. A general trend of increase in the yield strength (YS), the ultimate tensile strength (UTS) and energy absorption (EA) with decreasing temperature was observed; however, work hardening coefficient was not altered and insignificant scatter was observed in case of the elongation. However, in the DP980 steel, dynamic strain ageing was observed only in the BM.

Keywords:Fiber, laser, welding,etc

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MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HOT ROLLED TINBSN ALLOYS

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ABSTRACT

Titanium alloys with lower elastic modulus and free from toxic elements such as Al and V have been studied for biomedical matters. Ti–Nb–Sn alloys showed up as presenting great potential for the aforementioned purpose. The current study got Ti–35Nb-XSn alloys (x = 2.5; 5.0; 7.5) by applying the following techniques: arc melting, homogenizing and cooling in furnace, homogenizing and water quenched, hot rolling and water quenched. According to each step of the study, the microstructures were featured by means of optical microscopy, by applying a scanning electron microscopy (SEM) analysis as well as X-ray diffraction. The mechanical properties were gotten by means of: Vickers microhardness, tensile and ultrasonic tests. Their ratio between tensile strength and elastic modulus as well as the ductility were compared to other biomedical alloys already available in the literature. The mechanical behavior of the Ti–Nb alloys directly depends on the Sn rates that constitutes the phases as well as on the thermomechanical background to which the alloy was submitted to. The hot rolled Ti–35Nb–2.5Sn alloy showed high ratio between strength and elastic modulus as well as high ductility, just as high as those of some cold rolled Ti alloys.

Keywords:β Titanium alloys,Biomaterials,Mechanical properties

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A MATERIALS SELECTION PROCEDURE FOR SANDWICHED BEAMS VIA PARAMETRIC OPTIMIZATION WITH APPLICATIONS IN AUTOMOTIVE INDUSTRY

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Abstract

The future of automotive industry faces many challenges in meeting increasingly strict restrictions on emissions, energy usage and recyclability of components alongside the need to maintain cost competiveness. Weight reduction through innovative design of components and proper material selection can have profound impact towards attaining such goals since most of the lifecycle energy usage occurs during the operation phase of a vehicle. In electric and hybrid vehicles, weight reduction has another important effect of extending the electric mode driving range between stops or gasoline mode. This paper adopts parametric models for design optimization and material selection of sandwich panels with the objective of weight and cost minimization subject to structural integrity constraints such as strength, stiffness and buckling resistance. The proposed design procedure employs a pre-compiled library of candidate sandwich panel material combinations, for which optimization of the layered thicknesses is conducted and the best one is reported. Example demonstration studies from the automotive industry are presented for the replacement of Aluminum and Steel panels with polypropylene-filled sandwich panel alternatives.

Keywords:Faces,design,goals,etc

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EFFECTS OF HEAT ACCUMULATION ON THE ARC CHARACTERISTICS AND METAL TRANSFER BEHAVIOR IN WIRE ARC ADDITIVE MANUFACTURING OF TI6AL4V

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Abstract

Wire arc additive manufacturing (WAAM) offers a promising alternative to traditional subtractive manufacturing of metallic components, particularly in the case of large Ti6Al4V structures for the aerospace sector that feature high buy-to-fly ratios. This study investigates the influence of heat accumulation on bead formation, arc stability, and metal transfer behaviour during the manufacture of Ti6Al4V with the gas tungsten wire arc additive manufacturing (GT-WAAM) using localized gas shielding. An infrared pyrometer is used to measure the in-situ interpass temperature which is a key factor in determining the heat accumulation. Arc stability and metal transfer behaviour are monitored by means of a high speed camera. The results show that due to the various thermal dissipation paths along the building height, there exists a significant difference in temperature variation between substrate and in-situ layer. Owing to the influences of heat accumulation, the interlayer surface oxidation and bead geometries vary along the building direction, especially for the first few layers of the deposited wall, which lead to variation in arc shape and metal transfer behaviour. The research outcome provides a better understanding of the effects of heat accumulation on deposition stability during WAAM process, which benefits future process optimization and control.

Keywords: Wire arc additive manufacturing,Ti6Al4V,Heat accumulation,Arc shape

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MICROSTRUCTURE AND MECHANICAL PROPERTIES OF FRICTION STIR WELDS ON UNMODIFIED AND P-MODIFIED AL-MG_2SI-SI ALLOYS

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ABSTRACT

Welded joints formed by friction stir welding (FSW) consist of three distinct zones: a base material zone (BMZ), a thermo-mechanically affected zone (TMAZ), and a weld nugget (WN). Primary Mg_2Si phases are identified as equiaxed crystals and polygonal particles in unmodified and P-modified Al-Mg_2Si-Si alloys in the BMZ, respectively. In the WN, the equiaxed primary Mg_2Si crystals in the unmodified alloys are transformed to significantly smaller polygonal/irregular particles; the corners of the polygonal primary Mg_2Si particles in the modified alloys become smoother and smaller. The segregation of the primary Mg_2Si phase is reduced for both the unmodified and modified alloys in the WN. Both unmodified and modified alloys have a lower solidus temperature in the WN. The ultimate tensile strengths (UTSs) of the welded joints are enhanced by 5% and 8% for the unmodified and modified alloys, respectively, in comparison with the parent material. The UTS of the welded joints in the modified alloy is ~20% higher than in the unmodified alloy.

Keywords:Al-Mg_2Si-Si alloy,Friction stir welding,Microstructure,Mechanical properties

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FATIGUE CRACK PROPAGATION BEHAVIOUR IN WIRE+ARC ADDITIVE MANUFACTURED TI-6AL-4V: EFFECTS OF MICROSTRUCTURE AND RESIDUAL STRESS

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ABSTRACT

Fatigue crack propagation tests of Ti-6Al-4V fabricated by the Wire+Arc Additive Manufacturing (WAAM) process are analysed. Crack growth rate and trajectory are examined before and after the crack tip crossing an interface between the WAAM and wrought alloys. The study has focused on the microstructure and residual stress effect. First, the differences in crack growth rate and path between WAAM and wrought alloys are attributed to their different microstructure; the equiaxed wrought alloy has straight crack path, whereas the WAAM lamellar structure causes tortuous crack path resulting in lower crack growth rate. Second, based on measured residual stress profile in the as-built WAAM piece, retained residual stress in the much smaller compact tension specimens and its effect on crack growth rate are calculated by the finite element method. Numerical simulation shows considerable residual stress in the test specimen and the stress magnitude depends on the initial crack location and propagation direction in relation to the WAAM-wrought interface. Residual stress is released immediately if the initial crack is in the wrought substrate; hence it has little effect. In contrast, when crack grows from WAAM to wrought, residual stress is retained resulting in higher stress intensity factor; hence greater crack growth rate.

Keywords:Additive manufacturing,Titanium alloy,Fatigue crack propagation,Residual stress.

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FORMATION MCHANISM OF TYPICAL ONION RING STRUCTURES AND VOID DEFECTS IN FRICTION STIR LAP WELDED DISSIMILAR ALUMINUM ALLOYS

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Abstract

The formation mechanism for typical onion ring structure and void defect with heat input during FSLW was continuously visualized by an exit-hole continuous observation technique. Based on this result, the compatibility between microstructure, microtexture, element maps and strain maps using electron backscattered diffraction (EBSD) with the chemical indexing assisted by EDS analysis was simultaneously investigated. The results revealed that the threaded probe was significantly correlated to typical onion ring structure and the onion structure formed as soon as it touched the probe. This result is different from the results so far. On the other hand, the remnant of original interface between top and bottom plates after FSLW and asymmetrical flow around rotating tool were significantly correlated to the formation of void defect in low heat input condition.

Keywords:Friction stir lap welding,Dissimilar aluminum alloy,Material flow.etc

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CHARACTERIZATION OF HEAT AFFECTED ZONE LIQUATION CRACKING IN LASER ADDITIVE MANUFACTURING OF INCONEL 718

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Abstract

The heat affected zone liquation cracking behavior was studied in laser additive manufactured Inconel 718. Liquation cracking was found initiating from the weak site near the fusion line in the pre-deposited layer, propagating along the interdendritic region with the further deposition proceeding layer by layer. Total cracking length calculation results showed that when controlling the heat input and height increment constant, liquation cracking susceptibility increased with the increase of laser scanning speed; and when controlling the laser scanning speed and height increment constant, liquation cracking susceptibility increased with the increase of heat input. The effect of grain boundary misorientation on susceptibility to liquation cracking was also investigated through electron backscatter diffraction (EBSD) measurement, and the results showed that liquation cracking tendency increased with the increase of grain boundary angle, which was considered to be attributed to the higher stability of liquation film at larger grain boundary during the last stage of solidification.

Keywords:HAZ cracking,Laser cladding,EBSD,Grain boundary misorientation

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3D PRINTING FOR FUNCTIONAL ELECTRONICS BY INJECTION AND PACKAGE OF LIQUID METALS INTO CHANNELS OF MECHANICAL STRUCTURES

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Abstract

With the fabrication freedom and high efficiency introduced by 3D printing, such technology has been explored in the electronic manufacturing processes. In the present work, we reported a developed method for the fabrication of functional electronics with liquid phase electronic circuits. The technique involves printing hollow channels within elastomer structures via fused deposition modeling (FDM), then injecting and encapsulating liquid metal to form electrical traces. The process parameters in printing elastomer objects and the design of hollow channels were investigated via the extrusion experiments. The influence of flow rates on liquid metal injection was also studied under pressure injection. Based on these discussions and validations, the relationships between process parameters and the printing structures were demonstrated, and the flexible substrate with hollow channels was successfully printed by optimization of the process parameters. Moreover, a probe signal circuit has been fabricated to demonstrate the ability of injecting and packaging liquid metal into 3D printed structures for functional electronics.

Keywords: 3D printing,Functional electronics,Additive manufacturing,Hollow channel

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POLYMER-BASED SMART MATERIALS BY PRINTING TECHNOLOGIES: IMPROVING APPLICATION AND INTEGRATION

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Abstract

Smart and functional materials processed by printing technologies reveal an increasing interest due to reduced cost of assembly, easy integration into devices and the possibility to obtain multifunctional materials over flexible and large areas. After introducing smart materials, printing technologies and inks, this review discusses the materials that are already being printed, mainly piezoelectric, piezoresistive, magnetostrictive, shape memory polymers (SMP), pH sensitive and chromic system materials. Since polymer-based smart materials are particularly attractive for device implementation, this review will focus on printed polymer-based smart materials. Finally, critical challenges and future research directions will be addressed.

Keywords:Printing, technologies,Smart materials,Internet,Additive manufacturing,Polymers

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3D PRINTING OF POLYMER-BONDED MAGNETS FROM HIGHLY CONCENTRATED, PLATE-LIKE PARTICLE SUSPENSIONS

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ABSTRACT

This paper reports the 3d printing of polymer-bonded magnets using highly concentrated suspensions of non-spherical magnetic particles. In a previous study, magnets of arbitrary shapes have been successfully fabricated using the uv-assisted direct write (uadw) method. The magnetic remanence (b_r) of the uadw magnets was limited by the type of magnetic particles used and the highest printable particle loading. Magnetic particles produced from melt spinning have better intrinsic magnetic properties, but their plate-like shape has resulted in a higher working viscosity, posing a major challenge in 3d printing with uadw. Inspired by the "farris effect" in rheology, we mixed the plate-like particles of two different sizes to increase the polydispersity and reduce the overall viscosity of the mixture as the smaller particles can now fill the interstitial space between the larger ones. Using this rheological technique, a particle loading of as high as 65% by volume, or 93% by weight, was 3d printed. The resulting magnet has a density of 5.2 g/cm^3, an intrinsic coercivity (h_{ci}) of 9.39 koe, a remanence (b_r) of 5.88 kg, and an energy product ($(bh)_{max}$) of 7.26 mgoe, marking the highest values reported for 3d printed polymer-bonded magnets.

Keywords:3D printing,Magnets,Rheology,Direct write,Suspensions

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WIRE + ARC ADDITIVELY MANUFACTURED INCONEL 718: EFFECT OF POST-DEPOSITION HEAT TREATMENTS ON MICROSTRUCTURE AND TENSILE PROPERTIES

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Abstract

Wire + Arc Additive Manufacturing (WAAM) can be used to create large free-form components out of specialist materials such as nickel-base superalloys. Inconel (IN) 718 is well suited for the WAAM process due to its excellent weldability. However, during deposition, WAAM IN718 is susceptible to micro-segregation, leading to undesirable Laves phase formation in the interdendritic regions. Further, the WAAM process encourages columnar grain growth and the development of a strong fibre texture, leading to anisotropy in grain structure. This unfavourable microstructure can be addressed through specialised post-deposition homogenisation heat treatments. A new modified heat treatment was found to be effective in dissolving Laves phase, whereas a standard treatment precipitated δ phase. Tensile test results revealed that Laves and δ phases lead to low ductility when present in a precipitation-hardened matrix. The modified heat treatment also reduced the anisotropy in grain structure, leading to almost isotropic elevated temperature tensile properties, which meet minimum specifications for conventional cast but not for wrought material. Specialised post-deposition heat treatments, which address the unique microstructure of WAAM IN718, are crucial to achieving optimal mechanical properties.

Keywords:manufacturing,Nickel-base superalloy,Heat treatment,Microstructure,etc.

REVIEW ON DESIGN AND STRUCTURAL OPTIMISATION IN ADDITIVE MANUFACTURING: TOWARDS NEXT-GENERATION LIGHTWEIGHT STRUCTURES

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Abstract

As the application of additive manufacturing (AM) reaches an unprecedented scale in both academia and industry, a reflection upon the state-of-the-art developments in the design for additive manufacturing (DfAM) and structural optimisation, becomes vital for successfully shaping the future AM-landscape. A framework, highlighting both the interdependencies between these two central aspects in AM and the necessity for a holistic approach to structural optimization, using lightweight strategies such as topology optimization and/or latticing, was established to summarize the reviewed content. Primarily focusing on isotropic material considerations and basic stiffness-optimal problems, these concepts have already found wide application, bridging the gaps between design and manufacturing as well as academia and industry. In pursuit of streamlining the AM-workflow towards digitally print-ready designs, studies are increasingly investigating mathematically-based structural optimization approaches in conjunction with DfAM-specific constraints, providing a portfolio of solutions like generative design, which is gaining traction in industry. Besides an overview on economically-driven to performance-driven design optimizations, insight into commercial AM-specific software is provided, elucidating potentials and challenges for the community. Despite the abundance of AM design methods to-date, computationally inexpensive solutions for common engineering problems are still scarce, which is constituting one of many key challenges for the future.

PERFORMANCE OF TRANSMISSION LOSS ON HYBRID MUFFLER BY USING ROCK WOOL AND GLASS FIBER AS A ABSORBING MATERIALS

Venkateswarlu , lokesh ,Prof. N. Tamiloli

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Abstract

Muffler is categorized in two broad manners as absorptive muffler and reactive muffler. A Muffler (silencer) is an important noise control element for reduction of machinery exhaust noise, fan noise, and other noise sources involving the flow of gases. Reactive mufflers which reduce noise by reflecting sound energy back to its source, and absorption mufflers, which absorb sound due to the energy dissipated in the sound-absorbing material. The attenuation levels of these types of muffler are dependent on the frequency of the noise source. Investigations on absorption mufflers have indicated that these have fairly good noise attenuation over a relatively wide frequency band. The combination of both reactive and absorptive muffler is termed as hybrid muffler. Hybrid muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Experimental Two load setup and Wave 1-D is used to predict the transmission loss of hybrid muffler. Hybrid muffler generally includes the number of perforated tubes, number of perforated baffles with absorptive materials like asbestos, rock wool, bensoil, powertex & advantex etc. Transmission loss measurement using hybrid muffler is discussed in this paper. Various sound absorption materials that are currently used for noise reduction are used. This paper shows the acoustic performance of packed dissipative muffler with the variation in packing density of absorptive material. Here easy available absorptive materials glass fiber & rock wool is used with same space. This study is performed by taking four designs to observe the transmission loss performance by applying different absorptive materials with different packing density.

KEYWORDS: Transmission Loss (TL), Hybrid Muffler, Sound Absorptive Materials, Two Load Method, Wave 1-D.

EFFECT OF CHANGE IN DIAMETER ON MUFFLER TRANSMISSION LOSS USINGCOMSOL

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Abstract

Muffler analysis is always challenging task due to complex design, shape and size limitation for specific application. In this paper the inlet diameter of muffler is varied for comparison. Two finite element methods (FEM) Results are compared using COMSOL 5.0 software. Two different muffler configurationsare considered, representing the effects of adding absorptive lining and without absorptive lining to increase the transmission loss (TL), from computational analysis it is observed that for 40 mm inlet transmission loss is more compared with 30 mm inlet diameter.

Keywords – Transmission loss (TL), Acoustic liners.

DESIGN, ASSESSMENT AND OPTIMIZATION OF AUTOMOTIVE MUFFLER.

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ABSTRACT: Mufflers are important part of engine system and commonly used in exhaust system to minimize sound transmissions caused by exhaust gases. Design of mufflers is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Therefore muffler design becomes more and more important for noise reduction. The objective of the paper is to propose a design of simple reactive muffler for effective sound attenuation and for getting highest transmission losses. The paper contains two optimization problem to get optimize model which can further optimize by using Taguchi method. The problem were built and analysed by using 'COMSOL MULTIPHYSICS' in pressure acoustic analysis domain for getting Maximum Transmission Losses and minimum Sound Pressure Level (SPL). First optimization problem contain muffler in which perforation diameter and pipe diameter are varied which again optimizes by eliminating perforation and by varying pipe lengths in second optimization problem. Among the best problem is further optimized by using Taguchi method.The effect of SPL on the walls of the muffler is not considered. The material of the muffler is also not considered. This optimized model of elliptical muffler is manufacture and then validate with the experimental analysis.

KEYWORDS: Transmission Losses, Sound Pressure Level, Acoustic, Optimization

ANALYSIS OF EXHAUST SYSTEM- 'SEMI ACTIVE MUFFLER'

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ABSTRACT: Main drawback of I.C. engines working is that it is a major source of noise pollution. That is why the reduction of exhaust noise generated from engine is in today's world an important issue. Attaching a muffler in the exhaust pipe is the good option for reducing noise. But muffler requires specific design and construction considering various noise parameters produced by the engine. Since early development of mufflers, the main objective of design was attenuation of sound in regular mufflers. Which causes a great amount of back pressure at the exhaust port thus losingpower,increasing fuel consumption and piston effort to exhale the gases out. For high performance engines the free flow exhaust is made in which the sound level is not important but zero or less back pressure is. There is no intermediate muffler type in between both these, so semi active muffler is an step between these two, in which it attenuates sound when engine is running at low rpm , and converts in free flow when engine at higher revs.

KEYWORDS: CFR-cylinder firing ratio, EFR-engine firing ratio, Semi active muffler, Vm-volume of muffler.

ANALYSIS OF FLOW FIELD AND PRESSURE LOSS FOR FORK TRUCK MUFFLER BASED ON THE FINITE VOLUME METHOD

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ABSTRACT

Having the premise of the certain acoustic performance, a muffler should make the pressure loss as small as possible. A simulation model of a fork truck muffler with a complex structure is established. Based on the finite volume method, multidimensional numerical simulation regarding velocity field and pressure field of steady flows for a muffler is performed using CFD (computational fluid dynamic method). Flow characteristics and pressure distribution of the muffler are analyzed. It is found that the vortex inside the muffler creates a great pressure loss. With the increases of inlet gas flow rate , the pressure loss of the muffler increases gradually. The internal structure of the muffler is redesigned for obtaining the optimized structure on the basis of analysis. The influences of the inner tube length on the flow and pressure loss of muffler are researched. The study will provide a theoretical basis for designing a complex muffler.

Keywords: Complex muffler, Velocity field, Pressure field, Structure improvement.

STUDY OF MULTI-CHAMBER MICRO-PERFORATED MUFFLFLER WITH ADJUSTABLE TRANSMISSION LOSS

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Abstract

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The noise behavior of the blower used on fuel cell vehicles is measured and analyzed. According to the noise behaviors, the multi-chamber micro-perforated mufflfler with adjustable transmission loss is proposed for silencing. The adjustment is achieved by the change of the third chamber length. The relation model between the chamber length and the mufflfler resonant frequency is fifitted. In addition, the mufflfler sample is manufactured for experiment. According to the study, the blower noise contains the wide bandnoise with frequency range of 500–1000 Hz and the narrow band harmonics with frequency range of 2000–3500 Hz. The experimental results show that the proposed mufflfler is effective and effificient to attenuate the low-medium frequency wide band noise and the narrow band harmonics simultaneously.

Keywords: Blower noise ,Micro-perforated mufflfler ,Adjustable transmission loss .

ASSESSMENT OF VARIOUS ALGORITHMS FOR IMPROVING ACOUSTIC ATTENUATION PERFORMANCE AND FLOW CHARACTERISTIC OF REACTIVE MUFFLFLERS

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abstract

The parametric optimization of the reactive mufflflers is researched by numerical analysis, regarding the performance of the acoustic and flflow fifields synthetically. The fifinite element method, based on the Helmholtz equation and the Navier–Stokes equation respectively, is utilized in the analysis of the acoustic and flflow fifields. And the initial and boundary conditions are set up in the physical fifields respectively. The weighting multi-objective function about acoustic and flflow fifields is formulated. In addition, the optimization results of multidisciplinary, obtained by the Nelder Mead algorithm (NMA) based on the sensitivity analysis, the Monte Carlo algorithm (MCA) and Genetic Algorithm (GA) based on the random sampling, are analyzed comparatively. The optimization results indicate that the NMA can maximize the transmission loss (TL) and minimize the pressure drop with the given weight factor. Finally, numerical optimization examples confifirm the validity and reliability of the proposed optimization method in the acoustic-flflow fifield.

Keywords: Transmission loss, Pressure drop, Reactive mufflfler, Multidisciplinary optimization

TOPOLOGY OPTIMIZATION OF A SUCTION MUFFLER IN A FLUID MACHINE TO EXPLOIT ENERGY COMPETENCE AND MINIMIZE BROADBAND SOUND

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Abstract

A suction mufflfler used in a fluid machine has three functions: noise reduction; minimizing pressure drop and improving energy efficiency using acoustic effects. However, no method of

suction mufflfler design considers all three of these functions concurrently. Therefore, in this study, we attempt to provide an integrated design method of a suction mufflfler in aflfluid machine that considers all three functions. The topology optimization method for acoustic and flfluid systems was applied to an integrated design. However, the interaction between fluid and acoustic was not considered. In addition, the acoustic input impedance of a suction mufflfler was used for a specifific acoustical resonance frequency to improve the energy effificiency of a fluid machine. Finally, the sequential optimization method based on physical investigations was proposed to satisfy several design criteria.The proposed method was applied to the suction mufflfler in refrigerator's compressor.

Key wards: Muffler,efficiency,Method,etc.

FINITE ELEMENT ANALYSIS OF AN INDUSTRIAL RASH SILENCER

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Abstract

Classical analytical models used for prediction of the performance of reactive silencers are limited to conditions where the dimensions of the duct and resonators are small compared to the

wavelength of the sound. Finite Element Analysis does not suffffer from such limitations and has therefore been used to analyse the design of a reactive silencer for the exhaust stack of a 980MW power station. To assist in the design process, resonators of various dimensions were analysed using FEA which has led to the derivation of expressions for the resonance frequencies of slot-type rhomboid shaped resonators as a function of the geometry. An important design issue is the inflfluence that adjacent resonators have on the overall performance of the system. It was found that when resonators of similar resonance frequency are in close proximity, they can interact and lead to a decrease in the overall performance compared to that of a single resonator.

FLOW STUDY OF REACTIVE MUFFLER USING CFD ANALYSIS

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Abstract

Muffler design is traditionally a trial and error process. This paper describes the flow analysis of a reactive muffler using CFD simulation in order to improve its performance by reducing the back pressure created on the engine. The back pressure of the muffler is computed from CFD simulation. The CFD analysis is done to avoid the tedious experimentation. The flow simulation is carried out using k-ε turbulent model as it is most suitable for turbulent flows having less

converging time. Total four cases were analyzed including the base model muffler. Thus three modifications were done in muffler geometry. The modification with reduced baffle spacing produced least back pressure with reduction in back pressure by 8.59%.

STRUCTURAL ANALYSIS FOR EXHAUST GAS FLOW THROUGH AN ELLIPTICAL CHAMBER MUFFLER UNDER STATIC AND DYNAMIC LOADING CONDITION

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Abstract

High pressure and temperature exhaust gases coming out from automobile engine are made to pass through muffler for reduction of sound resulting from propagation of these pressure waves. The mufflers may be of reactive, dissipative and resonating type. The present paper deals with an automotive muffler that is modeled based on practical dimensions of a 4-stroke 2-cylinder

MAHINDRA MAXIMO PLUS C.I. engine in CATIA V5software. The geometry adopted is elliptical in nature. Comparative static structural analysis for stress, strain anddeformation along with modal analysis for deformation under dynamic loading has been performed for perforated and non-perforated design of the muffler using ANSYS Workbench 14.5. The effect of incorporation of perforation is studied on the corresponding static and dynamic behavior of the muffler.

Keywords:*automotive muffler, dynamic loading, modal analysis, static loading, structural analyis.*

DESIGN AND ANALYSIS OF PERFORATED MUFFLER IN AUTOMOBILE

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Abstract

A muffler is a device for reducing the amount of noise emitted by an automobile. To reduce the noise, the engine drain is connected via output pipe to silencer called muffler. The muffler makes a major contribution to reduce the noise. Mufflers are connected to the exhaust pipe of internal combustion engine to suppress the acoustic flow of the engine in combustion process. Mufflers form an integral part of automobile. Mufflers are designed to increase the back pressure so as to reduce the noise level. In this study, attempt has been made to improve the design of muffler for reducing noise. The design of a muffler is to reduce the noise, for that an

existed automobile muffler has modified and compared with the arrangement of plates inside the muffler where the noise emitted by the muffler gets changed and to improve the acoustic efficiency of the modified design. Modelling has performed by using CATIA V5.Analysis has to be performed in ANSYS Fluid Flow (Fluent)simulation, can be used to analyse the acoustic power level flow in the muffler, Pressure developed while air flows through the muffler, Velocity of air inside the muffler, Strain rate of the Muffler. By varying the muffler design parameters the flow will be analysed.

Keywords: Muffler, Catia modelling, Acoustic Power level, Back Pressure.

REVIEW PAPER ON DESIGN AND DEVELOPMENT OF MUFFLER TO OPTIMIZETRANSMISSION LOSSES

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Abstract

New regulations and standards for noise reductions and emission compel the automobile industries tomake some improvements in the design of silencer for attaining desired noise reduction. In this project, modifications are desired in the silencer design of upcoming Eicher tractor to fulfill the current standards. The current noise level at Operator Ear Level (OEL) is 97dB (decibels), it is desired to reduce it to 94 dB and below. Also the maximum backpressure of 50 mm of Hg is to be maintained. New design should be analyzed with respect to both

acoustics and back pressure. As per the various studies reactive mufflers with extended inlet and outlet pipes into muffler, which is not present in current design can significantly reduce the noise level. Helmholtz resonator can also be introduced to cancel the noise of dominating frequencies. Also a sound absorbing material like glass fibers and steel wool can be incorporated for better results. Further, the design modifications are to be verified for noise reduction by COMSOL Multi-physics software. Also the numerical results for transmission loss will be verified with experimentally measured results.

Keywords: Operator Ear Level (OEL), backpressure, mufflers, COMSOL Multiphysics, transmission loss

CFD FLOW ANALYSIS AND OPTIMIZATION OF EXHAUST MUFFLER

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Abstract

Silencer is an integral part of the exhaust system. The silencer serves the function of noise andvibration reduction. The exhaust gases in the combustion chamber which are at temperatures of around 1200K are released to the atmosphere at around 323K. Temperature reduction takes place efficiently as the flue gases flow through the exhaust system. In this study, flow analysis is carried out on various geometries and the geometries are checked for the pressure drop and temperature drop based on which the optimum geometry having minimum pressure drop and maximum temperature drop across the flow is selected and considered suitable. The entire flow analysis is done using ANSYS Fluent 18.0. Various Geometry combinations are used considering the minimum pressure drop. These geometries are analysed for flow considering

Standard Air, Air as Ideal gas and Real gas as the fluid material for each of the geometries. For all the load cases the geometry which is having minimum pressure drop and maximum temperature drop is considered suitable for structural analysis.

Keywords—Silencer, CFD, Fluent,ANSYS, Flow.

OPTIMAL TOPOLOGY OF REACTIVE MUFFLER ACHIEVING TARGET TRANSMISSIONLOSS VALUES: DESIGN AND EXPERIMENT

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Abstract

A topology-optimization-based mufflfler design method for a reactive mufflfler is proposed and experimentally validated. In a reactive mufflfler design problem, rigid partitions should be located optimally inside the mufflfler to improve its acoustical attenuation performance in the target frequency range. In an optimal-performance mufflfler, the partition volume should be made as small as possible, and the transmission loss value in the target frequency range should be high enough for flflow noise reduction in a duct. To this end, a partition-volume-minimization problem achieving target transmission loss values is formulated by using acoustical topology optimization. The formulated muffler design problem is solved for several

target frequencies, and the effect of the initial values of the design variables on the optimal topology is investigated. Numerical simulation results show that the proposed formulation requires a smaller volume of partition than the previoustopology-optimization-based formulation. The calculated transmission loss curves of the optimal mufflflers agree well with the measured transmission loss curves of mufflflers made of acrylic.

*Keywords:*Mufflfler design Optimal mufflfler Topology optimization Transmission loss Finite element method

OPTIMAL PARTITION LAYOUT OF EXPANSION CHAMBER MUFFLER WITH OFFSET INLET/OUTLET

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Abstract

An optimal partition layout inside an expansion chamber muffler with an offset inlet/outlet is systematically designed by using topology optimization to achieve the desired characteristics in terms of acoustics and fluid mechanics. To that end, a partition volume minimization problem is formulated by applying acoustical and flow topology optimization methods. The partition volume is set as an objective function with constraints imposed on the target values of the transmission loss and pressure drop. The finite element method is employed for the acoustical and flow analyses. A design variable is assigned to each finite element such that it changes continuously between 0 and 1 to determine the state of the associated finite element. The design

variables are updated during the optimization process and parameterized to converge to 0 or 1 at the end of the process. Finite elements with design variables of 1 build up rigid partitions which are optimally placed to achieve the target values of transmission loss and pressure drop. Different optimal partition layouts are obtained depending on the target frequency, the target values of transmission loss and pressure drop, and the initial values of the design variables. An experiment-based validation strongly supports the validity of the proposed muffler design method.

KEY WORDS : Muffler design, Topology optimization, Transmission loss, Pressure drop

DESIGN AND ANALYSIS OF MUFFLER TO REDUCE THE STUDY OF BACK PRESSURE

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Abstract

The function of an exhaust muffler is to make the smooth path for flue gases emitted from the exhaust manifold while reduces the clam our build by the engine. Due to the twists and turns that the exhaust gas has to make to reach the atmosphere, there is a considerable amount of backpressure which restricts the free flow of the exhaust gases. It is necessary to reduce the Backpressure as it reduces the fuel consumption of the engine. The major concern for a designer is to ensure that the backpressure is minimum. This project deals with four different models of chambered exhaust muffler and concludes the best possible design for least pressure drop. SolidWorks 2014 version was used to design the exhaust mufflers. Numerical analysis for backpressure testing was conducted by Flow Simulation of SolidWorks 2014. Heat balance test

on single cylinder diesel engine was performed to know the mass flow rate of the exhaust gases. Flow trajectories are viewed to know the flow of exhaust gases through the muffler. The cut plots for pressure and exhaust gas velocity are viewed. Pressure drop is calculated across the exhaust muffler by viewing the pressure distribution.

Keywords - Back pressure, CFD analysis, Diesel engine, Muffler

PREDICTION OF COMPRESSOR MUFFLER FREQUENCY RESPONSE FUNCTION USING CFD

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Abstract

The acoustic filters of hermetic reciprocating compressors, also called mufflers, are usually developed through acoustic simulation solving the discretized wave equation to obtain the Frequency Response Function, which translates the acoustic response of the muffler. Nonlinear effects are neglected in this approach, which are attributed to flow patterns, as turbulence phenomena, which occur in the contractions, expansions and changing directions within the geometry. The main aim of this work is to investigate the influence of non-linear effects in the acoustic response of mufflers, solving the flow field by computational fluid dynamics (CFD). A discharge acoustic filter design was simplified for the study purpose and simulated using both

CFD and Linear Acoustic techniques; the difference in the two approaches is made by comparing the Frequency Response Function (FRF). The flow effects are analyzed varying the compressor piston displacement and operating conditions. FRF predicted by CFD presents reasonable agreement with acoustics approach for lower frequencies identifying resonances and anti-resonances. It was observed increased disagreement for higher mass flow rates due to the predominance of flow effects over acoustics vibrations modes.

TOPOLOGY OPTIMIZATION OF REACTIVE ACOUSTIC MUFFLERS USING A BI-DIRECTIONAL EVOLUTIONARY OPTIMIZATION METHOD

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Abstract

This article proposes an acoustic muffler design procedure based on finite element models and a Bi-directional Evolutionary Acoustic Topology Optimization. The main goal is to find the best configuration of barriers inside acoustic mufflers used in the automotive industry that reduces sound pressure level in the outlet of the muffler. The acoustic medium is governed by Helmholtz equation and rigid wall boundary conditions are introduced to represent acoustic barriers. The continuum problem is written in the frequency domain and it is discretized using the finite element method. The adopted objective function is Transmission Loss (TL). Increasing TL guarantees that the sound pressure level ratio between outlet and inlet of the muffler is reduced. To find the configuration of acoustic barriers that increases the Transmission Loss function of the muffler an adaptation of the Bi-directional Evolutionary Structural Optimization (BESO) method is used. Applying the proposed design procedure

topologies in 2D models are reached, which raises the Transmission Loss function for one or multiple frequencies. Three examples are presented to show the efficiency of the proposed procedure.

Keywords:Transmission lossBESO AcousticsTopology optimization Mufflers

DESIGN AND ANALYSIS OF MUFFLER FOR TWOWHEELER

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Abstract

Noise from automobiles is one of the components for noise pollution to environment. Exhaust noise is one of the main source of vehicle and exhaust systems are developed to attenuate noise meeting required levels and sound quality emissions based on environment norms. Muffler is important part of engine system and commonly used in exhaust system to minimize sound transmission caused by exhaust gases. So to deal with this problem, muffler should be modified. But again there is one problem that is selection of type of muffler either reactive or absorptive. Absorptive muffler has more weight than reactive type as it is consisted of wound material over perforated pipes. So in this study reactive type muffler is modified for 110 cm3 four stroke engine of two wheelers. But maximum noise reduction affect backpressure of engine. Also pressure drop is one of the parameter which influences backpressure of engine as minimum pressure drop indicates minimum backpressure. Depending on space availability for muffler on vehicle body, external dimensions of new muffler are kept same as that of existing one. In this paper, a muffler is analyzed for varying porosity of pipes and it's effect on pressure drop by simulation.

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Keyword : - Acoustic Analysis, Backpressure, Muffler, Noise Reduction, Transmission Loss.

DESIGN AND ANALYSIS OF AUTOMOTIVE MUFFLER

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Abstract

Noise pollution is a very crucial problem for today's life, so to reduce noise level sound proofing is necessary. Muffler is a very important part of the vehicle exhaust system to reduce the noise produced by engine combustible products when passing through the exhaust system. To achieve maximum noise reduction withthe minimum pressure drop is very difficult. A conventional muffler of Maruti-Suzuki WagonR is taken as reference and depending upon parameters new muffler is designed and modelled in software and analysis will be done numerical codes. Analysis ease the design parameters to be change, so that an appropriate design can be generate and maximum amount of noise reduction and pressure drop takes place with minimum back pressure. Comparison of conventional muffler and proposed designed muffler is based on amount of noise reduction, pressure drop and muffler life. In experimental

setup pressure drop calculated by the water manometer tube and sound intensity measured by Sound Level Meter (SLM) device.

Keywords—Pressure Drop; Back Pressure; Noise Reduction; Water Tube Manometer; Sound Level Meter(SLM)

EFFECT OF PERFORATED TUBE ON TRANSMISSION LOSS OF MUFFLER- A REVIEW

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Abstract

Noise pollution produced by engines becomes a vital concern especially for residential areas or in the areas where noise creates hazard. The main source of noise produced by an engine is the exhaust noise. With the increased use of industrial machinery and automobiles, it is necessary to have an effective noise attenuation device. Muffler is such a device used for reducing the amount of noise produced by an IC Engine. Noise attenuation quality of muffler depends on the used materials and its internal geometry. Perforated tube is used in muffler to reduce backpressure as well as to increase transmission loss of muffler. There are many methods for evaluation of transmission loss of muffler such as analytical method, computational method using FEM and BEM and experimental method. This paper discuss the effect of various parameters of perforated tube on transmission loss.

Keywords – muffler, expansion chamber, perforated tube, transmission loss, FEM, BEM, backpressure

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A COUPLED 1D-MULTID NONLINEAR SIMULATION OF I.C. ENGINE SILENCERS WITH PERFORATES AND SOUND-ABSORBING MATERIAL

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Abstract

Nowadays a great attention is paid to the level and quality of noise radiated from the tailpipe end of intake and exhaust systems, to control the gas dynamic noise emitted by the engine as well as the characteristics of the cabin interior sound. The muffler geometry can be optimized consequently, to attenuate or remark certain spectral components of the engine noise, according to the result expected. Evidently the design of complex silencing systems is a time-consuming operation, which must be carried out by means of concurrent experimental measurements and numerical simulations. Inparticular, 1D and multiD linear/non-linear simulation codes can be applied to predict the silencer behavior in the time and frequency domain. This paper describes the development of a 1D-multiD integrated approach for the simulation of complex mufflfler confifigurations such as reverse chambers with inlet and outlet pipe extensions and perforated silencers with the addition of sound absorbing material. The 1D-multiD integrated approach is exploited to validate the transmission loss prediction of reverse chamber confifigurations with inlet and outlet extensions. Results have pointed out thecapability of capturing transversal resonances at high and mid frequencies. Moreover, a non linear approach is proposed to take into account the presence of the sound absorbing material into the conservation equations of a multidimensional solver. The properties of the sound absorbing material have been taken from correlations adopted in the literature for 1D models. The momentum and energy conservation equations have been modifified to take into

account the interaction between the gas and sound absorbing material. Both the 1D and the integrated 1D-multiD approach have been exploited for validation, considering two different geometries: an expansion chamber with an extended outlet pipe, with the sound absorbing material placed between the pipe extension and the canning, and a perforated pipe whose cavity has been completely fifilled with sound absorptive metallic wool. The results obtained by the fully 1D analysis and the integrated approach are in agreement with the measured mufflfler performances.

EFFECT OF AQUA SILENCER & CATALYTIC CONVERTER ON EXHAUST EMISSION : A REVIEW

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Abstract

Automobile exhaust emission is one of the major part of air pollution all around. A human will take 20 to 22Kg of O2 while 20000 times taking breadth. It means in order to take clean O2 environment need to be clean & automobile pollution like CO, HC & NOX which creates human illness need to be reduce. This study will gives highlight of advance catalytic converter which uses non noble metals & technology with which disadvantage of catalytic converter like cold start & back pressure can be minimize & design modification in aqua silencer till date, These technologies are economical & able to reduce emission up to emission norms also research gap is identified at the end of the review which gives direction for the future research.

Keywords: Aqua Silencer, Catalytic Converter, Catalyst, Emission Control Technique, Exhaust Emission

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OPTIMIZATION OF TRANSMISSION LOSS OF PERFORATED TUBE MUFFLER BY USING CAE TOOL ANSYS

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Abstract

Noise produced by exhaust of an IC Engine, is one of the main cause of noise pollution in today's environment. With the increase in vehicles at alarming rate, it has become necessary to have an effective noiseattenuating device to control this noise pollution. Muffler is one of such device that can be used for noise reduction. Transmission loss is the major performance parameter of muffler and it depends on the acoustic filters applied to it. This paper reveals the performance of transmission loss on using perforated tube as an acoustic filter. Different parameter of the perforated tube such as perforated whole diameter, porosity and dimension of the tube are considered for study. All the analysis for the evaluation of transmission loss is performed by using ANSYS which is one of the major CAE tool for simulation. The paper also reveals new models that have better sound attenuation capabilities than the conventional model especially at low to medium frequencies level.

Keywords- ANSYS, COMSOL, Exhaust muffler, perforated tube, transmission loss

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ASSEMBLY LINE BALANCING: A CASE STUDY IN SILENCER MANUFACTURING

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Abstract

An assembly line balancing is to know how tasks are to be assigned to workstations, so that the predetermined goal is achieved. Minimization of the number of workstations and maximization of the production rate are the most common goals. The silencer assembly line is studied in this paper which assembles four products. For line improvement purpose, various Lean Manufacturing tools are employed such as cycle time study, line imbalance calculation, bottleneck identification, Kaizen, space utilization through layout change. Many industries are facing lot of problems like inability to meet production targets, imbalance of work content at work stations, discontinuity in material flow, manpower allotment. In this paper, the design to evaluate the performance, bottleneck identification , reduction in bottleneck cycle time, minimizing line imbalance, workstations organization, reduction in manpower and space saving, increasing manpower utilization of industrial production assembly line are discussed.

Keywords: Assembly Line Balancing, Cycle Time Reduction, resource utilization

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FIELD MEASUREMENT OF THE ACOUSTICAL AND AIRFLOW PERFORMANCE OFINTERIOR NATURAL-VENTILATION OPENINGS AND SILENCERS

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Abstract

This paper discusses measurements of the acoustical and airflflow performance of interior naturalventilation openings and silencers (‘ventilators’) in existing buildings. It reviews the characterization of ventilator performance, and methods and theory for measuring it. Performance measures for sixteen ventilators in fifive buildings are presented and discussed. The measured acoustical and airflflow performance of rectangular ventilation openings in thin partitions is slightly better than the theoretical performance of a sharp-edged, rectangular opening. The measured performance of slot openings next to reflflective surfaces is similar to the theoretical performance of a sharp-edged, rectangular opening. Adding absorptive material to a surface next to a slot opening increases the sound-transmission loss by about ASTC 5, with negligible reduction in airflflow. Duct-like ventilation openings have airflflow performance approximately 50% greater than for a thin opening of the same cross-section. Z-shaped crosstalk silencers were measured to reduce sound transmission by at least ASTC 16, and only slightly to restrict airflflow. Adding a grille to a ventilation opening results in negligible change in sound transmission, but approximately halves airflflow.

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*Keywords:*Natural ventilation Ventilation opening Sound transmission Airflflow Open area ratio Silencer

A REVIEW ON DESIGN AND DEVELOPMENT OF AQUA SILENCER

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Abstract

Instantly, a like pollution has become a greatest threat in the world. It is important from the public health point of view, because Polluted air causes physical ill effects. Increasing toxic pollutant in the air has focused the world's attention on the need of reducing it. The main pollutants contribute by automobiles are carbon monoxide, unburned hydrocarbon, oxides of nitrogen and Lead. Aqua silencer is used to reduce harmful pollutants and noise levels. Since water is used in this silencer it has been named as Aqua silencer. Aqua silencer is cheaper, effective and easy to install.

Keywords: *Aqua Silencer; Pollutant; Air Pollution; Emission; Noise*

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A REVIEW ON DESIGN OF ABSORPTIVE MUFFLER WITHAMMONIA PULSATOR FOR IC ENGINE

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Abstract

In these review paper, we discuss about the absorptive muffler. There are various types of engines exhaust noise pollutes harmful in environment. The main principle of this paper is on reducing the noise and emission of engine. Any type of engine exhaust noise is controlled by using silencers/mufflers. By attaching of muffler in the exhaust pipe is the most effective means of reducing the noise, but muffler requires specific design and construction by considering various noise parameters which produced by the engine. The analysis and design work for the absorptive muffler has been going on since the early 1920s. Here we are taking different design parameters and improving the efficiency of the absorptive muffler. The formulated muffler traditional design problem will be solved by new design and optimization.

Keywords: Internal combustion Engine, Absorptive Muffler, Engine Exhaust Noise and Emission Reduction.

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A REVIEW ON ANALYSIS OF DOUBLE BAFFLE MUFFLER

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Abstract

Muffling devices are essential part of any vehicle that uses internal combustion engine. Noise from automobile is one of the components for noise pollution to environment thus Exhaust noise is one of the main source of vehicle and exhaust system to attenuate noise meeting required levels and sound quality emission based on environment norms. Change in muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Various sound absorption material used in this process. Here easily available absorptive materials are glass fiber which used with same space. Generally there are different process which used in reduction of noise and pollution so basically such all things are studied in these system and their application.

Keyword: - ANOVA, hybrid muffler, material for sound absorption, Taguchi, pollution reduction technique.

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PERFORMANCE OF TRANSMISSION LOSS ON HYBRID MUFFLER BY USING ROCK WOOL AND GLASS FIBER AS A ABSORBING MATERIALS

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Abstract

Muffler is categorized in two broad manners as absorptive muffler and reactive muffler. A Muffler (silencer) is an important noise control element for reduction of machinery exhaust noise, fan noise, and other noise sources involving the flow of gases. Reactive mufflers which reduce noise by reflecting sound energy back to its source, and absorption mufflers, which absorb sound due to the energy dissipated in the sound-absorbing material. The attenuation levels of these types of muffler are dependent on the frequency of the noise source. Investigations on absorption mufflers have indicated that these have fairly good noise attenuation over a relatively wide frequency band. The combination of both reactive and absorptive muffler is termed as hybrid muffler. Hybrid muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Experimental Two load setup and Wave 1-D is used to predict the transmission loss of hybrid muffler. Hybrid muffler generally includes the number of perforated tubes, number of perforated baffles with absorptive materials like asbestos, rock wool, bensoil, powertex & advantex etc. Transmission loss measurement using hybrid muffler is discussed in this paper. Various sound absorption materials that are currently used for noise reduction are used. This paper shows the acoustic performance of packed dissipative muffler with the variation in packing density of absorptive material. Here easy available absorptive materials glass fiber & rock wool is used with same space. This study is performed by taking four designs to observe the transmission loss performance by applying different absorptive materials with different packing density.

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KEYWORDS: Transmission Loss (TL), Hybrid Muffler, Sound Absorptive Materials, Two Load Method, Wave 1-D.

EFFECT OF CHANGE IN DIAMETER ON MUFFLER TRANSMISSION LOSS USINGCOMSOL

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Abstract : Muffler analysis is always challenging task due to complex design, shape and size limitation for specific application. In this paper the inlet diameter of muffler is varied for comparison. Two finite element methods (FEM) Results are compared using COMSOL 5.0 software. Two different muffler configurationsare considered, representing the effects of adding absorptive lining and without absorptive lining to increase the transmission loss (TL), from computational analysis it is observed that for 40 mm inlet transmission loss is more compared with 30 mm inlet diameter.

Keywords – Transmission loss (TL), Acoustic liners.

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DESIGN, ASSESSMENT AND OPTIMIZATION OF AUTOMOTIVE MUFFLER

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ABSTRACT: Mufflers are important part of engine system and commonly used in exhaust system to minimize sound transmissions caused by exhaust gases. Design of mufflers is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Therefore muffler design becomes more and more important for noise reduction. The objective of the paper is to propose a design of simple reactive muffler for effective sound attenuation and for getting highest transmission losses. The paper contains two optimization problem to get optimize model which can further optimize by using Taguchi method. The problem were built and analysed by using 'COMSOL MULTIPHYSICS' in pressure acoustic analysis domain for getting Maximum Transmission Losses and minimum Sound Pressure Level (SPL). First optimization problem contain muffler in which perforation diameter and pipe diameter are varied which again optimizes by eliminating perforation and by varying pipe lengths in second optimization problem. Among the best problem is further optimized by using Taguchi method.The effect of SPL on the walls of the muffler is not considered. The material of the muffler is also not considered. This optimized model of elliptical muffler is manufacture and then validate with the experimental analysis.

KEYWORDS: Transmission Losses, Sound Pressure Level, Acoustic, Optimization

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ANALYSIS OF EXHAUST SYSTEM- 'SEMI ACTIVE MUFFLER'

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ABSTRACT: Main drawback of I.C. engines working is that it is a major source of noise pollution. That is why the reduction of exhaust noise generated from engine is in today's world an important issue. Attaching a muffler in the exhaust pipe is the good option for reducing noise. But muffler requires specific design and construction considering various noise parameters produced by the engine. Since early development of mufflers, the main objective of design was attenuation of sound in regular mufflers. Which causes a great amount of back pressure at the exhaust port thus losingpower,increasing fuel consumption and piston effort to exhale the gases out. For high performance engines the free flow exhaust is made in which the sound level is not important but zero or less back pressure is. There is no intermediate muffler type in between both these, so semi active muffler is an step between these two, in which it attenuates sound when engine is running at low rpm , and converts in free flow when engine at higher revs.

KEYWORDS: CFR-cylinder firing ratio, EFR-engine firing ratio, Semi active muffler, Vm-volume of muffler.

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ANALYSIS OF FLOW FIELD AND PRESSURE LOSS FOR FORK TRUCK MUFFLER BASED ON THE FINITE VOLUME METHOD

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ABSTRACT

Having the premise of the certain acoustic performance, a muffler should make the pressure loss as small as possible. A simulation model of a fork truck muffler with a complex structure is established. Based on the finite volume method, multidimensional numerical simulation regarding velocity field and pressure field of steady flows for a muffler is performed using CFD (computational fluid dynamic method). Flow characteristics and pressure distribution of the muffler are analyzed. It is found that the vortex inside the muffler creates a great pressure loss. With the increases of inlet gas flow rate , the pressure loss of the muffler increases gradually. The internal structure of the muffler is redesigned for obtaining the optimized structure on the basis of analysis. The influences of the inner tube length on the flow and pressure loss of muffler are researched. The study will provide a theoretical basis for designing a complex muffler.

Keywords: Complex muffler, Velocity field, Pressure field, Structure improvement.

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STUDY OF MULTI-CHAMBER MICRO-PERFORATED MUFFLFLER WITH ADJUSTABLETRANSMISSION LOSS

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Abstract

The noise behavior of the blower used on fuel cell vehicles is measured and analyzed. According to the noise behaviors, the multi-chamber micro-perforated mufflfler with adjustable transmission loss is proposed for silencing. The adjustment is achieved by the change of the third chamber length. The relation model between the chamber length and the mufflfler resonant frequency is fifitted. In addition, the mufflfler sample is manufactured for experiment. According to the study, the blower noise contains the wide bandnoise with frequency range of 500–1000 Hz and the narrow band harmonics with frequency range of 2000–3500 Hz. The experimental results show that the proposed mufflfler is effective and effificient to attenuate the low-medium frequency wide band noise and the narrow band harmonics simultaneously.

Keywords: Blower noise ,Micro-perforated mufflfler ,Adjustable transmission loss ,Resonant frequency

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COMPARISON OF VARIOUS ALGORITHMS FOR IMPROVING ACOUSTIC ATTENUATION PERFORMANCE AND FLOW CHARACTERISTIC OF REACTIVE MUFFLFLERS

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Abstract

The parametric optimization of the reactive mufflflers is researched by numerical analysis, regarding the performance of the acoustic and flflow fifields synthetically. The fifinite element method, based on the Helmholtz equation and the Navier–Stokes equation respectively, is utilized in the analysis of the acoustic and flflow fifields. And the initial and boundary conditions are set up in the physical fifields respectively. The weighting multi-objective function about acoustic and flflow fifields is formulated. In addition, the optimization results of multidisciplinary, obtained by the Nelder Mead algorithm (NMA) based on the sensitivity analysis, the Monte Carlo algorithm (MCA) and Genetic Algorithm (GA) based on the random sampling, are analyzed comparatively. The optimization results indicate that the NMA can maximize the transmission loss (TL) and minimize the pressure drop with the given weight factor. Finally, numerical optimization examples confifirm the validity and reliability of the proposed optimization method in the acoustic-flflow fifield.

Keywords: Transmission loss, Pressure drop, Reactive mufflfler, Multidisciplinary optimization

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TOPOLOGY OPTIMIZATION OF A SUCTION MUFFLER IN A FLUID MACHINE TO MAXIMIZE ENERGY EFFICIENCY AND MINIMIZE BROADBAND NOISE

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abstract

A suction mufflfler used in a fluid machine has three functions: noise reduction; minimizing pressure drop and improving energy efficiency using acoustic effects. However, no method of suction mufflfler design considers all three of these functions concurrently. Therefore, in this study, we attempt to provide an integrated design method of a suction mufflfler in aflfluid machine that considers all three functions. The topology optimization method for acoustic and flfluid systems was applied to an integrated design. However, the interaction between fluid and acoustic was not considered. In addition, the acoustic input impedance of a suction mufflfler was used for a specifific acoustical resonance frequency to improve the energy effificiency of a fluid machine. Finally, the sequential optimization method based on physical investigations was proposed to satisfy several design criteria. The proposed method was applied to the suction mufflfler in refrigerator's compressor.

FINITE ELEMENT ANALYSIS OF AN INDUSTRIAL REACTIVE SILENCER

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Abstract

Classical analytical models used for prediction of the performance of reactive silencers are limited to conditions where the dimensions of the duct and resonators are small compared to the wavelength of the sound. Finite Element Analysis does not suffffer from such limitations and has therefore been used to analyse the design of a reactive silencer for the exhaust stack of a 980MW power station. To assist in the design process, resonators of various dimensions were analysed using FEA which has led to the derivation of expressions for the resonance frequencies of slot-type rhomboid shaped resonators as a function of the geometry. An important design issue is the inflfluence that adjacent resonators have on the overall performance of the system. It was found that when resonators of similar resonance frequency are in close proximity, they can interact and lead to a decrease in the overall performance compared to that of a single resonator.

FLOW ANALYSIS OF REACTIVE MUFFLER USING CFD

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GIT,Vellore,Tamilnadu

Abstract

Muffler design is traditionally a trial and error process. This paper describes the flow analysis of a reactive muffler using CFD simulation in order to improve its performance by reducing the back pressure created on the engine. The back pressure of the muffler is computed from CFD simulation. The CFD analysis is done to avoid the tedious experimentation. The flow simulation is carried out using k-ε turbulent model as it is most suitable for turbulent flows having less converging time. Total four cases were analyzed including the base model muffler. Thus three modifications were done in muffler geometry. The modification with reduced baffle spacing produced least back pressure with reduction in back pressure by 8.59%.

STRUCTURAL ANALYSIS FOR EXHAUST GAS FLOW THROUGH AN ELLIPTICAL CHAMBER MUFFLER UNDER STATIC AND DYNAMIC LOADING CONDITION

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Abstract

High pressure and temperature exhaust gases coming out from automobile engine are made to pass through muffler for reduction of sound resulting from propagation of these pressure waves. The mufflers may be of reactive, dissipative and resonating type. The present paper deals with an automotive muffler that is modeled based on practical dimensions of a 4-stroke 2-cylinder MAHINDRA MAXIMO PLUS C.I. engine in CATIA V5software. The geometry adopted is elliptical in nature. Comparative static structural analysis for stress, strain anddeformation along with modal analysis for deformation under dynamic loading has been performed for perforated and non-perforated design of the muffler using ANSYS Workbench 14.5. The effect of incorporation of perforation is studied on the corresponding static and dynamic behavior of the muffler.

Keywords:*automotive muffler, dynamic loading, modal analysis, static loading, structural analyis.*

DESIGN AND ANALYSIS OF PERFORATED MUFFLER IN AUTOMOBILE

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Abstract

A muffler is a device for reducing the amount of noise emitted by an automobile. To reduce the noise, the engine drain is connected via output pipe to silencer called muffler. The muffler makes a major contribution to reduce the noise. Mufflers are connected to the exhaust pipe of internal combustion engine to suppress the acoustic flow of the engine in combustion process. Mufflers form an integral part of automobile. Mufflers are designed to increase the back pressure so as to reduce the noise level. In this study, attempt has been made to improve the design of muffler for reducing noise. The design of a muffler is to reduce the noise, for that an existed automobile muffler has modified and compared with the arrangement of plates inside the muffler where the noise emitted by the muffler gets changed and to improve the acoustic efficiency of the modified design. Modelling has performed by using CATIA V5.Analysis has to be performed in ANSYS Fluid Flow (Fluent)simulation, can be used to analyse the acoustic power level flow in the muffler, Pressure developed while air flows through the muffler, Velocity of air inside the muffler, Strain rate of the Muffler. By varying the muffler design parameters the flow will be analysed.

Keywords: Muffler, Catia modelling, Acoustic Power level, Back Pressure.

REVIEW PAPER ON DESIGN AND DEVELOPMENT OF MUFFLER TO OPTIMIZE TRANSMISSION LOSSES

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International Journal for Innovative Engineering and Management Research
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Abstract

New regulations and standards for noise reductions and emission compel the automobile industries tomake some improvements in the design of silencer for attaining desired noise reduction. In this project, modifications are desired in the silencer design of upcoming Eicher tractor to fulfill the current standards. The current noise level at Operator Ear Level (OEL) is 97dB (decibels), it is desired to reduce it to 94 dB and below. Also the maximum backpressure of 50 mm of Hg is to be maintained. New design should be analyzed with respect to both acoustics and back pressure. As per the various studies reactive mufflers with extended inlet and outlet pipes into muffler, which is not present in current design can significantly reduce the noise level. Helmholtz resonator can also be introduced to cancel the noise of dominating frequencies. Also a sound absorbing material like glass fibers and steel wool can be incorporated for better results. Further, the design modifications are to be verified for noise reduction by COMSOL Multi-physics software. Also the numerical results for transmission loss will be verified with experimentally measured results.

Keywords: Operator Ear Level (OEL), backpressure, mufflers, COMSOL Multiphysics, transmission loss

CFD FLOW ANALYSIS AND OPTIMIZATION OF EXHAUST MUFFLER

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Abstract

Silencer is an integral part of the exhaust system. The silencer serves the function of noise andvibration reduction. The exhaust gases in the combustion chamber which are at temperatures of around 1200K are released to the atmosphere at around 323K. Temperature reduction takes place efficiently as the flue gases flow through the exhaust system. In this study, flow analysis is carried out on various geometries and the geometries are checked for the pressure drop and temperature drop based on which the optimum geometry having minimum pressure drop and maximum temperature drop across the flow is selected and considered suitable. The entire flow analysis is done using ANSYS Fluent 18.0. Various Geometry combinations are used considering the minimum pressure drop. These geometries are analysed for flow considering Standard Air, Air as Ideal gas and Real gas as the fluid material for each of the geometries. For all the load cases the geometry which is having minimum pressure drop and maximum temperature drop is considered suitable for structural analysis.

Keywords—Silencer, CFD, Fluent,ANSYS, Flow.

OPTIMAL TOPOLOGY OF REACTIVE MUFFLER ACHIEVING TARGET TRANSMISSIONLOSS VALUES: DESIGN AND EXPERIMENT

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Abstract

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A topology-optimization-based mufflfler design method for a reactive mufflfler is proposed and experimentally validated. In a reactive mufflfler design problem, rigid partitions should be located optimally inside the mufflfler to improve its acoustical attenuation performance in the target frequency range. In an optimal-performance mufflfler, the partition volume should be made as small as possible, and the transmission loss value in the target frequency range should be high enough for flflow noise reduction in a duct. To this end, a partition-volume-minimization problem achieving target transmission loss values is formulated by using acoustical topology optimization. The formulated muffler design problem is solved for several target frequencies, and the effect of the initial values of the design variables on the optimal topology is investigated. Numerical simulation results show that the proposed formulation requires a smaller volume of partition than the previoustopology-optimization-based formulation. The calculated transmission loss curves of the optimal mufflflers agree well with the measured transmission loss curves of mufflflers made of acrylic.

*Keywords:*Mufflfler design Optimal mufflfler Topology optimization Transmission loss Finite element method

OPTIMAL PARTITION LAYOUT OF EXPANSION CHAMBER MUFFLER WITH OFFSET INLET/OUTLET

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Abstract

An optimal partition layout inside an expansion chamber muffler with an offset inlet/outlet is systematically designed by using topology optimization to achieve the desired characteristics in terms of acoustics and fluid mechanics. To that end, a partition volume minimization problem is formulated by applying acoustical and flow topology optimization methods. The partition volume is set as an objective function with constraints imposed on the target values of the transmission loss and pressure drop. The finite element method is employed for the acoustical and flow analyses. A design variable is assigned to each finite element such that it changes continuously between 0 and 1 to determine the state of the associated finite element. The design variables are updated during the optimization process and parameterized to converge to 0 or 1 at the end of the process. Finite elements with design variables of 1 build up rigid partitions which are optimally placed to achieve the target values of transmission loss and pressure drop. Different optimal partition layouts are obtained depending on the target frequency, the target values of transmission loss and pressure drop, and the initial values of the design variables. An experiment-based validation strongly supports the validity of the proposed muffler design method.

KEY WORDS : Muffler design, Topology optimization, Transmission loss, Pressure drop

DESIGN AND ANALYSIS OF MUFFLER TO REDUCE THEBACK PRESSURE

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Abstract

The function of an exhaust muffler is to make the smooth path for flue gases emitted from the exhaust manifold while reduces the clam our build by the engine. Due to the twists and turns that the exhaust gas has to make to reach the atmosphere, there is a considerable amount of backpressure which restricts the free flow of the exhaust gases. It is necessary to reduce the backpressure as it reduces the fuel consumption of the engine. The major concern for a designer is to ensure that the backpressure is minimum. This project deals with four different models of chambered exhaust muffler and concludes the best possible design for least pressure drop. SolidWorks 2014 version was used to design the exhaust mufflers. Numerical analysis for backpressure testing was conducted by Flow Simulation of SolidWorks 2014. Heat balance test on single cylinder diesel engine was performed to know the mass flow rate of the exhaust gases. Flow trajectories are viewed to know the flow of exhaust gases through the muffler. The cut plots for pressure and exhaust gas velocity are viewed. Pressure drop is calculated across the exhaust muffler by viewing the pressure distribution.

Keywords - Back pressure, CFD analysis, Diesel engine, Muffler

PREDICTION OF COMPRESSOR MUFFLER FREQUENCY RESPONSE FUNCTION USING CFD

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Abstract

The acoustic filters of hermetic reciprocating compressors, also called mufflers, are usually developed through acoustic simulation solving the discretized wave equation to obtain the Frequency Response Function, which translates the acoustic response of the muffler. Nonlinear effects are neglected in this approach, which are attributed to flow patterns, as turbulence phenomena, which occur in the contractions, expansions and changing directions within the geometry. The main aim of this work is to investigate the influence of non-linear effects in the acoustic response of mufflers, solving the flow field by computational fluid dynamics (CFD). A discharge acoustic filter design was simplified for the study purpose and simulated using both CFD and Linear Acoustic techniques; the difference in the two approaches is made by comparing the Frequency Response Function (FRF). The flow effects are analyzed varying the compressor piston displacement and operating conditions. FRF predicted by CFD presents reasonable agreement with acoustics approach for lower frequencies identifying resonances and anti-resonances. It was observed increased disagreement for higher mass flow rates due to the predominance of flow effects over acoustics vibrations modes.

TOPOLOGY OPTIMIZATION OF REACTIVE ACOUSTIC MUFFLERS USING A BI-DIRECTIONAL EVOLUTIONARY OPTIMIZATION METHOD

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Abstract

This article proposes an acoustic muffler design procedure based on finite element models and a Bi-directional Evolutionary Acoustic Topology Optimization. The main goal is to find the best

configuration of barriers inside acoustic mufflers used in the automotive industry that reduces sound pressure level in the outlet of the muffler. The acoustic medium is governed by Helmholtz equation and rigid wall boundary conditions are introduced to represent acoustic barriers. The continuum problem is written in the frequency domain and it is discretized using the finite element method. The adopted objective function is Transmission Loss (TL). Increasing TL guarantees that the sound pressure level ratio between outlet and inlet of the muffler is reduced. To find the configuration of acoustic barriers that increases the Transmission Loss function of the muffler an adaptation of the Bi-directional Evolutionary Structural Optimization (BESO) method is used. Applying the proposed design procedure topologies in 2D models are reached, which raises the Transmission Loss function for one or multiple frequencies. Three examples are presented to show the efficiency of the proposed procedure.

Keywords:Transmission lossBESO AcousticsTopology optimization Mufflers

DESIGN AND ANALYSIS OF MUFFLER FOR TWOWHEELER

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Abstract

Noise from automobiles is one of the components for noise pollution to environment. Exhaust noise is one of the main source of vehicle and exhaust systems are developed to attenuate noise meeting required levels and sound quality emissions based on environment norms. Muffler is

important part of engine system and commonly used in exhaust system to minimize sound transmission caused by exhaust gases. So to deal with this problem, muffler should be modified. But again there is one problem that is selection of type of muffler either reactive or absorptive. Absorptive muffler has more weight than reactive type as it is consisted of wound material over perforated pipes. So in this study reactive type muffler is modified for 110 cm3 four stroke engine of two wheelers. But maximum noise reduction affect backpressure of engine. Also pressure drop is one of the parameter which influences backpressure of engine as minimum pressure drop indicates minimum backpressure. Depending on space availability for muffler on vehicle body, external dimensions of new muffler are kept same as that of existing one. In this paper, a muffler is analyzed for varying porosity of pipes and it's effect on pressure drop by simulation.

Keyword : - Acoustic Analysis, Backpressure, Muffler, Noise Reduction, Transmission Loss.

DESIGN AND ANALYSIS OF AUTOMOTIVE MUFFLER

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Abstract

Noise pollution is a very crucial problem for today's life, so to reduce noise level sound proofing is necessary. Muffler is a very important part of the vehicle exhaust system to reduce the noise produced by engine combustible products when passing through the exhaust system.

To achieve maximum noise reduction withthe minimum pressure drop is very difficult. A conventional muffler of Maruti-Suzuki WagonR is taken as reference and depending upon parameters new muffler is designed and modelled in software and analysis will be done numerical codes. Analysis ease the design parameters to be change, so that an appropriate design can be generate and maximum amount of noise reduction and pressure drop takes place with minimum back pressure. Comparison of conventional muffler and proposed designed muffler is based on amount of noise reduction, pressure drop and muffler life. In experimental setup pressure drop calculated by the water manometer tube and sound intensity measured by Sound Level Meter (SLM) device.

Keywords—Pressure Drop; Back Pressure; Noise Reduction; Water Tube Manometer; Sound Level Meter(SLM)

EFFECT OF PERFORATED TUBE ON TRANSMISSION LOSS OFMUFFLER- A REVIEW

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Abstract

Noise pollution produced by engines becomes a vital concern especially for residential areas or in the areas where noise creates hazard. The main source of noise produced by an engine is the exhaust noise. With the increased use of industrial machinery and automobiles, it is necessary to have an effective noise attenuation device. Muffler is such a device used for reducing the amount of noise produced by an IC Engine. Noise attenuation quality of muffler depends on the used materials and its internal geometry. Perforated tube is used in muffler to reduce

backpressure as well as to increase transmission loss of muffler. There are many methods for evaluation of transmission loss of muffler such as analytical method, computational method using FEM and BEM and experimental method. This paper discuss the effect of various parameters of perforated tube on transmission loss.

Keywords – muffler, expansion chamber, perforated tube, transmission loss, FEM, BEM, backpressure.

A COUPLED 1D-MULTID NONLINEAR SIMULATION OF I.C. ENGINE SILENCERS WITH PERFORATES AND SOUND-ABSORBING MATERIAL

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Abstract
Nowadays a great attention is paid to the level and quality of noise radiated from the tailpipe end of intake and exhaust systems, to control the gas dynamic noise emitted by the engine as well as the characteristics of the cabin interior sound. The muffler geometry can be optimized consequently, to attenuate or remark certain spectral components of the engine noise, according to the result expected. Evidently the design of complex silencing systems is a time-consuming operation, which must be carried out by means of concurrent experimental measurements and numerical simulations. Inparticular, 1D and multiD linear/non-linear simulation codes can be applied to predict the silencer behavior in the time and frequency domain. This paper describes the development of a 1D-multiD integrated approach for the simulation of complex mufflfler

confifigurations such as reverse chambers with inlet and outlet pipe extensions and perforated silencers with the addition of sound absorbing material. The 1D-multiD integrated approach is exploited to validate the transmission loss prediction of reverse chamber confifigurations with inlet and outlet extensions. Results have pointed out thecapability of capturing transversal resonances at high and mid frequencies. Moreover, a non linear approach is proposed to take into account the presence of the sound absorbing material into the conservation equations of a multidimensional solver. The properties of the sound absorbing material have been taken from correlations adopted in the literature for 1D models. The momentum and energy conservation equations have been modifified to take into account the interaction between the gas and sound absorbing material. Both the 1D and the integrated 1D-multiD approach have been exploited for validation, considering two different geometries: an expansion chamber with an extended outlet pipe, with the sound absorbing material placed between the pipe extension and the canning, and a perforated pipe whose cavity has been completely fifilled with sound absorptive metallic wool. The results obtained by the fully 1D analysis and the integrated approach are in agreement with the measured mufflfler performances.

EFFECT OF AQUA SILENCER & CATALYTIC CONVERTER ON EXHAUST EMISSION : A REVIEW

Venkateswarlu , Jyoti and Prof. N. Tamiloli

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Abstract

Automobile exhaust emission is one of the major part of air pollution all around. A human will take 20 to 22Kg of O2 while 20000 times taking breadth. It means in order to take clean O2 environment need to be clean & automobile pollution like CO, HC & NOX which creates human illness need to be reduce. This study will gives highlight of advance catalytic converter which uses non noble metals & technology with which disadvantage of catalytic converter like cold start & back pressure can be minimize & design modification in aqua silencer till date, These technologies are economical & able to reduce emission up to emission norms also research gap is identified at the end of the review which gives direction for the future research.

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Keywords: Aqua Silencer, Catalytic Converter, Catalyst, Emission Control Technique, Exhaust Emission

OPTIMIZATION OF TRANSMISSION LOSS OF PERFORATED TUBE MUFFLER BY USING CAE TOOL ANSYS

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Abstract

Noise produced by exhaust of an IC Engine, is one of the main cause of noise pollution in today's environment. With the increase in vehicles at alarming rate, it has become necessary to have an effective noiseattenuating device to control this noise pollution. Muffler is one of such device that can be used for noise reduction. Transmission loss is the major performance parameter of muffler and it depends on the acoustic filters applied to it. This paper reveals the performance of transmission loss on using perforated tube as an acoustic filter. Different

parameter of the perforated tube such as perforated whole diameter, porosity and dimension of the tube are considered for study. All the analysis for the evaluation of transmission loss is performed by using ANSYS which is one of the major CAE tool for simulation. The paper also reveals new models that have better sound attenuation capabilities than the conventional model especially at low to medium frequencies level.

Keywords- ANSYS, COMSOL, Exhaust muffler, perforated tube, transmission loss

ASSEMBLY LINE BALANCING: A CASE STUDY IN SILENCER MANUFACTURING

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Abstract

An assembly line balancing is to know how tasks are to be assigned to workstations, so that the predetermined goal is achieved. Minimization of the number of workstations and maximization of the production rate are the most common goals. The silencer assembly line is studied in this paper which assembles four products. For line improvement purpose, various Lean Manufacturing tools are employed such as cycle time study, line imbalance calculation, bottleneck identification, Kaizen, space utilization through layout change. Many industries are facing lot of problems like inability to meet production targets, imbalance of work content at

work stations, discontinuity in material flow, manpower allotment. In this paper, the design to evaluate the performance, bottleneck identification , reduction in bottleneck cycle time, minimizing line imbalance, workstations organization, reduction in manpower and space saving, increasing manpower utilization of industrial production assembly line are discussed.

Keywords: Assembly Line Balancing, Cycle Time Reduction, resource utilization

FIELD MEASUREMENT OF THE ACOUSTICAL AND AIRFLOW PERFORMANCE OF INTERIOR NATURAL-VENTILATION OPENINGS AND SILENCERS

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Abstract

This paper discusses measurements of the acoustical and airflflow performance of interior naturalventilation openings and silencers (‘ventilators’) in existing buildings. It reviews the characterization of ventilator performance, and methods and theory for measuring it. Performance measures for sixteen ventilators in fifive buildings are presented and discussed. The measured acoustical and airflflow performance of rectangular ventilation openings in thin partitions is slightly better than the theoretical performance of a sharp-edged, rectangular opening. The measured performance of slot openings next to reflflective surfaces is similar to the theoretical performance of a sharp-edged, rectangular opening. Adding absorptive material

to a surface next to a slot opening increases the sound-transmission loss by about ASTC 5, with negligible reduction in airflflow. Duct-like ventilation openings have airflflow performance approximately 50% greater than for a thin opening of the same cross-section. Z-shaped crosstalk silencers were measured to reduce sound transmission by at least ASTC 16, and only slightly to restrict airflflow. Adding a grille to a ventilation opening results in negligible change in sound transmission, but approximately halves airflflow.

*Keywords:*Natural ventilation Ventilation opening Sound transmission Airflflow Open area ratio Silencer

REVIEW ON DESIGN AND DEVELOPMENT OF AQUA SILENCER

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Abstract

Instantly, a like pollution has become a greatest threat in the world. It is important from the public health point of view, because Polluted air causes physical ill effects. Increasing toxic pollutant in the air has focused the world's attention on the need of reducing it. The main pollutants contribute by automobiles are carbon monoxide, unburned hydrocarbon, oxides of nitrogen and Lead. Aqua silencer is used to reduce harmful pollutants and noise levels. Since water is used in this silencer it has been named as Aqua silencer. Aqua silencer is cheaper, effective and easy to install.

Keywords: *Aqua Silencer; Pollutant; Air Pollution; Emission; Noise*

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A REVIEW ON DESIGN OF ABSORPTIVE MUFFLER WITHAMMONIA PULSATOR FOR IC ENGINE

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Abstract

In these review paper, we discuss about the absorptive muffler. There are various types of engines exhaust noise pollutes harmful in environment. The main principle of this paper is on reducing the noise and emission of engine. Any type of engine exhaust noise is controlled by using silencers/mufflers. By attaching of muffler in the exhaust pipe is the most effective means of reducing the noise, but muffler requires specific design and construction by considering various noise parameters which produced by the engine. The analysis and design work for the absorptive muffler has been going on since the early 1920s. Here we are taking different design parameters and improving the efficiency of the absorptive muffler. The formulated muffler traditional design problem will be solved by new design and optimization.

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Keywords: Internal combustion Engine, Absorptive Muffler, Engine Exhaust Noise and Emission Reduction.

A REVIEW ON ANALYSIS OF DOUBLE BAFFLE MUFFLER

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Abstract

Muffling devices are essential part of any vehicle that uses internal combustion engine. Noise from automobile is one of the components for noise pollution to environment thus Exhaust noise is one of the main source of vehicle and exhaust system to attenuate noise meeting required levels and sound quality emission based on environment norms. Change in muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Various sound absorption material used in this process. Here easily available absorptive materials are glass fiber which used with same space. Generally there are different process which used in reduction of noise and pollution so basically such all things are studied in these system and their application.

Keyword: - ANOVA, hybrid muffler, material for sound absorption, Taguchi, pollution reduction technique.

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TECHNICAL AND ECONOMIC OPTIMIZATION OF SUBCRITICAL, WET EXPANSION ANDTRANSCRITICAL ORGANIC RANKINE CYCLE (ORC) SYSTEMS COUPLED WITH A BIOGAS POWER PLANT.

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ABSTRACT: Generally,>40% of the useful energy (cooling engine and exhaust gases) are wasted by a biogas power plant through the cooling radiator and the exhaust gases. An efficient way to convert this waste heat into work and eventually electricity is the use of an organic Rankine cycle (ORC) power system. Over the last few years, different architectures have been widely investigated (subcritical, wet expansion and trans-critical). Despite the promising performances, realistic economic and technical constraints, also related to the application, are required for a meaningful comparison between ORC technologies and architectures. Starting from the limited literature available, the aim of the present paper is to provide a methodology to compare sub-critical, transcritical and wet expansion cycles and different types of expanders (both volumetric and turbomachinery) from both technical and economic point of view, which represent one of the main novel aspects of the present work. In particular, the paper focuses on the thermo-economic optimization of an ORC waste heat recovery unit for a 500 kWe biogas

power plant located in a detailed regional market, which was not investigated yet. By means of a genetic algorithm, the adopted methodology optimizes a given economic criteria (Pay-Back Period, Net Present Value, Profitability Index and Internal Rate of Return) while respecting technical constraints (expander limitations) and thermodynamic constraints (positive pinch points in heat exchangers, etc.).The results show that optimal ORC solutions with a potential of energy savings up to 600 MWh a year and with a pay-back period lower than 3 years are achievable in the regional market analysed.

KEY WORDS: Biogas, power, plant, recovery,Organic Rankine cycle,etc.

MULTI-OBJECTIVE OPTIMIZATION AND SENSITIVITY ANALYSIS OF AN ORGANIC RANKINECYCLE COUPLED WITH A ONE-DIMENSIONAL RADIAL-INFLOW TURBINE EFFICIENCY PREDICTION MODEL

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ABSTRACT: The organic Rankine cycle (ORC) has been demonstrated to be a viable approach to recover low-grade waste heat and has been widely investigated in recent years. In the current research focused on the multi-objective optimization problem of ORC systems, few scholars consider the variation in turbine efficiency with the cycle parameters. This paper focused on the comparison of multi-objective optimization with variable turbine efficiency and that with constant turbine efficiency. The results obtained for the two types of turbine efficiency were compared, and the differences were analyzed. Flue gas at 523.15 K was used as the heat source, and pentane, hexane, heptane, cyclohexane, benzene and toluene were selected as working fluid candidates. The one-dimensional radial-inflow turbine efficiency prediction model was applied to replace constant turbine efficiency.The multi-objective model in conjunction with the turbine efficiency model was constructed by defining the net power output and system total cost per unit net power output as the objective functions. The non-dominated sorting genetic algorithm-II (NSGA-II) was used to optimize the evaporation temperature and

condensation temperature as the decision variables. With the aid of the ideal point, the optimal solution of each working fluid was selected from the Pareto frontier. The results showed that the turbine efficiency varies with changes in evaporation temperature and condensation temperature. In the multi-optimization with constant turbine efficiency, toluene and cyclohexane are the optimal working fluids, whereas with variable turbine efficiency, benzene is the optimal working fluid. In the sensitivity analysis, the optimal exergy efficiency shows opposite trends for the multi-objective optimization with constant and variable turbine efficiency.

KEY WORDS: Organic, Rankine ,cycle,optimization,thermoeconomic,etc.

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THERMODYNAMIC AND ECONOMIC ANALYSES AND OPTIMIZATION OF A MULTIGENERATIONSYSTEM COMPOSED BY A COMPRESSED AIR STORAGE, SOLAR DISH COLLECTOR, MICRO GAS TURBINE, ORGANIC RANKINE CYCLE, AND DESALINATION SYSTEM

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ABSTRACT: In this work, a hybrid system composed of a compressed air energy storage, a micro gas turbine, an organic Rankine cycle, a solar dish collector, and a multi effect distillation is presented as a combined power, heat, and fresh water production system. Energy and exergy analyses are applied to investigate thermodynamic performance of the system. The results show that the system consumes 278 kWh electricity and produces about 3.7 ton hot water during charging mode. Also, the system is capable of generating up to 523 kWh electrical energy and 2.5 ton potable water during the discharge period. The charge and the discharge period are 6.52 and 4 h respectively. Exergy analyses reveals that solar dish collector and combustion chamber are the major contributors for exergy destruction. Parametric analysis is employed to investigate the key parameters which have the major influence on the system performance. These parameters include cavern minimum and maximum pressures, gas turbine inlet temperature, dish collector aperture diameter, steam turbine inlet pressure, and desalinator feed water temperature. Optimization results show that round trip efficiency can rise from 65.2% to 70.35%, using upper limits of cavern minimum and maximum pressures. Besides, rising inlet temperature of gas turbine and restricting air cavern maximum and minimum pressures to their lower limits results in a 19.18% exergy efficiency improvement. Finally, economic analysis is performed to evaluate main cost and income sources of the system. As multi objective optimization shows, devising conditions that lead to produce more electrical energy improves system economic performance considerably.

KEY WORDS: Hybrid systemMicro gas turbine,,Dish collector,ORC,etc.

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MULTI-OBJECTIVE OPTIMISATION AND FAST DECISION-MAKING METHOD FOR WORKING FLUID SELECTION IN ORGANIC RANKINE CYCLE WITH LOW-TEMPERATURE WASTE HEAT SOURCE IN INDUSTRY

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ABSTRACT: In China, the utilisation of low-temperature waste heat (especially at temperatures lower than 100 °C) plays a significant role in increasing the energy-consumption efficiency in the industry. The organic Rankine cycle (ORC) is considered as a promising method to recover the aforementioned part of the waste heat. In the study, six potential candidates, namely R141b, R142b, R245ca, R245fa, R600a, and R601a were screened from 12 dry or adiabatic organic working fluids based on their thermodynamic performances in the ORC. A multi-objective optimisation (MOO) was performed for the thermodynamic performance (exergy efficiency, EXE) and economic performance (levelised energy cost, LEC) by using non-dominated sorting genetic algorithm-II (NSGA-II). The Pareto frontiers were obtained for the six candidates with the algorithm, and each optimal compromise solution was accurately obtained with the fuzzy set theory. Based on the EXE and LEC of the optimal compromise solution, the total cost and power generation efficiency for the six candidates were determined. This was used to obtain an explicit evaluation index in economic performance, namely static investment payback period (SIPP), to identify that the R245ca corresponded to the most cost-effective working fluid with the shortest SIPP. This suggests R245ca was the fastest to cover the investment and cost of the ORC system. Furthermore, a fast decision-making method was introduced to select the optimal working fluid based on the grey relational analysis (GRA) by considering key physical property parameters of the working fluids. The results suggest that any potential working fluid to recover low-temperature waste heat in the ORC can be evaluated by the simplified grey relational degree (SGRD) proposed in the study.

KEY WORDS: Working, fluid, selection,,Low etc

OPTIMIZATION OF A NOVEL COGENERATION SYSTEM INCLUDING A GAS TURBINE, A SUPERCRITICAL CO2

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RECOMPRESSION CYCLE, A STEAM POWER CYCLE AND AN ORGANIC RANKINE CYCLE

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ABSTRACT: According to the principles of energy grade recovery and cascade utilization, a novel cogeneration system including a gas turbine, a supercritical CO2 (S-CO2) recompression cycle, a steam power cycle and an organic Rankine cycle (ORC) is proposed. In particular, a part of waste heat from the supercritical CO2 recompression cycle is used to preheat the steam power cycle, and ORC uses the zeotropic mixture as working fluid. Comprehensive thermodynamic and exergoeconomic analyses are presented for the proposed cogeneration system. Parametric studies are conducted to study the effects of key system design parameters as pressure ratio of gas turbine, pressure ratio of the S-CO2 cycle, split ratio of the S-CO2 cycle, evaporation temperature of the steam power cycle, mass fraction of isopentane in the zeotropic mixture, evaporation temperature of ORC and pinch point temperature difference in the ORC evaporator on the exergy efficiency and total product unit cost. The optimum system parameters are obtained through the multi-objective optimization method based on GA (genetic algorithm) and TOPSIS (Technique for Order Preference by Similarity to Ideal Situation) decision making. The optimization results indicate that the optimum values of exergy efficiency and total product unit cost are 69.33% and 10.77$/GJ, respectively. Furthermore, the superiority of the proposed cogeneration system is verified by comparison with other seven forms of power generation systems.

KEY WORDS: Cogeneration system,Gas turbine, recompression, cycle,etc.

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THERMODYNAMIC OPTIMISATION OF A HIGH-ELECTRICAL EFFICIENCY INTEGRATED INTERNAL COMBUSTION ENGINE – ORGANIC RANKINE CYCLE COMBINED HEAT AND POWER SYSTEM

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ABSTRACT:

Organic Rankine cycle (ORC) engines are suitable for heat recovery from internal combustion engines (ICE) forthe purpose of secondary power generation in combined heat and power (CHP) systems. However, trade-offs must be considered between ICE and ORC engine performance in such integrated solutions. The ICE design and operational characteristics influence its own performance, along with the exhaust-gas conditions available as heat source to the ORC engine, impacting ORC design and performance, while the heat-recovery heat exchanger (ORC evaporator) will affect the ICE operation. In this paper, an integrated ICE-ORC CHP whole-system optimisation framework is presented. This differs from other efforts in that we develop and apply a fully-integrated ICE-ORC CHP optimisation framework, considering the design and operation of both the ICE and ORC engines simultaneously within the combined system, to optimise the overall system performance. A dynamic ICE model is developed and validated, along with a steady-state model of subcritical recuperative ORC engines. Both naturally aspirated and turbocharged ICEs are considered, of two different sizes/capacities. Nine substances (covering low-GWP refrigerants and hydrocarbons) are investigated as potential ORC working fluids. The integrated ICE-ORC CHP system is optimised for either maximum total power output, or minimum fuel consumption. Results highlight that by optimising the complete integrated ICE-ORC CHP system simultaneously, the total power output increases by up to 30% in comparison to a nominal system design. In the integrated CHP system, the ICE power output is slightly lower than that obtained for optimal standalone ICE application, as the exhaust-gas temperature increases to promote the bottoming ORC engine performance, whose power increases by 7%. The ORC power output achieved accounts for up to 15% of the total power generated by the integrated system, increasing the system efficiency by up to 11%. When only power optimisation is performed, the specific Fuel consumption increases, highlighting that high-power output comes at the cost of higher fuel consumption. In contrast, when specific fuel consumption is used as the objective function

(minimised), fuel consumption drops by up to 17%, thereby significantly reducing the operating fuel costs. This study proves that by taking a holistic approach to whole-system ICE-ORC CHP design and operation optimisation, more power can be generated efficiently, with a lower fuel consumption. The findings are relevant to ICE and ORC manufacturers, integrators and installers, since it informs component design, system integration and operation decisions.

KEY WORDS: Combined, heat , power,Efficient, etc

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AN INNOVATIVE ORGANIC RANKINE CYCLE (ORC) BASED OCEAN THERMAL ENERGY CONVERSION (OTEC) SYSTEM WITH PERFORMANCE SIMULATION AND MULTI-OBJECTIVE OPTIMIZATION

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ABSTRACT: Based on multi-objective particle swarm optimization (MOPSO) algorithm, with considering levelized cost of energy (LCOE) and exergy efficiency as two different objective functions, an innovative Organic Rankine Cycle (ORC) model based Ocean Thermal Energy Conversion (OTEC) system is investigated for trade-off Pareto optimization. In the present study, six key parameters including evaporating temperature, condensing temperature, warm seawater temperature at the outlet of evaporator, cool seawater temperature at the outlet of condenser, degree of superheat, and depth of cool seawater have been selected as decision variables. R717, R152a, R134a, R227ea, R600a and R601 are chosen as working fluids. Meanwhile, Linear Programming Technique for Multidimensional Analysis of Preference (LINMAP) is introduced in order to make decision for Pareto frontier. The results indicate that LCOE and exergy efficiency are two conflicting objectives, which are impossible to both achieve their optimal values simultaneously. According to the non-dominated sorting of Pareto optimal solution (POS) for the six working fluids, R717 and R601 have the best performance with 0.34 $/kWh of LCOE, 28.17% of exergy efficiency and 0.52 $/kWh of LCOE, 28.47% of exergy efficiency, respectively, followed by R152a, R600a and R134a which have relatively poor performance, but better than R227ea.

KEY WORDS:OTEC,ORC,,MOPSO,Multi,objective,etc

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ARTIFICIAL NEURAL NETWORK (ANN) BASED PREDICTION AND OPTIMIZATION OF AN ORGANIC RANKINE CYCLE (ORC) FOR DIESEL ENGINE WASTE HEAT RECOVERY

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ABSTRACT: This paper presents performance prediction and optimization of an organicRankine cycle (ORC) for diesel engine waste heat recovery based on artificial neural network (ANN). An ANN based prediction model of the ORC system is established with consideration of mean squared error and correlation coefficient. A test bench of combined diesel engine and ORC waste heat recovery system is developed, and the experimental data used to train and test the proposed ANN model are collected. A genetic algorithm (GA) is also considered in this study to increase prediction accuracy, and the ANN model is evaluated with different learning rates, train functions and parameter settings. A prediction accuracy comparison of the ANN model with and without using GA is presented. The effects of seven key operating parameters on the power output of the ORC system are investigated. Finally, a performance prediction and parametric optimization for the ORC system are conducted based on the proposed ANN model. The results show that prediction error of the ANN model with using the GA is lower than that without using GA. Therefore, it is recommended to optimize the weights of the ANN model with GA for a high prediction accuracy. The proposed ANN model shows a strong learning ability and good generalization performance. Compared to the experimental data, the maximum relative error is less than 5%. The experimental results after optimizing the operating parameters are very close to ANN's predictions, indicating one or more operating parameters can be adjusted to obtain a higher power output during the experiment process.

KEY WORDS: Diesel engine,Organic Rankine cycle,Artificial neural network

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DESIGN AND OPERATION OPTIMIZATION OF ORGANIC RANKINE CYCLE COUPLED TRIGENERATION SYSTEMS

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ABSTRACT:

The utilization of organic Rankine cycle (ORC) technology is increasing rapidly due to its adaptability to various low-grade heat sources. This paper examines the economic and environmental performances of different trigeneration systems integrated with ORC unit based on different low/medium-temperature heat sources. By coupling the ORC unit to combined cooling, heating and power (CCHP) plant, solar collector and biomass boiler, three systems, namely, CCHP-ORC, Solar-ORC as well as Biomass-ORC are proposed. In order to realize the best performance of each integrated system, a mixed integer linear programming (MILP) model is developed to deduce the optimal system combination and corresponding operation strategies, from different preferences. As an illustrative example, the above three integrated systems have been assumed to cover the energy demands of two typical commercial buildings: hotel and office for a calendar year. Comparative analysis among the proposed three systems is implemented considering both economic and environmental objectives. The simulation results indicate that the Solar- ORC system has the best economic performance, whereas the Biomass-ORC system enjoys the best environmental benefit. In addition, the potential environmental benefits of the ORC unit are recognized be higher than the economic ones.

KEY WORDS: Combined, cooling heating, power,Solar,etc

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DESIGNED BINARY MIXTURES FOR SUBCRITICAL ORGANIC RANKINE CYCLES BASED ON MULTIOBJECTIVE OPTIMIZATION

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ABSTRACT:

The use of binary zeotropic mixtures as working fluids applied to Organic Rankine Cycles (ORCs) is investigated in this paper. In total, six (6) hydrocarbons and (2) hydrofluorocarbons are considered, leading to twenty-eight (28) possible binary combinations. The mixtures were tested with a basic Rankine cycle while using the heat source temperature as independent variable, which assumed six different values, ranging from 80 °C to 180 °C, in steps of 20 °C. The simulations aimed to identify the ideal mixtures that maximized the net power and exergeticefficiency, and minimized the heat exchanger's global conductance for a given temperature of the heat source. The optimization process relied on a genetic algorithm and the selection of the best mixtures, on a non-dominated sorting method (NDS), which returned Pareto fronts gathering the best solutions. While no one specific ideal mixture was identified, the results showed that the range of the so-called ideal mixtures narrows as the heat source temperature increases, with mixtures including fluids like R245fa and pentane being good options, whereas at low temperature, a larger number of fluid mixtures perform well. Finally, a scale analysis is proposed and shows that the maximal net power varies linearly with a Number of Transfer Units (NTU) factor while its slope depends on the heat source temperature. The latter analysis is compared with the results obtained with the Pareto front and NDS, showing that both sets of results agree well while correlated by a single constant for the entire temperature range covered in the present study.

KEY WORDS: Organic Rankine Cycle (ORC),Working fluid,Mixture,Genetic algorithms (GA),Multi-objective optimization

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DEVELOPMENT AND MULTI-OBJECTIVE OPTIMIZATION OF GEOTHERMAL-BASED ORGANIC RANKINE CYCLE INTEGRATED WITH THERMOELECTRIC GENERATOR AND PROTON EXCHANGE MEMBRANE ELECTROLYZER FOR POWER AND HYDROGEN PRODUCTION

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ABSTRACT: The aim of this study is to enhance the performance of a geothermal-based organic Rankine cycle by proposing two novel systems in which some part of the waste heat is recovered employing thermoelectric generator for power and/or hydrogen production (using proton exchange membrane electrolyzer). Accordingly, two novel systems are proposed and analyzed along with the basic organic Rankine cycle (configuration (a)). In the first proposed system, some part of the waste heat is recovered by employing thermoelectric generator (configuration (b)), while in the second one the additional power generated by thermoelectric generator is used in the proton exchange membrane electrolyzer for hydrogen production (configuration (c)). The performances of the proposed systems are investigated and compared with that of the basic cycle from energy, exergy and exergoeconomicviewpoints and are optimized using genetic algorithm via a multi-objective optimization strategy. The results indicate that, at the best solution point obtained from multi-objective optimization, the exergy efficiencies of the proposed systems (configurations (b) and (c)) are higher than that of the basic organic Rankine cycle by 21.9% and 12.7%, respectively. Furthermore, another interesting result is found which reveals that the specific product cost for the proposed configurations (b) and (c) is lower than that for the basic organic Rankine cycle, despite the higher total cost rate for the proposed configurations.

KEY WORDS: Multi-objective, optimization,Exergoeconomic,Thermoelectric generator

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ECONOMIC OPTIMIZATION OF ORGANIC RANKINE CYCLE WITH PURE FLUIDS AND MIXTURES FOR WASTE HEAT AND SOLAR APPLICATIONS USING PARTICLE SWARM OPTIMIZATION METHOD

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ABSTRACT:

The optimization criterion for designing the thermodynamic layout of an organic Rankine cycle is often based oneither achieving maximum thermodynamic efficiency or incurring minimum initial specific investment costs. Such designs, however, need not lead to the maximum utilization of waste heat potential or an optimal investment. For full potential utilization of a waste heat source, its temperature should be brought down to near ambient temperatures via transfer of enthalpy to the organic Rankine cycle working fluid. In the limit, however, pursuit of complete source utilization may lead to capital intensive organic Rankine cycle layouts that demand infinitesimal temperature gradients in heat exchangers leading to massive heat transfer areas. This paper defines a new objective function that reveals the tradeoffs between specific investment cost and the extent to which waste heat is utilized. A particle swarm optimization algorithm is used to optimize 7 and 8 dimensional search space for pure and mixture based working fluids, respectively, for case studies involving power capacities of 5, 50 and 500 kWe, waste heat source temperatures ranging from 75 to 275 °C and a number of working fluids. As a practical aid to designers, a methodology for generating high isentropic efficiency scroll geometries corresponding to optimized cycles is presented, and the optimization analysis is further extended to solar thermal applications.

KEY WORDS: Organic Rankine cycles,Thermo-economics,Waste heat application,Solar heat application,Particle swarm optimization

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ENERGETIC OPTIMIZATION OF REGENERATIVE ORGANIC RANKINE CYCLE (ORC) CONFIGURATIONS

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ABSTRACT: The present study focuses on the energetic optimization of regenerative Organic Rankine Cycle (ORC) configurations. More specifically, three regenerative ORCs are examined. The first includes an open preheater, in which the bleed stream is mixed with the working fluid exiting the pump of the cycle (O-ORC). The other two configurations include a closed preheater. In the second configuration, the bleed stream is throttled and conveyed to the condenser (CB-ORC), while in the third one, it is repressurized via a secondary pump and recirculates into the evaporator of the cycle (CF-ORC). The systems are optimized for different working fluids, and their energetic efficiencies are estimated and compared to that of a standard ORC (S-ORC). In all cases, the inclusion of a recuperator has also been investigated. In principle, recuperative and regenerative ORCs are mostly suitable for dry fluids, while the critical temperature can also have a positive influence on the performance improvement. Furthermore, it is estimated that while the recuperative S-ORC has a higher efficiency than the non-recuperative regenerative cycles, recuperative O-ORC and CF-ORC exhibit a relative efficiency gain ranging from 4.98% to 8.05% and 6.22% to 9.29%, respectively. The highest efficiency improvement achieved by the CB-ORC, however, is minimal.

KEY WORDS:ORC,RegenerativeRecuperator,Optimization

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EXERGETIC AND HEAT LOAD OPTIMIZATION OF HIGH TEMPERATURE ORGANIC RANKINECYCLE

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ABSTRACT:

This paper presents an optimization of a high temperature organic Rankine cycle (ORC) system providing the basis for optimal fluid selection and subsequent design parameters based on the working fluid selected. The working fluids used are m-xylene, propylcyclohexane and decane having high critical temperatures. The proposed system deals with the application of biomass due to the high content heat available during its combustion. The system is optimized through non-dominated sorting genetic algorithm (NSGA-II) by taking the prime operators such as; exergetic efficiency (ηex) to extract maximum work and total heat transfer requirement (UA) to get a prediction of the heat transfer area and hence the cost of the system. The parameters subjected to constraints for optimization are evaporation pressure, degree of superheating and pinch point conditions at heat exchangers. The optimization results exhibit an increase of 22.9% for propylcyclohexane and 45.5% for decanein UA values, relative to m-xylene. Highest exergetic efficiency values for m-xylene among three working fluids further ensures its use in the system as the most viable option from both thermodynamic and economic aspect. Moreover, optimal evaporation pressure range is evaluated by taking the maximum and minimum of exergeticefficiency and UA value, respectively. Both objective functions show negative trend with increase in degree of superheating, with less significant drop. As the pinch point value increases, the UA value decreases showing significantly smaller areas of heat transfer and less cost, but with low exergetic efficiency, therefore, moderate pinch point condition of 8–10 °C is recommended.

KEY WORDS: Organic Rankine cycle,High temperature,Heat transfer requirement,

Optimization

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EXERGETIC OPTIMIZATION OF DOUBLE STAGE ORGANIC RANKINE CYCLE (ORC)

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ABSTRACT:

The present work focuses on the exergetic optimization of double stage Organic Rankine Cycle (DS ORC) for waste heat recovery. A model of a DS ORC, consisting of a high temperature (HT) stage serially connected to a low temperature (LT) stage is developed, while different combinations of working fluids with variable critical temperatures are considered in each stage. The optimization variables are the evaporation pressures in the HT and LT stages, as well as the evaporator pinch point and condenser temperature in the HT stage. The aim is to explore the exergetic efficiency improvement potential of DS ORCs compared to the single stage cycles and establish optimization guidelines for maximizing their total power output for heat source temperatures ranging from 100 _C to 300_C. Compared to single stage ORCs, DS ORCs can lead to a relative increase of the exergetic efficiency by up to 25%, depending on the heat source temperature and the working fluids considered. Meanwhile, DS ORCs are especially favourable when the heat source temperature is far lower or between the critical temperatures of the fluids used in their two stages.

KEY WORDS: Organic Rankine Cycle,ORC,Double stage,Double evaporation

EXERGY AND EXERGO-ECONOMIC ANALYSIS AND OPTIMIZATION OF A SOLAR DOUBLE PRESSURE ORGANIC RANKINE CYCLE

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ABSTRACT: This study presents an exergo-economic analysis and optimization of a double pressure organic Rankinecycle coupled with a solar collector via a thermal storage tank. Numerical analysis has been done to perform the exergetic analysis along with economic analysis. The performance of the system was examined during a day. Results showed that the system is capable of generating stable power during the day with a solar fraction of 100%. In nights and overcasts, the system can still generate power with the help of storage tank and an auxiliary heater. A parametric analysis examined the effect of key parameters on the system performance including exergy efficiency and product cost rate. The effective parameters included turbine inlet pressure and temperature. Exergo-economic criteria revealed that solar collector has the most value of Z_ þ C_ D which is due to both high exergy destruction and high investment costs of the collector. Following the collector, the storage tank, condenser, turbine, recuperator and evaporators had the highest destruction. To perform the optimization process, two objective functions including exergy efficiency and product cost rate were considered. Ten decision variable including inlet temperature and pressure of the turbines, heat exchanger minimum temperature differences and the mass flow rate of solar collector and tank and pressure of condenser were chosen according to the parametric analysis. Also, with the aid of a reliable decision-making technique called TOPSIS method, the optimal point was selected among the Pareto frontier of the genetic algorithm. Results show that system can reach the efficiency of 22.7% and product cost rate of 2.66 million dollars per year.

KEYWORDS: Exergo-economic,Organic Rankine cycle,Solar collector,Optimization, decision making

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EXPERIMENTAL COMPARISON AND OPTIMIZATION GUIDANCE OF R1233ZD(E) AS A DROP-IN REPLACEMENT TO R245FA FOR ORGANIC RANKINE CYCLE APPLICATION

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ABSTRACT: The organic Rankine cycle is capable of converting the low-temperature waste heat into electricity. The commonly used working fluid R245fa will be phased out in the near future because of the significant impact to climate change. In that case, a new refrigerant R1233zd(E) with extremely low GWP is proposed as an environmental friendly substitute in this paper. The investigation is processed with four steps: firstly, a thermodynamic analysis was carried out for prior prediction of the applicability of R1233zd(E) as an alternative to R245fa; secondly, an experimental comparison between two refrigerants was implemented under a design of extensive operating conditions; Afterwards, experimental results were presented. Differences in expansion and evaporation procedure based on three non-dimensionless indicators were analyzed; Eventually, a multi-objective optimization guidance involved with aforementioned indicators was proposed. Comparing the maximum cycle thermal efficiency, R1233zd(E) leads to approximately 3.8% higher than R245fa. Comparing the maximum output electrical power, R1233zd(E) leads to 4.5% better than R245fa. R1233zd(E) is proven as an appropriate alternative to R245fa based on current study. Prediction precision of the volume ratio dependent curves of filling factor and isentropic effectiveness are within 1.2% and 2.7%, which can be used to model a certain expander in optimization procedure.

KEY WORDS:R1233zd(E),R245fa,ORC,Cycle thermal efficiency

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GLOBAL OPTIMIZATION OF THE DIESEL ENGINE–ORGANIC RANKINE CYCLE (ORC) COMBINED SYSTEM BASED ON PARTICLE SWARM OPTIMIZER (PSO)

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ABSTRACT:

The organic Rankine cycle (ORC) system powered by exhaust heat has great potential in improving engine performance. Many optimizations of the only ORC system were conducted, while the existing literature pays limited attention to the optimization of the engine–ORC combined system. By considering the importance of interaction, cooperation, and influence between the engine and ORC system, a global optimization of the diesel engine–ORC combined system (herein, the combined system) is conducted in this paper with respect to power output and fuel economy. A GT-Suite model of the combined system and a GT-Suite/Simulink co-simulation model are proposed to obtain the optimum operating parameters of the engine and the ORC system under various operating conditions. Furthermore, the effects of the operating parameters, namely, exhaust valve timing, injection timing, expander speed, and pump speed, are evaluated on the combined system. In addition, models of the engine and the ORC system are calibrated, and a particle swarm optimizer (PSO) is designed and adopted for global optimization. Optimization results show improvements of 3.24% and 3.13% on the power output and brake specific fuel consumption (BSFC), respectively, with full engine load when the engine is operated at 3600 r/min. In the optimization of fuel economy with partial engine load, a maximum reduction of 5.71% on the BSFC of the combined system is obtained at 3600 r/min engine speed.

KEY WORDS: Organic Rankine cycle,combined system,Integrated simulation

Global optimization,Particle swarm optimizer

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MODELING AND OPTIMIZATION CRITERIA OF SCROLL EXPANDER INTEGRATED INTO ORGANIC RANKINE CYCLE FOR COMPARISON OF R1233ZD(E) AS AN ALTERNATIVE TO R245FA

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ABSTRACT: HFCs are suggested to be banned in 2020 because of high GWP (Global Warming Potential). New type of HFO refrigerant R1233zd(E) is proposed as a drop-in replacement to R245fa for organic Rankine cycle application considering the similar thermo-physical properties. In this paper, a description of previous experimental comparison between two refrigerants is presented in the first section. In the second section, further investigation in expansion procedure is implemented with a semi-empirical expander model, which is validated with experimental data based on 'Genetic Algorithm'. Internal leakage, mechanical friction and heat transfer are presented as main irreversible losses. Input parameters are assigned to mass flow rate, expander rotational speed, supplytemperature and exhaust pressure. Supply pressure, exhaust temperature and net power are computed as output results. The maximum deviation between the measured and predicted results are 3.35%, 2.24 K and 6.09% respectively. In the last section, polynomial curve-fittings of dimensionless expander efficiency are conducted for wider prediction of operating range of the expander. Values of filling factor and expander isentropic efficiency are predicted with $R2$ = 99.517% and $R2$ = 97.997%. Curve-fittings of expander efficiency can be integrated into systematic simulation, which is aimed for further optimization of cycle performance to better take advantage of new refrigerants.

KEY WORDS:croll expander,ORC,Alternative,Polynomial curve-fitting

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OPTIMISATION OF A HIGH-EFFICIENCY SOLAR-DRIVEN ORGANIC RANKINE CYCLE FOR APPLICATIONS IN THE BUILT ENVIRONMENT

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ABSTRACT: Energy security, pollution and sustainability are major challenges presently facing the international community, in response to which increasing quantities of renewable energy are to be generated in the urban environment. Consequently, recent years have seen a strong increase in the uptake of solar technologies in the building sector. In this work, the potential of a solar combined heat and power (CHP) system based on an organic Rankine cycle (ORC) engine is investigated in a domestic setting. Unlike previous studies that focus on the optimisation of the ORC subsystem, this study performs a complete system optimisation considering both the design parameters of the solar collector array and the ORC engine simultaneously. Firstly, we present thermodynamic models of different collectors, including flat-plate and evacuated-tube designs, coupled to a non-recuperative sub-critical ORC architecture that delivers power and hot water by using thermal energy rejected from the engine. Optimisation of the complete system is first conducted, aimed at identifying operating conditions for which the power output is maximised. Then, hourly dynamic simulations of the optimised system configurations are performed to complete the system sizing. Results are presented of: (i) dynamic 3-D simulations of the solar collectors together with a thermal energy storage tank, and (ii) of an optimisation analysis to identify the most suitable working fluids for the ORC engine, in which the configuration and operational constraints of the collector array are considered. The best performing working fluids (R245fa and R1233zd) are then chosen for a whole-system annual simulation in a southern European climate. The system configuration combining an evacuated-tube collector array and an ORC engine is found to be best-suited for electricity prioritisation, delivering an electrical output of 3,605 kWh/year from a 60m2 collector array. In addition, the system supplies 13,175 kWh/year in the form of domestic hot water, which is equivalent to more than 6 times the average annual household demand. A brief cost analysis and comparison with photovoltaic (PV) systems is also performed, where despite

the lower PV investment cost per kWel, the levelised energy costs of the different systems are found to be similar if the economic value of the thermal output is taken into account. Finally, a discussion of the modelled solar-CHP systems results shows how these could be used for real applications and extended to other locations.

KEY WORDS: Solar energy,Organic Rankine cycle,Dynamic modelling,Optimisation, Energy efficiency

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OPTIMIZATION AND MULTI-TIME SCALEMODELING OF PILOT SOLAR DRIVEN POLYGENERATION SYSTEM BASED ON ORGANIC RANKINE CYCLE

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ABSTRACT: Pilot-scale distributed polygeneration system driven by solar energy and its effective simulation mechanism provides promising solutions for the technology promotion and implementation, as the emerging of smart grid concepts. In this regard, this study aims to preliminary test such a system based on organic Rankine cycle withthe power output of 200 kW, which is combined with cooling and heating cycle. The developed pilot system is proven to sustain the power thermal efficiency of 10% with R123 and a self-made expansion valve. Targeting a whole optimized system in practical application, a multi-time scale mechanism is proposed and consists of long-, mid- and short-term simulation with yearly, hourly and second time step, respectively. The functionality of the concept is proven by showing the model-guided optimal sequential system with hexamethyldisiloxane working fluid. It achieves a high performance ratio, efficient cost, and less land occupation, corresponding to 67.61%, $0.12 million and 3774.2m2, respectively, under the long-term simulation. Rated operation decisions are correspondingly determined and present acceptable supply-and-demand matching performance at the level of midterm modeling, with the payback time of 7.41 years. Furthermore, the system dynamic behavior is analyzed in two typical sunny and cloudy days to understand and compare its running states. The short-term model shows a steady thermal efficiency of 9.6% within 15,000 s and capture a smaller period of safety state only within 6000 s under the sunny day condition. Although the peak irradiance in the cloudy day is higher than that in the sunny day, the performance degrades dramatically due to the irradiance fluctuation. It is expected that the proposed mechanism can be extended in analyzing operational security and control strategy.

KEY WORDS: Combined cooling, heating, and power,Organic Rankine cycle,Pilot system

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OPTIMIZATION OF ORGANIC RANKINECYCLE POWER SYSTEMS CONSIDERING MULTISTAGE AXIAL TURBINE DESIGN

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ABSTRACT:

Organic Rankine cycle power systems represent a viable and efficient solution for the exploitation of medium-to low temperature heat sources. Despite the large number of commissioned units, there is limited literature on the design and optimization of organic Rankine cycle power systems considering multistage turbine design. This work presents a preliminary design methodology and working fluid selection for organic Rankine cycle units featuring multistage axial turbines. The method is then applied to the case of waste heat recovery from a large marine diesel engine. A multistage axial turbine model is presented and validated with the best available data from literature. The methodology allows the identification of the most suitable working fluid considering the trade-off between cycle and multistage turbine designs. The results of the optimization of cycle and turbine suggest that the fluid n-butane yields the best compromise in terms of cycle net power output, turbine cost and efficiency for the considered case study. When a conservative design approach is adopted, the turbine features a two-stage configuration with supersonic converging nozzles and post-expansion. Conversely, a single-stage turbine featuring a supersonic converging-diverging nozzle and Mach number up to 2 is the resulting idealchoice when a more advanced design approach is implemented.

KEY WORDS: Organic Rankine cycle,Axial turbine,Multistage turbine

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OPTIMIZATION OF ORGANIC RANKINE CYCLE USED FOR WASTE HEAT RECOVERY OF CONSTRUCTION EQUIPMENT ENGINE WITH ADDITIONAL WASTE HEAT OF HYDRAULIC OIL COOLER

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ABSTRACT: The aim of this study is to provide an optimal organic Rankine cycle (ORC) system for waste heat recovery (WHR) from a construction equipment engine. Construction equipment machines have very high annual fuel consumption, and most of the engine power is used to drive a hydraulic oil pump, thus producing additional waste heat from the hydraulic oil cooler. In order to compare the WHR of the construction equipment engine with that of a conventional engine without the heat of the hydraulic oil, four different single-loop ORC cases were considered and optimized for maximum net power. The results of this study showed that at the half-load condition as the primary operating condition, the use of additional waste heat from the hydraulic oil can increase the net power output of the ORC in the construction equipment engine by 11% despite at a low expander inlet temperature without arecuperator as compared to the system without the heat of hydraulic oil. However, the use of waste heat from the hydraulic oil increased the cost of the system owing to the preheater used by hydraulic oil and the increased condenser size.

KEY WORDS: Organic Rankine cycle (ORC),Engine,Waste heat recovery (WHR),

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OPTIMIZATION OF ORGANIC RANKINE CYCLE USED FOR WASTE HEAT RECOVERY OF CONSTRUCTION EQUIPMENT ENGINE WITH ADDITIONAL WASTE HEAT OF HYDRAULIC OIL COOLER

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ABSTRACT:

The aim of this study is to provide an optimal organic Rankine cycle (ORC) system for waste heat recovery (WHR) from a construction equipment engine. Construction equipment machines have very high annual fuel consumption, and most of the engine power is used to drive a hydraulic oil pump, thus producing additional waste heat from the hydraulic oil cooler. In order to compare the WHR of the construction equipment engine with that of a conventional engine without the heat of the hydraulic oil, four different single-loop ORC cases were considered and optimized for maximum net power. The results of this study showed that at the half-load condition as the primary operating condition, the use of additional waste heat from the hydraulic oil can increase the net power output of the ORC in the construction equipment engine by 11% despite at a low expander inlet temperature without arecuperator as compared to the system without the heat of hydraulic oil. However, the use of waste heat from the hydraulic oil increased the cost of the system owing to the preheater used by hydraulic oil and the increased condenser size.

KEY WORDS: Organic Rankine cycle (ORC),Engine,Waste heat recovery (WHR), oil

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OPTIMIZATION OF THE COMBINED SUPERCRITICAL CO2 CYCLE AND ORGANIC RANKINECYCLE USING ZEOTROPIC MIXTURES FOR GAS TURBINE WASTE HEAT RECOVERY

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ABSTRACT: In order to further improve the efficiency of the gas turbine, a novel combined supercritical CO2 regenerative cycle and organic Rankine cycle using zeotropic mixtures for waste heat recovery of gas turbine is proposed. The zeotropic mixtures used in the present study are cyclopentane/R365mfc. Exergoeconomic analysis is reported for the proposed system and parametric studies have been carried out to investigate the effect of system parameters on the exergy efficiency and the unit cost of electricity. The multi-objective optimization method based on genetic algorithm is chosen to obtain the optimum system parameters. The results show that the overall values of the exergoeconomic factor, the optimal exergy efficiency and the optimal unit cost of electricity of the proposed system are 31.88%, 62.23% and 3.95 cent/kW h, respectively. The obtained result reveals the superiority of the proposed combined regenerative S-CO2 cycle and ORC system compared to the combined basic S-CO2 cycle and ORC system, the combined recompression S-CO2 cycle and ORC system. Therefore, the proposed system is suitable for gas turbine waste heat recovery, and it has advantages of deep utilization of waste heat, high efficiency and low cost.

KEY WORDS: Gas, turbine, waste heat recovery,CO2, regenerative cycle

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OPTIMIZATIONS OF THE ORGANIC RANKINE CYCLE-BASED DOMESTIC CHP USING BIOMASS FUEL

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ABSTRACT: The purpose of this study is to determine the optimal operating conditions and performance for the design of ORC based biomass compact CHP for 2 kW of electric, 25 kW of thermal power productions and 60 °C warm water supply. Eight organic working fluids were selected based on thermo-physical properties and related environmental regulations: cyclopentane, isopentane, n-pentane, diethyl ether, HFO-1233zd, HFC-245fa, HFE- 7000 and HFE-7100. The selected organic fluids were classified into three groups considering latent heat and boiling point. The group A fluids contained cyclopentane, isopentane, n-pentane and diethyl ether. The group B fluids contained HFO-1233zd and HFC-245fa. The group C fluids contained HFE-7000 and HFE-7100. A micro CHP system composed of a biomass boiler (200 °C heat source), an ORC power cycle and a cooling water line (20 °C cooling water supply) was modeled in four variants depending on whether post-heater and IHE were applied or not. The subcritical ORC cycle and saturated vapor state at the inlet of the expander were considered for the analysis. As a result of thermodynamic analyses and optimizations, the group A fluids have the best CHP performance because of the greatest latent heat amount. The systems using the group A fluids have the lowest mass flow rates from 0.053 kg/s to 0.081 kg/s, the lowest required heat supplies from 31.64 kW to 34.61 kW, the highest ORC efficiencies from 5.95% to 7.29% and the CHP efficiencies from 71.83% to 72.32%. The group B fluids have the mass flow rates from 0.157 to 0.215 kg/s, the highest required heat supplies from 36.98 kW to 46.41 kW, the lowest system efficiencies from 4.59% to 6.05% and the highest CHP efficiencies from 72.05% to 73.41%. The group C fluids have the highest mass flow rates from 0.213 kg/s to 0.230 kg/s, the required heat supplies from 32.30 kW to 40.54 kW, the system efficiencies from 5.07% to 6.36% and the lowest CHP efficiencies from 71.31% to 72.33%. In addition, ORC systems using the group A or group C fluids can operate at low pressure and can meet system requirements with low cooling water mass flow rate because of the high boiling points. For the group A fluids, both post-heater and IHE are very effective for the system, and the system using the group B fluids can highly improve the system through the application of the post heater. For the group C fluids, application of the IHE significantly improves system performance.

KEY WORDS: Combined heat and power (CHP),Organic Rankine cycle,Biomass

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PARAMETRIC OPTIMIZATION AND THERMODYNAMIC PERFORMANCE COMPARISON OF SINGLE-PRESSURE AND DUAL-PRESSURE EVAPORATION ORGANIC RANKINE CYCLES

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ABSTRACT:

Dual-pressure evaporation organic Rankine cycle (ORC) involves two evaporation processes with different pressures, and can significantly reduce the exergy loss in the heat absorption process compared with conventional single-pressure evaporation ORCs. However, the applicable heat source temperatures of dual-pressure vaporation ORCs and the effects of the working fluid thermophysical properties on the applicable conditions remain indeterminate. Optimal cycle parameters for various heat source temperatures also need to be studied. Solving these questions is crucial for the application and promotion of dual-pressure evaporation ORCs. This Study focuses on a typical dual-pressure evaporation ORC driven by the 100–200 °C heat sources without a limit on the outlet temperature. Nine pure organic fluids were selected as working fluids. Evaporation pressures and evaporator outlet temperatures of the single-pressure and dual-pressure evaporation ORCs were optimized, and their optimized system thermodynamic performance was compared. Results show that the applicable heat source temperature range of the dual-pressure evaporation ORC (Wnet,dual>Wnet,single) generally increases as the working fluid critical temperature increases. The upper limit of the applicable heat source temperatures (THS,inTP), working fluid critical temperature and pinch point temperature difference generally conform to a linear relation. For the heat source temperature below THS,inTP, the maximized net power output of the dual-pressure evaporation ORC is larger than that of the single-pressure evaporation ORC. Furthermore, the increment generally increases as the heat source temperature decreases, and the maximum increments are 21.4–26.7% for nine working fluids. For the heat source temperature above THS,inTP, the dual-pressure evaporation ORC is unbefitting.

KEY WORDS: Organic Rankine cycle,Dual-pressure evaporation,, aste heat recovery

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PERFORMANCE ANALYSIS AND PARAMETRIC OPTIMIZATION OF SUPERCRITICAL CARBON DIOXIDE (S-CO2) CYCLE WITH BOTTOMING ORGANIC RANKINE CYCLE (ORC)

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ABSTRACT: Supercritical carbon dioxide (S-CO2) cycle is proven to be one promising alternative to provide high Efficiency and has been developed for a wide range of energy conversion applications. Thermal efficiency of the S-CO2 cycle can be further improved by incorporating an appropriate bottoming cycle utilizing the Heat recovery. Different recuperative ratios of the topping S-CO2 cycle are considered and the influence of heat source initial temperature and total heat load on the bottoming ORC is evaluated. Two configurations of the SCO2- ORC combined cycle system are presented, one without a pre-cooler and the other still with a precooler, corresponding to total and partial residual heat recovery respectively. Though the entire residual heat recovery by the bottoming cycle could definitely increase the system thermal efficiency, the low ORC evaporation temperature and mediocre ORC performance leads to a limited improvement. While in the combined cycle system with a pre-cooler, higher ORC evaporation temperature could be attained and it has a remarkable effect on the ORC performance, even though part of the topping cycle residual heat is discharged to the ambient. The simulation results reveal that the S-CO2-ORC combined cycle system performance could be significantly improved through this parametric optimization. The recompression S-CO2 cycle with bottoming ORC is then analyzed and thermal performance is improved based on the previous optimization results. The bottoming ORC could effectively recover the residual heat of the topping S-CO2 cycle and increase the system thermal efficiency, thus it can be considered and applied in similar practical cases.

KEY WORDS:S-CO2 cycle,ORC,Combined cycle,Parametric optimization

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PERFORMANCE OPTIMIZATION OF COMBINED SUPERCRITICAL CO2 RECOMPRESSION CYCLE AND REGENERATIVE ORGANIC RANKINE CYCLE USING ZEOTROPIC MIXTURE FLUID

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ABSTRACT: Thermodynamic and exergoeconomic analysis are performed for a novel combined supercritical CO2 (S-CO2) recompression cycle and regenerative organic Rankine cycle (ORC) using zeotropic mixture. Comprehensive parametric studies are carried out to investigate the effect of significant system parameters as pressure ratio, split ratio, evaporation temperature, pinch point temperature difference in the evaporator and the mass fraction of zeotropic mixture on the exergy efficiency and total product unit cost. Employing the multi-objective optimization method based on genetic algorithm and the TOPSIS (Technique for Order Preference by Similarity to Ideal Situation) decision making, the Pareto front solutions and optimum system parameters are obtained. In particular, several zeotropic mixtures are parameterized and used as a decision variable to participate in the multiobjectiveoptimization process to obtain the optimal zeotropic mixture. The result shows that the optimal zeotropic mixture is R236fa/R227ea (0.46/0.54). The optimum values of exergy efficiency and total product unit cost are found to be 73.65% and 10.93 $/GJ, respectively. Furthermore, comparison analysis reveals the superiority of the proposed combined cycle to the single S-CO2 cycle and the combined S-CO2 cycle and basic ORC.

KEY WORDS: Supercritical, CO2, Rankine cycle,Combined cycle

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PROCESS OPTIMIZATION AND WORKING FLUID MIXTURE DESIGN FOR ORGANIC RANKINECYCLES (ORCS) RECOVERING COMPRESSION HEAT IN OXY-COMBUSTION POWER PLANTS

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ABSTRACT:

In this study, an Organic Rankine Cycle (ORC) is proposed to be integrated with the flue gas pre-compression process to reduce the energy cost resulting from Carbon Capture and Storage (CCS). An equation-based flowsheetoptimization model is developed considering the mixture working fluid design, ORC operating conditions and the compression process simultaneously. The optimal number of stages of CO2 compression, the working fluid composition and the optimal operating conditions of ORCs and the compression train can be determined simultaneously using the proposed mathematical model. Proper heat integration can boost the power output of the ORC system significantly. The heat integration model considering variable process streams is extended to the Integrated ORC and flue gas compression train process. The results show that the optimal number of stages is 4 and a pure working fluid could perform better than a mixture working fluid if operating conditions are chosen properly. The integration of ORCs can reduce the energy penalty by 7.9% compared with the original optimal design that did not include ORCs. In addition, one compressor stage is avoided.

KEY WORDS: Carbon Capture and Storage (CCS),Compression waste heat, Organic Rankine cycle

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SIMULTANEOUS OPTIMIZATION OF THE DISTRICT HEATING NETWORK TOPOLOGY AND THE ORGANIC RANKINE CYCLE SIZING OF A GEOTHERMAL PLANT

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ABSTRACT: This contribution presents the optimization of parallel distribution between electricity and heat production for a geothermal plant. The geothermal fluid is split into two streams, one used for an Organic Rankine Cycle (ORC) system, and the other for a District Heating Network (DHN). The superstructure to be used for the optimization problem includes the ORC components, one of which is an optional internal heat exchanger which allows exchange between the outlet streams of the turbine and the pump. Each of the components' characteristic dimensions (used in the installation cost) is an optimization variable. The operating cost of the ORC is proportional to the installation cost. The superstructure also includes the DHN topology constituted by a definite consumer and optional consumers. A Mixed Integer Non-Linear Programming (MINLP) optimization problem is formulated and solved using the GAMS software. The strategy used to overcome the critical point of the initialization of the MINLP problem is presented. It consists in dividing the general problem into sub-problems which are solved successively. Three different academic study cases are compared to a reference case. The results validate the stability and the robustness of this optimization tool. A sensitivity analysis is performed in geothermal source conditions. All these results highlight the relevance of the simultaneous approach.

KEY WORDS: Economic optimization,Geothermal power plant,Combined heat and power (CHP)

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STUDY OF WASTE HEAT RECOVERY POTENTIAL AND OPTIMIZATION OF THE POWER PRODUCTION BY AN ORGANIC RANKINE CYCLE IN AN FPSO UNIT

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ABSTRACT:

This paper aims to explore the alternatives for waste heat recovery in a floating production storage and offloading (FPSO) platform to meet the demand for heat (from hot water) and to maximize the electric powergeneration through the organic Rankine cycle (ORC) with purpose to increase the overall thermal efficiency of the process and reduce CO2 emissions. Two different cycles' configurations are explored (simple and regenerative) using exhaust gases from the gas turbines as the heat sources for the ORC and the cogeneration system. The curves of the GE LM2500 and GE LM2000 turbines are modeledtogether with the water heating systems and the organic Rankine cycle. The model is solved using a genetic algorithm optimization method, whose objective function is set to meet the electric power demand for the FPSO platform. The purchased equipment costs of the ORC, the reduction in fuel consumption and CO2 avoided are estimated. Waste heat recovery meets the heat demand and contributes up to 21% of the electric energy demand, which increases the overall efficiency of the system, and improves the utilization factor by up to 10.8% and 19.2%, respectively. There is an average reduction of 22.5% in fuel consumption and CO2 emissions during the lifetime of the FPSO. The economic analysis based on the NPV shows that a US$12.55 million return on investment is possible, in addition to reducing the initial investment cost by US$14.2 million through the exclusion of the GE LM2500 gasturbine at project implementation.

KEY WORDS: Organic Rankine cycle,Optimization,Offshore,CO2 reduction

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THERMODYNAMIC AND ECONOMIC OPTIMIZATION OF A DOUBLE-PRESSURE ORGANIC RANKINE CYCLE DRIVEN BY LOW-TEMPERATURE HEAT SOURCE

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ABSTRACT:

Low-temperature heat source has been exploited for decades to generate electricity. Organic Rankinecycle (ORC) system has a high energy conversion efficiency due to the good performance of organic fluids under the low-temperature heat source. In this study, a double-pressure organic Rankine cycle system driven by low-temperature heat source is used to generate electricity. The double-pressure ORC system achieves the cascaded utilization of energy, which can improve the efficiency of energy conversion. Geothermal heat source is employed as a typical low-temperature heat source. Mathematical model is established based on thermodynamic and economic laws, and the overall system performance has been evaluated. Parametric analysis is conducted to examine the effects of some key thermodynamic parameters, namely turbine high-level inlet pressure, turbine low-level inlet pressure, turbine high-level inlet temperature, on the system's performance. Multi-objective Parametric optimization based on turbine 1-D design is conducted by means of genetic algorithm (GA) to find the best operation conditions for both economic and thermodynamics. At the same time, the performances of three organic working fluids are examined. Results indicate that the double-pressure ORC system has a better performance than single-pressure ORC system, and R245fa has a better performance among three organic fluids. It is also found that the exergy efficiency has a peak value with the change of turbine high-level inlet pressure and turbine low-level inlet pressure. In addition, increasing turbine high-level inlet temperature brings a positive effect on the system performance. Exergy analysis is also conducted and the result indicated that the main exergy loss occurs in high-pressure evaporator. After system optimization, the double-pressure organic Rankine cycle has a better performance in utilizing geothermal energy than single-pressure

system.

KEY WORDS: Low-temperature heat source,Organic Rankine cycle,Double-pressure

Geothermal

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THERMO-ECONOMIC-ENVIRONMENTAL OPTIMIZATION OF A LIQUID SEPARATION CONDENSATION-BASED ORGANIC RANKINE CYCLE DRIVEN BY WASTE HEAT

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ABSTRACT:

Organic Rankine cycle (ORC) is a promising thermal-to-power conversion technology utilizing low enthalpy renewable resources or waste heat energy. The coupling of environmental impact analysis and thermo-economic optimization is effective in evaluating and improving the comprehensive performance of the ORC. In the present study, a thermo-economic-environmental analysis and optimization methodology is proposed for the design of a waste heat driven ORC. A multi-objective mathematical programming model integrating the environmental impact and thermo-economic performance is formulated for the simultaneous optimization of the component configurations and operation parameters for a waste heat driven ORC. The objective functions include the minimization of the environmental impact and the maximization of the net power output. The specific investment cost is used to evaluate the economic performance of the ORC. A previous developed solution strategy is applied to solve the single objective optimization problem and the ε-constrained method is applied to solve the multiobjectiveoptimization model. A case study is elaborated to test the proposed methodology and the formulated model. The single objective optimization results demonstrate the contradiction between the environmental objective and the thermo-economic objective. The trade-off solutions are achieved by multi-objective optimization. The Pareto-frontier is elaborated to show how the material allocation, component configuration, and operation parameters are influenced by the objective functions. Finally, a sensitivity analysis of the life cycle inventory of raw materials on the optimization results is conducted.

KEY WORDS: Environmental impact,Organic Rankine cycle,Life cycle assessment

THERMOECONOMIC MULTI-OBJECTIVE OPTIMIZATION OF AN ORGANIC RANKINECYCLE(ORC) ADAPTED TO AN EXISTING SOLID WASTE POWER PLANT

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ABSTRACT: In this paper, thermodynamic and thermoeconomic analyses, and also optimization of an organic Rankine cycle (ORC) were performed. The system was adapted to an existing solid waste power plant with a 5.66MW installed power capacity in order to produce additional power from the exhaust gas. The actual operating data of the plant were utilized during all stages of the analyses. The originality of this paper is based on the analysis of the possibility of the energy conversion of an exhaust gas with a temperature of 566 °C into the electricity by utilizing an ORC system in the concept of waste-to-energy. Four different working fluids: toluene, octamethyltrisiloxane(MDM), octamethylcyclotetrasiloxane (D4) and n-decane were considered and analyzed for the current system. This is also another novelty of this study due to lack of such a study, in the open literature, that deals with an ORC utilized for a typical municipal solid waste power plant. According to the thermoeconomicanalyses, toluene was found to be the optimum working fluid with the maximum power output of 584.6 kW and the exergy efficiency of 15.69%. The optimization of the cycle was performed by using the non-dominated sorting genetic algorithm method (NSGA-II) in MATLAB software environment. The optimization results were compared and the deviations of the net power output and the total cost rate were evaluated as −5.89%, −3.51 $/h for toluene; 0.96%, −3.60 $/h for MDM; 8.45%, −2.04 $/h for D4 and 2.00%, −5.54 $/h for n-decane, respectively.

KEY WORDS: Waste heat recovery,Organic Rankine cycle,Organic fluid,Genetic algorithm

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THERMO-ECONOMIC OPTIMIZATION OF SOLAR ORGANIC RANKINE CYCLE BASED ON TYPICAL SOLAR RADIATION YEAR

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ABSTRACT: The thermo-economic optimization of a solar organic Rankine cycle (SORC) should consider the features of fluctuations in solar radiation based on local historical solar radiation. However, the use of historical solar radiation is inconvenient for thermo-economic optimization because it involves considerable computational effort for simulation. To overcome this inconvenience, we propose the thermo-economic optimization of SORC by using typical solar radiation year (TSRY). TSRY is a synthesis of typical solar radiation on the basis of historical solar radiation, indicating that TSRY can reflect the typical features of fluctuations in solar radiation in a specific area. Afterward, the multi-objective genetic algorithm (GA) is selected to optimize the dynamic performance of a small-scale SORC by using the TSRY. In GA, the evaporation temperature and capacity of thermal energy storage are taken as optimization parameters, and the power output and fluctuation in power output are optimization goals. Accordingly, Pareto frontiers that optimize the SORC performance can be obtained. The effect of different parameter combinations in the Pareto frontiers and the scale of the SORC on thermo-economic are further analyzed using annual net profit as an indicator. Our analysis shows that a minimum SORC scale for profitability is set for a given location, and the profit growth rate increases as the system scale increases.

KEYWORDS: Organic Rankine cycle,,Solar energy, TSRY,Annual net profit

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STRESS ANALYSIS OF THIN RIMMED SPUR GEAR WITH ASYMMETRIC TROCHOID

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Abstract - Involute spur gears are widely used machine element in many industrial areas. Thin-rimmed spur gears are popular in applications where low weight design and high power transmission are required. The stress occurred on thin-rimmed spur gears are different from standard spur gears due to deformations on rim. For this reason, rim thickness is key parameter for stress analysis of thin-rimmed gears. As rim thickness decreases, the value of maximum bending stress increases and the location of maximum stress is moved bottom of tooth which results in fatigue life reduction. In this study, to decrease maximum bending stress and to move upper the critical point; asymmetric trochoid profile is proposed. Asymmetry is constituted with using rack cutter has different tip radius on sides. This allows using larger tip radius on one side. Firstly, 3D design of spur gear with thin rimmed is realized in CATIA precisely. Then gears are imported to ANSYS package for finite element analysis. Normal force is applied on HPSTC. The rim surface is not fixed to allow rim deformations. The effects of using asymmetric trochoid on value and location maximum bending stress of thin rimmed spur gears is obtained with conducted case studies.

Keywords: Thin rimmed, involute spur gear, asymmetric trochoid

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WIND AND SOLAR MOBILE CHARGER

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Abstract:

Charging of mobile phone is a big problem when travelling a long distance journey or where power supply is not available. This paper proposes a universal mobile charger which can work on wind as well as solar energy. This charger is highly efficient and very economical as it uses non conventional energy sources of power. It comprises photovoltaic array, wind turbine, asynchronous (induction) generator, controller, lead-acid storage batteries, and an inverter unit to convert DC power to AC power. But the energy generated from solar and wind is much less than the production by fossil fuels, however, electricity generation by utilizing PV cells and wind turbine increased rapidly in recent years. This paper presents the Solar-Wind hybrid Power system that harnesses the renewable energies in Sun and Wind to generate electricity. System control relies mainly on micro controller. It ensures the optimum utilization of resources and hence improve the efficiency as compared with their individual mode of generation. Also it increases the reliability and reduces the dependence on one single source. This hybrid solar-wind power generating system is suitable for industries and also domestic areas.

Keywords: Universal mobile charger, economical mobile charger, mobile charger, mobile phones

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DESIGN AND ANALYSIS OF CAM SHAFT IN AUTOMOBILES USING FEM

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Abstract:

Camshaft is used in the engine for transfers' motion to inlet & exhaust valve. If transfer of motion is not proper then the strokes of the engine will not do in proper way. It also effects on performance of engine. To make work of camshaft in precise way, it is require in order designing a good mechanism linkage of camshaft. In four strokes engine one of the most important component is camshaft, such a important part and that over the years subject of extensive research. In this study, Design of Camshaft is done as per power stroke and suction stroke and its model is done in CATIA and Static and Model Analysis is carried in Ansys Work bench. By varying Materials like Cast Iron & Nickel chromium molybdenum steel and find out which is best material Suits for design.

Keywords: Cam Shaft, Design, Ansys etc.

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DESIGN & ANALYSIS OF CAMSHAFT

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Abstract:

Camshaft is one of the key parts or components in the engines of automobile and other vehicles.The goal of the project is to design cam shaft analytically, its modeling and analysis under FEM. In FEM, behaviour of cam shaft is obtained by analysing the collective behaviour of the elements to make the cam shaft robust at all possible load cases. This analysis is an important step for fixing an optimum size of a camshaft and knowing the dynamic behaviours of the camshaft. Initially the model is created by the basic needs of an engine with the available background data such as power to be transmitted, forces acting over the camshaft by means of valve train while running at maximum speed

Keywords: FEM, Camshaft, Automobile, Design etc

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DESIGN AND ANALYSIS OF PRESSURE VESSEL ASSEMBLY FOR TESTING OF MISSILE CANISTER SECTIONS UNDER DIFFERENTIAL PRESSURES

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Abstract:

In this work, a pressure vessel is designed to simulate differential pressure conditions on components of missiles and canisters. This design mainly concerned with two pressure chamber mounted concentrically, out of which outer chamber experiences internal pressure and the other experiences external pressure. The operating pressure conditions are 45×10^5 Pa external and 10×10^5 Pa internal. The chamber is designed for 100×10^5 Pa external and 50×10^5 Pa internal pressure with consideration of safety issues involved in the operation. Primarily, the design is based on IS 2825 unfired pressure vessel code and materials are chosen as per the standard ASTM A516 Gr. 70 pressure vessel steels. The other mounting fixtures, supporting channels and beams are as per the standard and all the other materials are of IS 2062 structural steel. The design is iterated many times to satisfy the desired requirements. The equivalent stresses and strain energy stored in the critical location of both pressure vessels are calculated. The fatigue life of the entire system are also estimated based on the stress and strain based designs with consideration of the fully reversed and zero based loading conditions.

Keywords: Pressure Vessel, Assembly, Design etc.

DESIGN AND COMPARATIVE ANALYSIS OF CONNECTING ROD USING FINITE ELEMENT ANALYSIS

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Abstract:

Connecting rod is an intermediate link which connects the piston and the crankshaft in an internal combustion engine, the main work of connecting rod is to convert the linear motion of the piston (thrust force) into rotary motion of the crankshaft. In this study, an attempt has been made to analyze and understand the connecting rod structure using Finite Element Analysis method. An invariable model of connecting rod is modelled using NX 6.0 and on this model static structural analysis is carried out by using ANSYS14.5 simulation tool. Further analysis was carried out by considering different materials to understand the variations of equivalent von-mises stress, strain, total deformation and factor of safety.

KEYWORDS: connecting rod, design of connecting rod, etc.

DESIGN ANALYSIS AND OPTIMIZATION OF PISTON USING CATIA AND ANSYS

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Abstract:

Design, Analysis and optimization of piston which is stronger, lighter with minimum cost and with less time. Since the design and weight of the piston influence the engine performance. Study Design: Analysis of the stress distribution in the various parts of the piston to know the stresses due to the gas pressure and thermal variations using with Ansys. Methodology: The Piston of an engine is designed, analyzed and optimized by using graphics software. The CATIA V5R16, CAD software for performing the design phase and ANSYS 11.0 for analysis and optimization phases are used. Brief Results: The volume of the piston is reduced by 24%, the thickness of barrel is reduced by 31%, width of other ring lands of the piston is reduced by 25%, Vonmisses stress is increased by 16% and Deflection is increased after optimization. But all the parameters are well with in design consideration.

Keywords: Piston, PistonDesign, Analysis of Piston etc.

DESIGN OF FIXTURE FOR MANUFACTURING OF PITMAN ARM

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Abstract

Pitman Arm is very important part of Steering system. It should be accurately machined with the acceptable tolerance. At present scenario productivity and economics of machining work pieces in a large quantity is greatly affected with the use of work holding devices like fixtures. This device reduce the production cost and ensure interchangeability of machined work pieces This project is about the design and fabrication of fixture which is used in the manufacturing of Pitman Arm of steering system. The design of fixture is done by using software CATIAV5R21.The purpose of the fixture is to provide strength, holding, accuracy and interchangeability in the manufacturing of product. The main purpose of a fixture is to locate and in the cases hold a work piece during an operation. Our research methodology aims at optimal design and fabrication of fixture.

Keywords: - fixture, CATIA, Pitman Arm, Clamps, Locators, Supports

FINITE ELEMEMNT ANALYSIS OF PITMAN ARM

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Abstract

Steering system control the front wheels movement in response to driver inputs in order to provide overall directional control of the vehicle. Thus, Steering system plays key role in vehicle handling characteristics. Pitman arm plays a vital role in steering system as it transmits the steering movement to the wheel. The Pitman arm is a linkage attached to the sector shaft of the steering box and track rod, that converts the angular motion of the sector shaft into the linear motion needed to steer the wheels. The Pitman arm is supported by the sector shaft and supports the drag link or center link with a ball joint. It transmits the motion it receives from the steering box into the drag (or centre) link, causing it to move left or right to turn the wheels in the appropriate direction. Performance study is carried out followed by static structural analysis of the pitman arm under steering load done by numerical method and there by check the stress values comparison to prove the boundary conditions, and verified the FEA with hand calculation and proved the feasibility for topology optimization of the pitman arm by comparison of FEA stress value with yield strength of the material.

Key Words— Linkage; Pitman arm; Steering System; Structural analysis etc.

VIBRATIONAL ANALYSIS, LIFE PREDICTION AND OPTIMIZATION OF PITMAN ARM USING FEM

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Abstract

Steering system is used to steer the front wheels corresponding to the inputs provided by the driver in order to achieve overall directional control of the vehicle. Thus, in vehicle handling characteristics steering system plays very important role. Pitman arm transmits the steering movement to the wheel. The Pitman arm is a linkage attached to the steering box, sector shaft, which converts the angular motion of the sector shaft into the linear motion needed to steer the wheels. The Pitman arm is supported by the sector shaft on one side and on the other side to the drag link or center link with a ball joint. It transmits the motion it receives from the steering box into the drag (or center) link, causing it to move left or right to turn the wheels in the appropriate direction. A performance study will be carried to analyze fatigue life and vibrational behavior of pitman arm using FEA tools. The structural optimization will be done on the pit man arm using Optistruct, changing the structure of pitman arm by adding ribs or slots to the structure which will increase its strength. The meshing and boundary conditions will be applied using Hypermesh 12.0 and analysis will be carried out using ANSYS. The testing of Pitman arm is carried out for fatigue analysis and the result will be validated with the simulation results.

KEYWORDS - Ansys, Catia, Fatigue analysis, Modal analysis, Pitman arm.

DESIGN AND ANALYSIS OF I.C. ENGINE PISTON AND PISTON-RING ON COMPOSITE MATERIAL USING CREO AND ANSYS SOFTWARE

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Abstract

In this Paper the stress distribution is evaluated on the four stroke engine piston by using FEA. The finite element analysis is performed by using FEA software. The couple field analysis is carried out to calculate stresses and deflection due to thermal loads and gas pressure. These stresses will be calculated for two different materials. The results are compared for all the two materials and the best one is proposed. The materials used in this project are aluminium alloy, and SiC reinforced ZrB2 composite material. In this project the natural frequency and Vibration mode of the piston and rings were also obtained and its vibration characteristics are analyzed. With using computer aided design (CAD), CREO software the structural model of a piston will be developed. Furthermore, the finite element analysis performed with using software ANSYS. SiC reinforced ZrB2 : Silicon carbide reinforced Zirconium diboride is a ceramic matrix composite (CMC) material is also used.

frequency, Vibration mode, Computer aided design (CAD), Ceramic m atrix composite (CMC) material, Ansys

KEYWORDS: Stress distribution, four stroke engine piston, analysis of stresses etc.

ANALYSIS AND OPTIMAL DESIGN OF A PRODUCER CARBURETOR

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Abstract

Design of a carburetor for producer gas application with special reference for reduced loss of pressure is taken up to generate the optimal fuel–air mixture to meet different load conditions of the engine as well as for varying operating conditions of producer gas reactor. The differential pressure controller based carburetor includes an optimally designed mixing chamber with tuned orifices to get stable stoichiometric mixture working at near–to–ambient conditions. The hardware built has been tested for an engine simulation of 25 kWe capacity. The carburetor design has been studied comprehensively with detailed analysis for its mixing and operations with CFD modeling. The CFD simulations and the experiments carried out are used with their results to complement each other in optimising the design and to validate the analysis at the all stages. The results show a consistency in the experimental data and the CFD modeling that has provided a better insight of the flow details and has allowed for carrying out the optimization to a great extent, and to get a good mixing. Figures included give out a highlight of the relevant data of the analysis.

Keywords: computational fluid dynamics, producer gas, carburetor, air/fuel

ratio, and biomass gasification.

DESIGN AND ANALYSIS OF VERTICAL PRESSURE VESSEL USING ASME CODE AND FEA TECHNIQUE

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Abstract

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In this project we are designing a pressure vessel using ASME section VIII and Division 2, designing a closed container to find the required thickness of the shell, head, nozzle and leg support. Uniform thickness assigned to the entire vessel, Modelling of the pressure vessel is carried out using Pro-e 2.0; meshing is carried out using Hypermesh 6.1. Here we used 2D Quad element for the meshing, Analysis is carried out using ANSYS Software 11 for two different cases, working pressure and Maximum operating pressure, fatigue analysis is carried out, and the result is 10^6. Finally, theoretical validation is carried out for the entire model, And the results are within the limit.

Key Words: Pressure Vessel, Design of Pressure vessel, Analysis etc.

DESIGN AND ANALYSIS OF PROPELLER SHAFT

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Abstract

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Substituting composite structures for conventional metallic structures has many advantages because of higher specific stiffness and strength of composite materials. This work deals with the replacement of conventional two-piece steel drive shafts with a single-piece e-glass/ epoxy, high strength carbon/epoxy and high modulus carbon/epoxy composite drive shaft for an automotive application. The design parameters were optimized with the objective of minimizing the weight of composite drive shaft. The design optimization also showed significant potential improvement in the performance of drive shaft. The main concept of our project is to reduce the weight of automotive drive shaft with the utilization of composite material. Composite materials have been used in automotive components because of their properties such as low weight, high specific stiffness, corrosion free, ability to produce complex shapes, high specific strength and high impact energy absorption etc .As the automotive drive shaft is a very important component of vehicle. The modeling of the drive shaft assembly was done using SOLIDWORKS software. A shaft has to be designed to meet the stringent design requirements for automotives. In automobiles the drive shaft is used for the transmission of motion from the engine to the differential. An automotive propeller shaft, or drive shaft , transmits power from the engine to differential gears of rear wheel-driving vehicle. In present work an attempt has been to estimate deflection, stresses under subjected loads & natural frequencies using Ansys software.

Keywords: propeller shaft, Design, Anasys etc.

A REVIEW ON THE DESIGN AND ANALYSIS OF COMPOSITE DRIVE SHAFT

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Abstract

In current scenario, the most important component in any power transmission application is the drive shaft. Drive shaft is a mechanical component used to connect the drive train components which are not connected due to the distance between them. Drive shafts are used for transmitting torque and power which subjects the drive shafts to high torsional and shear stress. Composite materials are having high specific stiffness, strength, specific modulus, corrosion resistance, wear resistance, fatigue life and light weight properties. Automobile industries are exploring composite materials usage by replacing the conventional one because of light weight properties reduces the vehicle weight without compromising the quality and reliability. The literature raises the issue on torsion, buckling, natural bending frequency and the weight of the drive shaft. The objective of the paper is to review: (a) the work carried out on the composite drive shafts which are used in the automotive applications; (b) fabrication techniques and materials used in the fabrication of composite shafts (c) finite element analysis on composite shaft and steel shaft.

KeywordsPower transmission,Composite drive shaft,Filament winding

Finite element analysis.

DESIGN AND ANALYSIS OF SPUR GEAR

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Abstract

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Gear is the one of the important machine element in the mechanical power transmission system. Spur gear is most basic gear used to transmit power between parallel shafts. Spur gear generally fails by bending failure or contact failure. This paper analyses the bending stresses characteristics of an involute spur gear tooth under static loading conditions. The tooth profile is generated using Catia and the analysis is carried out by Finite element method using ANSYS software. The stresses at the tooth root are evaluated analytically using existing theoretical models. The theoretical and FEM results are compared. The results obtained theoretically are in good agreement with those obtained from software. Also an attempt is made to introduce Stress and displacement characteristics of tooth under dynamic loading conditions.

Key words: Ansys, Bending stress & Deflection by FEA, Dynamic analysis, Static analysis, Spur gear.

DESIGN AND ANALYSIS OF GEAR-BOX USING SPUR GEAR AND ELIMINATING THE DIFFERENTIAL UNIT

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Abstract

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A gear is a rotating machine part having a cut tooth, which meshes with another toothed part in order to transmit torque. Gears are mainly typed like spur gears, helical gears, double helical gears, bevel gears, crown gears, hypoid gears, worm gears, rack and pinion, epi cyclic gears etc. This paper presents the stress analysis of mating teeth of spur gear to find maximum contact stress in the gear teeth. The results obtained from Finite Element Analysis (FEA). For the analysis, 15NiCr1Mo15 and SCM415 are used as the materials of the spur gear. The spur gears are designed in the Creo Parametric and the .iges file is exported to ANSYS. As Finite Element Method (FEM) is the easy and accurate technique for stress analysis, FEA is done in finite element software ANSYS 14.0. Also, deformation for 15NiCr1Mo15 and SCM415 is obtained as the efficiency of the gear depends on its deformation. The results show that the maximum contact stresses and induced bending stresses obtained from Finite Element Analysis are very less and well under the safe limit. The deformation patterns of 15NiCr1Mo15 and SCM415 gears depict that the difference in their deformation is negligible.

Key words: Bending Stress, Contact Stress, ANSYS, Finite Element Analysis, Spur Gear.

A REVIEW ON DESIGN, ANALYSIS AND SHAPE OPTIMIZATION OF SPUR GEARS OF THE GEAR-BOX REDUCTION OF THE WORKING WHEEL OF THE EXCAVATOR SCHRS 1300 24/5.0 USING CAD/CAE SOFTWARE

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Abstract

Gears are one of the most important components in mechanical power transmission systems. The bending and surface strength of the gear tooth are considered to be one of the main contributors for the failure of the gear in gear set. The three dimensional solid model can be generated in CAD software, in this case we have created model in Autodesk Inventor 2015. This model of the spur gears are imported in ANSYS software and then contact stress and bending stress can be calculated in ANSYS. The paper presents the results of calculation of pair spur-gears that it used in the gear-box reduction of the working wheel of the Excavator located in open-cast coal mines in “BardhiiMadh - FushëKosovë” , and after that will be optimized the shape of the spur gear with usage of ANSYS software. To be more specific, how much material can be removed from the gear body.

Keywords- CAD/CAE software, FEM, Stress-Strain Analysis, Spur-Gear, Shape Optimization CAD-Computer Aided Design, CAE-Computer Aided Engineering, FEM-Finite Element Method.

DESIGN AND STATIC STRUCTURAL ANALYSIS OF BEVEL GEAR

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Abstract

Gears are fundamental asset for power transmission in automation industry. Bevel gears are used to transmit the power between two intersecting shafts at almost any angle or speed. In this present work an attempt is made to design the bevel gear for compact MIG welding robot and static structural analysis using ANSYS. A pair of bevel gear while transmitting the power

generally subjected to two types of Failure. The bending failure due to bending stresses and pitting failure due to contact stresses. Various forces acting on the gear has been calculated. The bending stress equation by using Lewis bending stress equation and bending stress value determined for straight teeth bevel gear and carried out comparison between analytical value and value obtain by the ANSYS Workbench 15.0.

Keywords: Bending Stress, Straight Bevel Gear, ANSYS, Moment.

MODELING, DESIGN & ANALYSIS OF STRAIGHT BEVEL GEAR AND PINION BY FEM, SOLID WORKS & ANSYS BENCHWORK 14.0

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Abstract

In this research developing an analytical approach, modeling and analysis to evaluate stress distribution, natural frequencies and predict the life of the gear and pinion under the plateform of ANSYS 14.0 with the help of solid works modeling. The function of gears to provide proper gearing for transmission. These gears must typically operate at extremely high rotational speeds and carry high power level Bevel gears are used to transmit the power between two intersecting

shafts at almost any angle or speed. Various forces acting on the gear has been calculated. The purpose of this work is to analyze and validate the stress distribution in bevel gears using contemporary FEM program and ANSYS 14.0 the design of the gear housing should incorporate a methodology for dealing with factors causing vibrations and to promote scientific means to minimize the effect of frequencies. This vibration analysis is done by using ANSYS 14.0 software as a computational technique and validation Keywords natural frequencies, stress distribution, ANSYS 14.0

Keywords-- Modeling, ANSY, BEVEL, etc.

DESIGN & ANALYSIS OF BEVEL GEAR FOR DYNAMIC AND WEAR LOADING USING GEOMETRICAL PROGRAMMING

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Abstract

This paper is a proficient approach for solving the problem of design and analysis for Dynamic and Wear load of Bevel gear, principally to aid the industries and designers. Surrounded by the diverse optimization techniques the approach breaks new era by utilizing Geometrical

Programming Technique, because this is one of the proficient and enhanced techniques to resolve non-linear equations of the complex and sensible design problems. The research deals with the design of bevel gear train for lowest dynamic load and wear load. The load capacity of bevel gears is based on either bending or wears capacity whichever is lesser. The tangential force for passing on utmost power has been found by lowering the dynamic load or wear load as per the necessity. The arbitrary nature of design variables has been given appropriate deliberation and probability of fulfilling constraints equation has also been taken care of. A clarifying instance of bevel gear train design has been considered. The bevel gears are designed and optimized using Geometric Programming technique, considering the nature of parameters, proper values are given to convince constraints. The problem taken is solved for optimization by lowering dynamic load on the gear as well as to lower the wear load on the gear. The manually computed results are compare for the diverse values achieved from the software implemented.

Keywords : Gear, Bevel Gear, Geometrical programming.

DESIGN AND ANALYSIS OF A CRANK SHAFT

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Abstract

Crankshaft is one of the critical components for the effective and precise working of the internal combustion engine. In this paper a static simulation is conducted on a crankshaft from a single cylinder 4- stroke diesel engine. A three - dimension model of diesel engine crankshaft is created using Pro-E software. Finite element analysis (FEA) is performed to obtain the variation

of stress magnitude at critical locations of crankshaft. Simulation inputs are taken from the engine specification chart. The static analysis is done using FEA Software ANSYS which resulted in the load spectrum ap lied to crank pin bearing. This load is applied to the FE model in ANSYS, and boundary conditions are applied according to the engine mounting conditions. The analysis is done for finding critical location in crankshaft. Stress variation over the engine cycle and the effect of torsion and bending load in the analysis are investigated. Von-mises stress is calculated using theoretical y and FEA software ANSYS. The relationship between n the frequency and the vibration modal is explained by the modal and harmonic analysis of crankshaft using FEA software ANSYS.

Keywords: Crankshaft, Design, Analysis, FEA etc.

STRESS ANALYSIS IN DOUBLE ENVELOPING WORM GEARS BY FINITE ELEMENT METHOD

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Abstract

A method and a corresponding computer program are developed for stress analysis in the worm and the gear of double enveloping worm gears by finite elements. By using this program stress distributions in the worm thread and the gear tooth are calculated, and the influence of the

design parameters and of the load position on deflections and stresses is investigated. On the basis of the obtained results, by using regression analysis and interpolation functions, equations are derived for the calculation of deflections and stresses in the worm thread and in the gear tooth of double enveloping worm gears.

Keywords: Gears, finite elements, worm thread etc.

CFD ANALYSIS OF SHELL AND TUBE HEAT EXCHANGER FILLEDWITH POROUS MEDIUM

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Abstract

Latest developments in the manufacturing technology have led to development of advance lightweight materials for thermal applications. Heat transfer through porous materials has gained significance in industrial as well as academic research. In this paper thermal performance including heat transfer and pressure drop through porous material, i.e. metal foam heat exchanger, has been presented. The experimental data has been used to calculate and present graphically various performance parameters such as effectiveness, friction factor,

Reynolds number and Nusselt number.The effectiveness of the heat exchangers was compared at u = 0.5–7 m/s fluid velocity, it was found that the best performance is exhibited by heat exchanger at effectiveness (ε = 30%, u = 0.2 m/s). Maximum heat transfer occurs at Reynolds number of 900. For further investigation advance methods such as artificial neural networks, fuzzy logic and genetic algorithm can be used.

Keywords: Forced Convection, Heat Exchanger, Heat transfer, Pressure drop

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USING POROUS MATERIAL FOR HEAT TRANSFER ENHANCEMENT IN HEAT EXCHANGERS: REVIEW

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Abstract

The increase in energy cost and energy consumption has required more effective use of energy. The problem of dissipating high heat fluxes has received much attention due to its importance in applications such as heat exchanger. The heat transfer duty of heat exchangers can be improved by heat transfer enhancement techniques. In recent years, Considerable efforts have been made to increase heat transfer rates in heat exchangers by implementing passive enhancement methods that require no direct consumption of external power. On the basis of a theoretical and experimental analysis the conclusion derived was that the best heat transfer enhancement can be reached by the use of porous material as an inexpensive technique to extend the heat transfer area, improve effective thermal conductivity, and mix fluid flow. This paper presents a brief discussion on the application of using porous media to heat exchangers by means of heat transfer enhancement.

Keywords: Heat Transfer Enhancement, Heat Exchanger, Porous Media, Porous Heat Exchanger

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Heat Transfer Enhancements in Heat Exchangers Ftted with porous media Part I: Constant Wall Temperature

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Abstract

This work investigates heat transfer enhancement for a flow in a pipe or a channel fully or partially filled with porous medium. The porous layer inserted at the core of the conduit. Forced, laminar flow is assumed and the effects of porous layer thickness on the rate of heat transfer and pressure drop were investigated. The Darcy number (permeability) is varied in the range of 10−6 to 10.0. Developing and fully developed flow conditions are considered in the analysis. It is found that the plug flow assumption is not valid for Da > 10−3. The effect of varying the inertia term (Forchheimer term) is also investigated and it is found that the inertia term is not that important for Da < 10−4 for the range of the parameters investigated. Partially filling the conduit with porous medium has two advantages: it enhances the rate of heat transfer, and the pressure drop is much less than that for a conduit fully filled with a porous medium.

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A MODEL FOR FLOW AND HEAT TRANSFER THROUGH POROUS MEDIA FOR HIGH HEAT FLUX APPLICATIONS

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Abstract

Fusion power plant studies have found helium to be an attractive coolant based on its safety advantages and compatibility with structural materials at high temperature. However, gas coolants in general tend to provide modest heat transfer performance due to their inherently low heat capacity and heat transfer coefficient. Innovative techniques have been proposed previously using porous metal heat transfer media infiltrated by the coolant. The general design strategy is to minimize the coolant flow path length in contact with the porous medium, and to minimize the friction factor in that zone while simultaneously maximizing the heat transfer coefficient. In this work we seek to develop a comprehensive thermo-fluid model including all key heat transfer processes to help in assessing and optimizing a helium-cooled porous media configuration for plasma facing component application.

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MODELLING OF CONVECTIVE HEAT TRANSFER IN POROUS MEDIA

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Abstract

This thesis details the process taken for the computational modelling of convective heat transfer in porous media with the objective of improving the accuracy of porous continuum models. CFD simulations were performed to predict convective heat transfer resulting from forced flow through highly conductive porous blocks. For the pore-level predictions, an idealized geometric model for spherical-void-phase porous materials was used to generate several domains over a range of porosity and pore diameter typical of graphitic foams. Simulation on these domains was conducted using the commercial software ANSYS CFX. Similar simulations were conducted using an in-house conjugate domain solver wherein porous regions are modelled using a porous continuum approach. These results were compared to the pore-level results and indicate that a modification to the conductivity of the solid phase of the porous material must be included to account for the tortuosity, or complexity of the solid structure. The tortuosity is shown to appear naturally in the derivation of the volume-averaged energy equation for the solid-phase constituent, and has not previously been considered when calculating the effective solid phase conductivity. The implementation of this modification resulted in a closer match of the heat transfer predicted by the in-house porous continuum model when compared to results generated by commercial CFD software. Subsequent simulations were performed to show that the tortuosity was purely a geometric function – depending only on the solid phase structure.

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Using Porous Media to Enhancement of Heat Transfer in Heat Exchangers

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Abstract

According to increasing human needs for energy and to avoid energy waste, researchers are struggling to increase the efficiency of energy production and energy conversion. One of these methods is increasing heat transfer and reducing heat dissipation in heat exchangers. Using porous materials in the fluid flow is one of the passive methods to increase heat transfer in heat exchangers. The existence of porous media in the flow path, improve the matrix of thermal conductivity and effective flow thermal capacity and also matrix of poroussolid increase radiation heat transfer, especially in two phase flow (gas-water) systems. In this paper, recent studies on the effect of using porous media on enhancement the amount of heat transfer in heat exchangers has been investigated via using porous media with difference porosity percentage, material and geometric structure in the flow path in numerical simulations and laboratory studies.

Keywords— Porous media, Heat transfer enhancement, Heat exchanger.

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HEAT TRANSFER IMPROVEMENT IN HEAT EXCHANGER USING POROUS MEDIUM: A REVIEW

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Abstract

The present study is to investigate the heat transfer enhancement in a cylindrical heat exchanger using porous media. The heat exchanger is modelled by a cylindrical cavity (Shell) with inlet and outlet thermally insulated ports and five tubes which contain hot water and cold water flows in the shell. The effect of porosity on heat transfer enhancement is studied at the different mass flow rate. The study about the effect of porosity on heat transfer enhancement is done by both experimentally and CFD based and the results are compared with the simple heat exchanger. By decreasing the porosity, the heat transfer rate increases and the mean outlet temperature of the fluid increases for different mass flow rate.

Keywords Porous medium, Heat exchanger, CFD, porosity, mass flow rate

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ANALYTICAL SOLUTIONS OF FLUID FLOW AND HEAT TRANSFER IN A PARTIAL POROUS CHANNEL WITH STRESS JUMP AND CONTINUITY INTERFACE CONDITIONS USING LTNE MODEL

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Abstract

Forced convection heat transfer is analytically performed in a channel partially filled with porous media located at two inner walls under local thermal non-equilibrium (LTNE) condition. A constant heat flux is imposed at the channel walls. The Brinkman extended Darcy model is applied in the porous region and the stress jump and continuity conditions are employed at the interface. Exact solutions are obtained for velocity, pressure drop, the fluid and solid temperatures and Nusselt number. The effects of pertinent parameters on the fluid flow and heat transfer are conducted. Furthermore, the solution for the Nusselt number is compared to that by applying the local thermal equilibrium (LTE) assumption and the validity of the LTE is examined. It is shown that by applying LTNE model for different solid to fluid effective thermal conductivity ratios (K) and Biot numbers (Bi), hollowratioincludethreetypesofcurves,whicharemaximizedNusseltnumberoccursatasmalloptimum hollow ratio, Nusselt number monotonically decreases by increasing hollow ratio and a minimized Nusselt number occurs at a small hollow ratio, respectively. For high K, a small critical value of S at which the Nusselt number reaches to LTE Nusselt number occurs and it lowers with the increase of Bi number and thedecrease of Darcy number;while forlowK, theLTNE Nunumberversus hollowratiois almostthe same with LTE Nu number and therefore the LTE is valid. The stress jump at the interface is found to have negligible effect on the Nusselt number and the pressure drop, except in a high Darcy number with a low stress jump coefficient where the calculation of pressure drop need to account for the stress jump effect at the interface and the Nusselt numbers for both LTE and LTNE models slightly differs from the case of stress continuity interface condition.

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Review of Fluid Flow and Heat Transfer through Porous Media Heat Exchangers

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Abstract

Latest developments in the manufacturing technology have led to development of advance lightweight materials for thermal applications. Investigation of thermal properties for such materials is desirable. On the other hand, it is recognized that there are different thermal management issues. Heat transfer through porous materials has gained significance in industrial applications based research. In this paper the research on heat transfer through porous material, mostly metal foam heat exchanger, has been reviewed. This paper aims to acquire state of the art knowledge and information in the field of porous materials as well as various research carried out on heat transfer and fluid flow through porous materials. The forced convection has been reviewed extensively. At the end, aspects which require further research have been identified.

Keywords: Forced Convection, Porous Media, Porosity, Permeability, Heat Transfer

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An Experimental Investigation of Heat Transfer Performance for Forced Convection of Water in a Horizontal pipe partially filled with a Porous Medium

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Abstract

In this paper, heat transfer in porous media under forced convection of water flow has been studied experimentally. A total of 36 sets of heat transfer experiments by varying the porosity, area and position have been conducted. cycle averaged local nusselt numbers and pressure drop are obtained by measuring the bulk temperature and pressure at the inlet and outlet cross sections. The porous inserts used in this study is made of packed steel balls. The primary purpose of conducting this experiment was to find out how the Nusselt number varies with porosity, area and position. Maximum Augmentation in heat transfer with minimum pressure drop was observed for core of diameter 55mm with porosity 0.44 which was around 4.6 times higher as compared to clear flow case where no porous materials are used. On calculations, the 43.5mm diameter core insert with 0.45 porosity (6.35mm steel balls) had a ΔP/Nu value equal to 159.14 N\m2. This was the least ΔP/Nu value of all the different combinations of area, porous insert design and porosity Keywords: Heat Transfer, Porous Media, Nusselt Number

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EFFECT OF HEAT TRANSFER IN THE THERMALLY DEVELOPING REGION OF THE CHANNEL PARTIALLY FILLED WITH A POROUS MEDIUM: CONSTANT WALL HEAT FLUX

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Abstract

Laminar forced convection in the thermally developing region of parallel plate channels porousmaterialhasbeenstudiednumerically.Theparallelplatesaresubjectedtoconstantwallheat flux.Porous insert is attached to both the walls of the channel with equal thickness. The flow field is assumed to be fully developed. Thesystemis characterized bythe parameters, Darcy number,Da andaporousfraction,γp definedas ratio of the porous insert thickness to the channel wall spacing. Numerical solutions have been obtained for $0 \leq \gamma p \leq 1.0$, for Da=0.001, 0.005, 0.01, 0.05 and 0.1. The non-dimensional temperature at the wall attains maximum values at a certain porous fraction. The local Nusselt number has been obtained on the porous side of the parallel plate channel.

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POTENTIALS OF POROUS MATERIALS FOR ENERGY MANAGEMENT IN HEAT EXCHANGERS – A COMPREHENSIVE REVIEW

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Abstract

Heat exchangers arerecognized aspopular thermal devices with variousand important applications inindustrial energy systems. Many techniques were employed in order to manage the energy in these devices. Among these techniques, porous materials with high potentials for the energy management and enhancing the thermal performances in heat exchangers were employed widely. This paper reviews recent developments and utilisation of different types of porous materials in the heat exchangers. Both simulation and experimental works were briefly explained. The gaps in current literatures and designs were investigated and solutions for them were discussed.

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ANALYSIS OF POROUS fiLLED HEAT EXCHANGERS FOR ELECTRONIC COOLING

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Abstract

An innovative porous filled heat exchanger is modelled to investigate the cooling effectiveness and temperature distribution at its base subject to a high heat flux. The effects of different nanofluid coolants (5% titanium dioxide (TiO2) in water, 1% alumina in water, 0.03% multi walled carbon nanotubes (MWCNT) in water, and 1% diamond in 40:60 ethylene glycol/water), different porous materials (copper and annealed pyrolytic graphite (APG)), and porosity values are investigated. The coolant enters from an inlet channel normaltothebase,movesthroughtheporousmedium,andleavestheheatexchangerthroughtwoopposite exit channels parallel to the base. The effects of the inclination angle of the foam filled channel, inlet velocity value, and heat flux value are also studied. In addition, the effect of the inlet cross section is investigated by studying two different designs. One of the designs has a rectangular crosssectional inlet channel (extended all along the transverse direction) and the other design has a square one. The results indicate the importance of the utilization of a high conductive porous material. Utilization of APG porous matrix improves the cooling effectiveness at the base of the heat exchanger, for all studied coolants of pure water and water based nanofluids. The results also show that utilizing titanium dioxide nanofluids (TiO2) as coolant for both copper and APG porous matrices at low and high porosity structures, and for both square and rectangular inlet cross sections improves the cooling efficiency and temperature uniformity over the base. Investigation of the effect of inlet channel geometry, i.e., square and rectangular, indicates that employing a square cross section inlet channel would result in lower temperature values along the streamwise direction while higher temperature values are observed far from the centre in transverse direction.

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A CRITICAL REVIEW ON HEAT TRANSFER AUGMENTATION OF PHASE CHANGE MATERIALS EMBEDDED WITH POROUS MATERIALS/FOAMS

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Abstract

Phase change material (PCM) is promising media for thermal energy storage owing to its extensive value oflatent heat(140–970 KJ/Kg). However, thermal conductivity ofPCMs is too lowwhich obstructs energy storage and retrieval rate. In recent days, thermally enhanced PCMs are considered promising materials for efficient heat transfer in many applications. This article designates the review on improved thermal properties and heat transfer of PCMs by using porous materials. Enhanced heat transfer of PCMs can be achieved using extended surfaces (triangular, conical, square, and rectangular fins), heat pipes, and additionofhighlyconductivenanoparticles(e.g. Cu,Al2O3,Au,SiC,SiO2 andTiO2).Majorfocusofthisarticle is to study the enhanced heat transfer of PCMs through metallic (copper, nickel, and aluminium) and carbon based (carbon, graphite and expanded graphite) porous materials/foams. Effects of porosity and pore density on heat transfer, thermal conductivity, specific heat, latent heat and charging/discharging time are critically reviewed. Porous materials/foams are reported to be efficient for heat transfer/thermal conductivity enhancement by 3–500 times. Furthermore, correlations to find the effective thermal conductivity of PCM/foam are reported. Important applications of PCM/foam reported by different researchers are also discussed in this paper. Finally, conclusions and recommendations are presented to highlight the research gap in this area.

Keywords: Phase change materials Porous materials Heat transfer enhancement Thermal conductivity enhancement Thermal management Energy storage

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HEAT TRANSFER AUGMENTATION IN TWO-PHASE FLOW HEAT EXCHANGER USING POROUS MICROSTRUCTURES AND A HYDROPHOBIC COATING

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Abstract

In this study, we improved the thermal performance of a slightly inclined tube for a twophase flow heat exchanger by means of surface modification techniques. The exchanger condenses pure steam inside the tube while boiling takes place outside the tube in a pool of saturated water. First, appropriate surface modification techniques for each boiling and condensation surface were separately investigated. An electroplating technique with hydrogen bubbles was utilized to create porous microstructures as cavities on a boiling surface, which remarkably promoted heterogeneous bubble nucleation and resulted in significant enhancement on average 107% in the boiling heat transfer coefficient. Hydrophobic thin films of Teflon were coated on a condensation surface, which considerably enhanced heat transfer on average 100% by promoting dropwise condensation. Secondly, the selected surface modification techniques were applied to outer boiling and inner condensation surfaces of a single-tube two-phase flow heat exchanger and remarkable improvement in heat transfer performance (>60%) due to the surface treatments was experimentally demonstrated.

Keywords: boiling; condensation; hydrophobic coating; porous microstructure; two-phase flow heat exchanger

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THERMAL-HYDRAULIC PERFORMANCE OF SMALL SCALE MICRO-CHANNEL AND POROUS-MEDIA HEAT-EXCHANGERS

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Abstract

Fluid ¯ow and forced convection heat transfer in micro-heat-exchangers with either micro-channels or porous media have been investigated experimentally. The influence of the dimensions of the micro-channels on the heat transfer performance was ®rstanalyzed numerically. Based on these computations, deep micro-channels were used for the experimental studies reported here. The measured performance of both micro-channel and porous-media micro-heatexchangers are compared with those of similar heat-exchangers tested by other researchers. It is shown that the heat transfer performance of the micro-heat-exchanger using porous media is better than that of the micro-heat-exchanger using micro-channels, but the pressure drop of the former is much larger. Over the range of test conditions, the maximum volumetric heat transfer coefficient of the micro-heat-exchanger using porous media was 86.3 MW/(m3 K) for a water mass ¯ow rate of 0.067 kg/s and a pressure drop of 4.66 bar. The maximum volumetric heat transfer coefficient of the micro-heat-exchanger using deep micro-channels was 38.4 MW/(m3 K) with a corresponding mass ¯ow rate of 0.34 kg/s and a pressure drop of 0.7 bar. Considering both the heat transfer and pressure drop characteristics of these heat-exchangers, the deep micro-channel design offers a better overall performance than either the porous media or shallow micro-channel alternatives. Ó 2001 Elsevier Science Ltd. All rights reserved.

Keywords: Micro-heat-exchangers; Micro-channels; Porous media; Volumetric heat transfer coefficient; Pressure drop

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DESIGN AND SIMULATION OF HEAT EXCHANGER FITTED WITH CU POROUS MEDIA AND RIDGES

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Abstract

Simulations using the k–epsilon model have been carried out to investigate the fluid flow and heat transfer characteristics in the Heat Exchanger with copper porous media. In designing heat exchanger, copper ridges are made on the surface in order to enhance the heat transfer. The parameters studied include the Reynolds number (Re<2000), pressure drop, temperature, thickness of the porous media used by maintaining the porosity e = 0.8. The comparison analysis is done between the computational work and existing heat exchanger with same boundary condition. Results show that newlydesigned heat exchanger enhance the heat transfer up to 150C.

Keywords: Heat Exchanger; Finite volume; Heat Transfer; Pressure Drop; Temperature; Simulation; k-epsilon model; copper ridges

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EXPERIMENTALSTUDYOFFORCEDCONVECTIONHEAT TRANSPORTINPOROUSMEDIA

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Abstract

The present study is aimed at extending this thematic issue through heat transport experiments and their interpretation at laboratory scale. An experimental study to evaluate the dynamics of forced convection heat transfer in a thermally isolated column filled with porous medium has beencarriedout.The behaviour oftwoporousmediawithdifferent grain sizes and specific surfaces has been observed. The experimental data have been compared with an analyticalsolutionforone-dimensionalheattransportforlocalnonthermal equilibrium condition. The interpretation of the experimental data shows that the heterogeneity of the porous medium affects heat transport dynamics, causing a channelling effect which has consequences on thermal dispersion phenomena and heat transfer between fluid and solid phases, limiting the capacity to store or dissipate heat in the porous medium.

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Mechanism of Heat Transfer Enhancement in the Core Flow of a Tube and Its Numerical Simulation

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Abstract

The principle of heat transfer enhancement in the core flow of a tube has been proposed, in this paper, to make fluid temperature uniform in the core region of a tube and decrease flow resistance, which is different from heat transfer enhancement in the boundary flow of a tube. Two new models, representing heat transfer enhancement in the laminar and turbulent tube flow, have been established and numerically analysed. Theoretical and numerical results indicate that heat transfer enhanced components designed according to the principle proposed in this paper will be benefit for increasing convective heat transfer coefficient, reducing flow resistance and raising the PEC value of a heat transfer enhanced tube. The presented principle, therefore, may help developing new type of heat transfer unit and designing heat exchanger with high heat transfer coefficient and low flow resistance.

Keywords: Heat transfer enhancement, core flow, tube, flow resistance

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NUMERICAL SIMULATION OF TRANSPIRATION COOLING THROUGH POROUS MATERIAL

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Abstract

Transpirationcoolingusingceramicmatrixcomposite(CMC)materialsisaninnovativeconceptforcooling rocket thrust chambers. The coolant (air) is driven through the porous material by a pressure difference between the coolant reservoir and the turbulent hot gas flow. The effectiveness of such cooling strategies relies on a proper choice of the involved process parameters such as injection pressure, blowing ratios, material structure parameters, to name only a few. In view of the limited experimental access to the subtle processes occurring at the interface between hot gas flow and porous medium, reliable and accurate simulations become an increasingly important design tool. In order to facilitate such numerical simulations for a carbon/carbon material mounted in the side wall of a hot gas channel that are able to capture a spatially varying interplay between the hot gas flow and the coolant at the interface, we formulate a two dimensional model for the porous medium flow of Darcy-Forchheimer type. A finite element solver for the corresponding porous media flow is presented and coupled with a finite volume solver for the compressible ReynoldsaveragedNavier-Stokesequation.TheresultsatMachnumberMa = 0.5andhotgastemperature Thg = 540K for different blowing ratios are compared with experiments.

KEY WORDS: Transpiration cooling, porous media flow, Darcy-Forchheimer equation, coupled finite element-, finite volume schemes, numerical tests

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NUMERICAL SIMULATION AND EXPERIMENTAL INVESTIGATION ON A SOLAR REFRIGERATORWITH INTERMITTENT ADSORPTION CYCLE

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Abstract

This work deals with a new design of a solar driven adsorption-refrigerator. The solar refrigerator uses a single bed adsorbed-collector and works with silica gel/water as a sorption pair. The novelty of this work is in the use of low cost and effective techniques that permitted to palliate to the problem of days with low solar radiation. In addition to that, a model with a minimum of constraining hypothesis was proposed. The model was implemented in a MATLAB-program and showed a good prediction accuracy during several tests with different operating conditions. This paper aims to put into evidence the impact of an enhancement with four external reflectors. The influences of the mass of the load as well as the influence of the initial mass of the refrigerant are also highlighted. Tests that were effectuated in the region of Sfax-Tunisia, resulted in a maximal *COPsolar* valuing 0.078 and maximal cooling capacity of 777.96 kJ. The proposed refrigerator was also able to make the temperature of a9 kg water-load decrease to reach 0 °C during a partially cloudy day.

Key word: Design, Refrigerator, solar, etc

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EXPERIMENTAL AND SIMULATION ANALYSIS OF THE COMBINED ADSORPTION SYSTEMDRIVEN BY 80–140 °C HEAT SOURCE

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Abstract

The shortage of fossil fuel, greenhouse gases emission, air pollution and global warming have attracted more and more researchers' attention on the adsorption technology, which utilizes low temperature thermal heat of solar thermal energy and waste heat. Moreover, the usage of natural materials as refrigerant such as water and methanol adds to its advantage. However, the low coefficient of performance and specific cooling power limits itsfurther application. This paper proposes a novel combined adsorption system, which can provide the functions ofair conditioning/refrigeration/heat pump heating and ammonia/organic expanding power generation. In addition, the consolidated advanced adsorbent is used in this system, the effect of which is investigated. The authoralso analyzed the most suitable organic for organic Rankine cycle in this system. The results reveal that theorganic of N-Butane has the highest potential exergy and the most appropriate work pressure. The cooling exergyefficiency in the working modes of air conditioning, refrigeration and heat pump heating are about 0.18, 0.13and 0.24, respectively. The simulation results indicate that, compared to the system with only cooling effect, thetotal exergy efficiency of the combined system can be improved from 0.15 to 0.31, because of the additionalexpanding power generation effect.

Key words: Fuel, Gases, Pollution,etc

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EXPERIMENTAL INVESTIGATION OF AN ADSORPTION REFRIGERATION PROTOTYPEWITH THE WORKING PAIR OF COMPOSITE ADSORBENT-AMMONIA

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Abstract

A 4-valve adsorption refrigeration prototype, which utilizes the composite adsorbent of calcium chloride/activated carbon and the refrigerant of ammonia, is developed and tested. System reliability is significantlyimproved because the integrated adsorbers are adopted, the closed circulation for heating and cooling processes is designed, and the system operation is optimized. Experiments showed that the prototype can start quickly, and the operation of the system is very stable. The influences of mass recovery time, cycle time, heating temperature, evaporating temperature and cooling water temperature on system performance have been studied. Experimental results indicate that for the -5 ºC evaporating temperature, 130 ºC heating temperature, 25 ºC cooling water temperature, the optimized cycle time is 50 min with a mass recovery time of 120 s. The optimal coefficient of performance (COP), specific cooling power (SCP) and cooling capacity of this prototype are 0.197, 205.2 W/kg and 1.64 kW, respectively.

Key word: Refrigerator,prototype,cooling,power,etc

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EXPERIMENTAL STUDY ON A NEW SOLAR REFRIGERATOR WITH INTERMITTENTADSORPTION CYCLE

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Abstract

This paper presents experimental results for a prototype intermittent solar adsorption ice-maker usingwater as the refrigerant and silica gel as the adsorbent. Four external flat reflectors made of polishedstainless steel were used to enhance the performance. On a cloudy day, without reflectors, a minimum temperatureof 7 ◦C was reached, so no ice was made. With reflectors 0.5 kg of ice was made from a 9 kg load.Increasing the load of water tended to increase the solar COP. The effect of the initial mass of refrigerant wasalso investigated.

Key word: solar, Refrigerator, prototype, cooling, power, etc

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EXPERIMENTAL STUDY ON ADSORPTION CAPACITY OFACTIVATED CARBON BASED ADSORPTION WATER CHILLER

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ABSTRACT

The objective of this study was to evaluate the adsorption capacity of working pair for adsorption water chiller. Activated carbon fiber-methanol, activated carbon fiber-ethanol and activated carbon pallet-ethanol were used as an adsorbent-adsorbate pair in this study. The experiment was conducted using a stainless steel adsorber, 110 mm diameter by 150 mm height, filled with adsorbent and transparent plastic evaporator, 100 ml capacity, filled with adsorbate. The experiment was performed by isobaric adsorption in the temperature range of10-100º C at the evaporator temperature of 20°C (water chiller). Experimental investigation showed that Activated carbon fiber- methanol pair has highest adsorption capacity (0.44kg/kg) compared to activated carbon fiber- ethanol and activated carbon pallet- ethanol pair.The finding revealed that uniform structure and large surface area of adsorbent as well lowboiling point and large latent heat of adsorbate had highly significant effects on adsorptioncapacity. The effect of time and adsorber temperature on adsorption capacity is also discussedin this study.

Key word: Refrigerator,prototype,cooling,power,etc

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INVESTIGATION OF THE HEAT TRANSFER PROPERTIES OF GRANULAR ACTIVATED CARBONWITH R723 FOR ADSORPTION REFRIGERATION AND HEAT PUMP

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ABSTRACT

This paper investigates the heat transfer coefficient of the wall to packed carbon contact *(h)* and the thermalconductivity of the packed bed *(λ)* by using parameters estimation method. A numerical heat conduction methodwas used in conjunction with an iterative process of minimizing the Mean Square Error *(MSE)* between bothexperimentally measured and model predicted temperatures in order to estimate h and λ parameters simultaneously.Experimental work was carried out by measuring the wall and centre temperatures of the samplereactor when suddenly submerged in a temperature controlled water bath at around 90 °C. Four samples withpacked bed density ranging from 600 kgm−3 to 750 kgm−3 were tested. The results for the GAC-R723 refrigerantpair show a quasi-linear increase in both thermal conductivity *(λ)* and wall contact heat transfercoefficient *(h)* with packed bed density. The thermal conductivity of GAC-R723 refrigerant varies between0.77W/mKand1.36W/mK (about three times the values without R723 refrigerant) while the wallcontact heat transfer coefficient varied between 390Wm−2 K−1 and 735Wm−2 K (up to 30% better thanvalues without R723).

Key word: Refrigerator,prototype,cooling,power,etc

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OPTIMISATION OF ECOFRIENDLY ADSORPTION REFRIGERATION SYSTEM

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ABSTRACT

Adsorption cooling system can be classified into two main types, namely, intermittent adsorption systemand continuous adsorption system. In this paper, attention has been focussed on the intermittent adsorptionrefrigeration system. Continuous adsorption system requires a pump, which requires electricity, andmore heat exchangers and more than one adsorbent bed, which increases the cost. Intermittent adsorptionsystem can be operated without electricity. This vapour adsorption refrigeration system is optimisedto reduce the product cost through Evaluation and Optimization method.

Keyword: cooling,system,method,optimization,etc

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ADSORPTION COOLING CYCLE USING SILICA-GEL PACKED IN OPEN-CELL ALUMINUM FOAMS

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ABSTRACT

Effective thermal conductivity of a silica-gel/water adsorption packed bed is significantly enhanced by placing silica-gel particles in a high-porosity aluminum (AL) foam. The enhancement leads to several folds increase in the specific cooling power (SCP), cooling capacity per unit volume (CPv) and coefficient of performance (COP) of an adsorption cooling (AC) chiller. The thermal response and adsorption kinetics of various silica-gel/AL foam beds under typical operating conditions are investigated experimentally and numerically. Effect of pores per inch (PPI) of the foam, silica-gel particle size, bed height and adsorption isotherm of different types of silica-gel on the bed performance are investigated. The results reveal that the AL foam with 20 PPI is recommended for adsorption cooling applications due to its high surface area and small cell size. 20 PPI AL foam can deliver a SCP of 827 W/kg, a CPv of 517 W/m3 and a COP of 0.75.

Keyword: CPV, cooling,system,method,optimization,etc

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PERFORMANCE EVALUATION OF SILICA GEL-WATER ADSORPTION BASED COOLING SYSTEMFOR MANGO FRUIT STORAGE IN SUB-SAHARAN AFRICA

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ABSTRACT

Refrigeration is generally recognised as a key tool for successful marketing of fresh produce. However, suchsophisticated cooling systems are unavailable or non-existent for African smallholder farmers due to financialconstraints and lack of electricity supply. The application of low cost silica gel-water adsorption based coolingsystems has attracted attention for on-farm storage. However, the drawback till now was low cooling performance. Therefore, this work focused on evaluating the cooling performance of adsorption based cooling refrigerator (prototype) at different cooling cycle times of 30, 60, 90 and 120 min with regeneration cycles fixed to 30 min and various hot water regeneration temperatures of 60, 70 and 80 °C. The study reveals that the cooling cycle time influences the reduction in storage temperature most, while both increasing hot water temperature and cooling cycle time enhance the cooling capacity of the prototype. Additionally, the adsorption based cooling system prototype was examined on its capability of storing fresh mangoes which resulted in 3% mass loss of fruits at average inside air temperature of 15 °C and relative humidity of 90%. These results suggest that the new energy saving storage technology, can be adopted for storage of fresh commodities in Sub-Saharan Africancountries.

Keywords: tool,temperature,technology,etc

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PHYSICAL PROPERTIES AND ADSORPTION KINETICS OF SILICA-GEL/WATER FOR ADSORPTION CHILLERS

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ABSTRACT

The choice of a suitable adsorbate/adsorbent pair is critical for an adsorption cooling cycle. The surface characteristicsand thermo-physical properties of the adsorbent, and the adsorption rate of adsorbate are keyparameters in making the choice. Through literature review, it is found that there are disagreements among theexperimental measurements and various equations/models used to describe adsorption isotherms and surfacediffusivity of water in silica-gel. In this work, an experimental set-up is built to measure theisotherms andkinetics of vapor adsorption for any working pair. Using the newly measured data, those from the manufacturersand from the literature, these inconsistencies are eliminated by utilizing the Dubinin-Astakhov (D-A) model to fitthe entire adsorption isotherm curve. The Brunauer-Emmett-Teller (BET) method is used to calculate the surfacearea, pore volume and pore diameter of two different types of silica-gel. Based on the adsorption rate and theadsorbent temperature measured simultaneously, a new approach is proposed to measure the surface diffusivityin the temperature and pressure ranges typical of those during the operating conditions of adsorption coolingsystems. Analysis of the results indicates that the surface diffusivity follows the Arrhenius-form equation. Thecalculated activation energy at different adsorption conditions varies from 40.0 to 41.2 kJ/mol and the preexponentialfactor varies from 2.5×10−4 to 2.8×10−4m2/s. These values are close to those previously reportedin the literature. Thus, the proposed approach can be used to measure the surface diffusivity in nanoporousmaterials.

Keywords: absorbate,BET,Diffusivity,etc

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A NOVEL SOLAR-POWERED ADSORPTION REFRIGERATION MODULE

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ABSTRACT

This paper presents the description and operation of a simple structure, low cost solar-poweredadsorption refrigeration module with the solid adsorption pair of local domestic type charcoal andmethanol. The module consists of: a—modified glass tube having a generator (sorption bed) at one end anda combined evaporator and condenser at the other end and, b—simple arrangement of plane reflectors toheat the generator. The testing of the module is mainly focused on the sorption bed, therefore, four types(1–4) of bed techniques and four reflector arrangements (A–D) to heat the sorption bed had been proposed and tested under climatic condition of Cairo (30_ latitude). The angles of inclination of the reflectors are varied every month to receive maximum solar energy at noon time. Glass shell is also used to cover the bedsin winter.Test results show that, the module composed of the bed technique Type 4 and reflector's arrangement Type C gives best performance. The time duration during which the bed temperature is above 100 _C was found to be 5 h, with a maximum temperature of 120 _C in winter. In summer, the corresponding values 6 h and 133 _C. During cooling, the minimum bed temperature recorded in either winter or summer time is very close to the ambient temperature due to the absence of bed insulation. The daily ice production is 6.9 and 9.4 kg/m2 and net solar COP is 0.136 and 0.159 for cold and hotclimate respectively.

Key words:glass,temperature,time,etc

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ACTIVATED CARBON AND GRAPHENE NANOPLATELETS BASED NOVEL COMPOSITE FOR PERFORMANCE ENHANCEMENT OF ADSORPTION COOLING CYCLE

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ABSTRACT

Adsorption cooling systems powered by low-grade thermal or renewable energy are considered as a potential alternative to the vapor compression systems. To improve the performance and compactness of the system, this study focuses on the synthesis and characterization of activated carbon (AC) composite employing graphene nanoplatelets (GNPs) namely H-grade and C-grade, and polyvinyl alcohol. The influence of GNPs on the porous properties, thermal conductivity, and ethanol adsorption characteristics of composites have been experimentally investigated. Porous properties results show that the studied composites possess high surface area and pore volume with microporous nature. The C-grade contained composite shows the higher porous properties compared to H-grade, however, thermal conductivity for the later one is the highest. The highest thermal conductivity is found to be 1.55Wm−1 K−1 for H-grade (40 wt%) contained composite which is 23.5 times higher than that of powder AC. Ethanol adsorption characteristics on studied composites are conducted gravimetrically at adsorption temperatures 30–70 °C. Experimental data are also fitted with Tóth and Dubinin-Astakhov (D-A) isotherm models within±5% RMSD and found 23% improvement of effective volumetric uptake for H25 (20 wt %) composite compared to parent AC. The instantaneous ethanol adsorption uptake onto composites has also been presented for adsorption temperature 30 °C and evaporator pressure at 1.8 kPa.

Key words: Grade,Data,Power,etc

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ADSORPTION COOLING SYSTEMS FOR HEAVY TRUCKS A/C APPLICATIONS DRIVEN BY EXHAUST AND COOLANT WASTE HEATS

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ABSTRACT

Water coolant and exhaust gases are the main waste heat sources of heavy trucks engine that can be used in driving adsorption cooling systems (ACS) for air conditioning and refrigeration demands. Due to the differences in heat source thermodynamic conditions, adsorbent materials and heating/cooling fluid flow loops of the exhaust and coolant driven ACS, identifying the higher performance system in terms of efficiency and cooling capacity under different operating conditions is not a trivial matter. In this study, considering an identical absorbent bed heat exchanger and ambient conditions, the performances of the coolant and exhaust driven systems with the working pairs of silica gel-water and zeolite13x-water, respectively, are investigated by means of a detailed numerical model. Parametric studies show that the exhaust driven system at different operating conditions is more capable of meeting the cooling demands in comparison with the coolant driven system at its practical operating conditions. In addition, the evaluation of both systems performance at higher ambient temperatures indicates that the increase in ambient temperature leads to an almost linear performance drop in both systems, however, that is more considerable in the coolant driven ACS. Finally, the design of both systems and their challenges are briefly discussed.

Key words: Gas,Engine,ACS,Drop,etc

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EVALUATING THE POTENTIAL OF USING ETHANOL /WATER MIXTURE AS AREFRIGERANT IN ADSORPTION COOLING SYSTEM BY USING ACTIVATED CARBON -SODIUM CHLORIDE COMPOSITE ADSORBENT

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ABSTRACT

Thermal properties and adsorbent - refrigerants compatibility, influence heat and masstransfer dynamics in adsorption cooling systems (ACS). Activated carbon (AC) +NaCl (10-35.7% w/v) composite adsorbents were paired with either high purity (99.7%) or low-gradeethanol (60% ethanol/ 40% water) refrigerants to assess the potential of ethanol/watermixture as a refrigerant. The ACS with activated carbon-sodium chloride (AC+ NaCl)composites adsorbent had a coefficient of performance and specific cooling power of up to0.091 and 79 Wkg-1, respectively, when paired with high purity ethanol, which increased toabout 0.146 and 150 Wkg-1, respectively, when paired with low-grade ethanol. About 16 -25 MJ per cycle was needed for evaporation of refrigerants in AC+NaCl compositesadsorbent when paired with the low-grade ethanol, whereas more energy, 27 MJ per cycle,was required to evaporate low-grade ethanol when paired with unmodified AC in ACS. Thestudy has shown that the thermal and mass transfer performances of AC+NaCl compositesadsorbents superseded that of unmodified AC providing the potential for low-grade ethanolto be used as a potential alternative refrigerant in ACS especially in areas where pureethanol is limited.

Key words: Cooling, ACs,NACL,low,etc

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EXPERIMENTAL STUDY ON PERFORMANCE CHANGE WITH TIME OF SOLAR ADSORPTIONREFRIGERATION SYSTEM

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ABSTRACT

Under the solar heating condition, the performance of the adsorption refrigerationsystem using SAPO-34 zeolite and water as the working pair was tested practically. Theexperiment provided insights into the dynamic change of the temperature and pressure in theadsorption bed, as well as the effect of the cycle time on the system performance. By analyzing therelationship between the solar energy input and the cooling output, the optimal cycle time of thesystem was identified. It was revealed that both the performance coefficient COP and the specificcooling power SCP presented a maximum value with respect to the adsorption time as the systemwas evaluated by the whole cycle time. However, the COP and the SCP did not share the sameadsorption time for their maximum values. The characteristic for the bed to decrease theadsorption rate with the time is considered to be responsible to interpret the optimal cycle time ofthe system. The overlong time of adsorption did not help to improve the cooling performance ofthe system.

Keywords: solar,COP,SCP,etc

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HEAT TRANSFER PERFORMANCE INVESTIGATION ON A FINNED TUBE ADSORBENT BED WITH ACOMPOUND PARABOLIC CONCENTRATOR (CPC) FOR SOLAR ADSORPTION REFRIGERATION

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ABSTRACT

In this work, activated carbon-methanol was used as the working pair in a solar adsorption refrigeration system (SAR). The thermal conductivity of the activated carbon was very poor, resulting in performance delays of the system. To improve the performance of the heat transfer for the adsorbent bed, a new adsorbent bed with finned tubes was designed and studied using commercial computational fluid dynamics (CFD) software. Two-dimensional (2D) numerical models of two kinds of adsorbent tubes (finned and smooth tubes) were constructed and simulated. The two different 2D numerical models had similar cell numbers and the same boundaries and initial conditions. An experiment for a grid verification model of the designed finned tube was conducted, and the model of the finned tube was validated via comparison between the numerical and experimental results. In addition, the heat performances of the newly designed finned tube and the smooth tube were compared in this paper. The temperature gradients of the activated carbon in the smooth and finned tubes were approximately 28.1 °C and 4 °C during isosteric heating, respectively. The conclusions are that the fins had a large effect on the thermal performance of SAR, and the possibility that the methanol was adsorbed again by the activated carbon of the lower temperature part in the finned tubes during isobaric heating was decreased greatly. Moreover, the radial heat loss of the finned tube wall was also less than the smooth tube, which may be an important factor for improving the performance of the system effectively.

Key words: SAR,temperature,CFD,etc

STUDY ON SOLAR DRIVEN COMBINED ADSORPTION REFRIGERATION CYCLES IN TROPICAL CLIMATE

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ABSTRACT

This paper presents the theoretical analysis of the performance of solar powered combined adsorptionrefrigeration cycles that has been designed for Singapore and Malaysia and similar tropical regions usingevacuated tube solar collectors. This novel cycle amalgamates the activated carbon (AC)-R507A as thebottoming cycle and activated carbon-R134a cycle as the topping cycle and deliver refrigeration load aslow as _10 _C at the bottoming cycle. A simulation program has been developed for modeling andperformance evaluation for the solar driven combined adsorption refrigeration cycle using the meteorologicaldata of Singapore and Malaysia. The results show that the combined cycle is in phase with theweather. The optimum cooling capacity, coefficient of performance (COP) and chiller efficiency arecalculated in terms of cycle time, switching time, regeneration and brine inlet temperatures.

Keyword: R507,Evaluation,COP,etc

THERMODYNAMIC ANALYSIS AND PERFORMANCE OF AN ADSORPTION REFRIGERATION SYSTEMDRIVEN BY SOLAR COLLECTOR

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ABSTRACT

This paper presents the operating and performance of an adsorption refrigeration systemdriven by a solar collector. The thermodynamic cycle and the working principle of the systemare based on the adsorption phenomena at a steady temperature. The system operates withactivated carbon (AC)-methanol as a working pair, and Dubinin-Astakhov (D-A) equationwas used to describe this phenomena. Comparative study between different types of ACreveals that the one based on stone coal had an optimal performance coefficient (COP) equalto 0.73 whereas a total energy input to the system is 18740.05kJ and a total daily iceproduction of 13.65kg at -3°C. The studied case indicates that the optimal performance of thesystem can be obtained for low ambient and condensation temperature with high evaporationtemperature. Ice produced can also be improved when the initial water temperature is low.

Key words: Refrigeration,energy,input,Ice,etc

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ADSORPTION STUDY OF SILICA GEL PARTICLE FOR IMPROVEMENT IN DESIGN OFADSORPTION BEDS USED IN SOLAR DRIVEN COOLING UNITS

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ABSTRACT

Simulations using Ansys Fluent 6.3.26 have been performed to look into the adsorption characteristics of a single silica gelparticle exposed to saturated humid air streams at Re=108& 216 and temperature of 300K. The adsorption of the particle hasbeen modeled as a source term in the species and the energy equations using a Linear Driving Force (LDF) equation. Theinterdependence of the thermal and the water vapor concentration field has been analysed. This work is intended to aid in understanding the adsorption effects in silica gel beds and in their efficient design.

Key word: Fluent, LDF, silica,etc

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A CASE STUDY OF A LOW POWER VAPOUR: ADSORPTIONREFRIGERATIONSYSTEM

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ABSTRACT

Industrial refrigeration is one of the most energy consuming sector. In conventional Vapor Compression refrigeration system, compressor is the major power consuming element. Vapor Adsorption refrigeration system is one of the best replacement for the Vapor Compression refrigeration system. Our main objective is to analyze, design and develop a Vapor Adsorption refrigeration system which is cost effective and environment friendly. A prototype model that is capable of producing a temperature drop in closed evaporator chamber was designed, fabricated and tested. Activated carbon/Methanol pair is chosen as Adsorbent/Refrigerant pair. The system is analyzed in ANSYS 14.5 using the inlet conditions obtained from the experimental setup. The performances and effectiveness of the unit was studied by determining Refrigeration Effect (RE), Coefficient of Performance (COP) and operational issues of the unit are explained. The results obtained from the analysis and experiments have marginal difference in COP i.e. with an error percentage of 5.94%. The overall COP obtained is 0.34 through experiments and from analysis the COP obtained is approximately 0.32.

Key word: NADYS,COP,Vapour,etc

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NUMERICAL INVESTIGATION OF SMALL-SCALE ADSORPTIONCOOLING SYSTEM PERFORMANCE EMPLOYING ACTIVATEDCARBON-ETHANOL PAIR

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ABSTRACT

Adsorber heat exchanger design has great importance in increasing the performanceof the adsorption-based cooling system. In this study, a transient two-dimensional axisymmetricComputational Fluid Dynamics (CFD) model has been developed for the performance investigationof finned tube type adsorber using activated carbon and ethanol as the working pair. The operatingconditions of the cooling system were 15, 20 and 80 for evaporation, cooling and heating temperatures,respectively. The simulated temperature profiles for different adsorbent thicknesses were validatedwith those from experimental data measured in our laboratory. Moreover, the error in mass andenergy balance were 3% and 7.88%, respectively. Besides, the performance investigation has beenperformed for cycle time ranging from 600 s to 1400 s. The optimum cycle time was 800 s and thecorresponding evaluated specific cooling power (SCP) and coefficient of performance (COP) werefound to be 488 W/kg and 0.61, respectively. The developed CFD model will be used for fin heightand fin pitch optimization and can be extended to other adsorbent-adsorbate based adsorptioncooling system.

Key words:CFD,COP,SCP,etc

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PARAMETRIC STUDY AND SIMULATION OF A HEAT-DRIVEN ADSORBER FOR AIRCONDITIONING SYSTEM EMPLOYING ACTIVATED CARBON–METHANOL WORKINGPAIR

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ABSTRACT

Objectives: This paper aims to present a parametric study to compare with the experimental results obtained previously for a typical activated carbon–methanol, adsorption air-conditioning system powered by exhaust heat. The main objective is to study the effect of wall thickness on the desorption temperature and the cooling performance.

Methods: The current study is a simulation/parametric investigation employing computational fluiddynamics (CFD) simulation technique.

Results: It is found that the CFD result is close to the experimental works. In this CFD investigation, aninput exhaust gas of 200 _C would have bed temperature around 120 _C while employing 20 mm thickof wall made by stainless steel. The adsorber took around 10 min to heat up and decrease to room temperaturearound the same period. This set of data produce a cooling power of 0.65 kW and COP around0.25 with cycle time of 1200 s.

Conclusion: It is concluded that higher input temperature would have relatively longer cycle time but it isable to produce higher cooling power in return. While in design, it proves that an optimal wall thicknessshould be 15–20 mm of stainless steel that offer lower heat transfer rate to maintain the system underfunctional Tdes at all time.

Practice implications: This paper proves that adsorption air-conditioning system is technically applicable;however wall thickness of the adsorber should be considered seriously as one of the important parametersfor suitable heat transfer and improved adsorption–desorption rate of the system.

Key words: COP,time,absorber,etc

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EXPERIMENTAL STUDY ON VAPOR ADSORPTION REFRIGERATIONSYSTEM WITH CARBON-METHANOL PAIR

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ABSTRACT

Adsorption systems may find its application in refrigeration and air-conditioning, ice-making, water chiller etc. In conventional vapor compression refrigeration system, compressor is the main power consuming component. A vapor adsorption systemcan be feasible replacement for vapor compression refrigeration system. The main objective of this project is to design, fabricate and test a cost effective and laboratory scale vapor adsorption refrigeration system. An intermittent type vapor adsorption system is fabricated using some common stainless steel utensils, copper tube, an electric heater and a laboratory vacuum pump. The Refrigeration effect and COP of the system is determined from basic thermodynamic relations. Though COP is ~0.175 but it's able to bring down temperature of circulating water by more than 10 ^{o}C.

Keyword: Vapour, absorber, pump, etc.

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RECENT ADVANCES IN ADSORPTION HEAT TRANSFORMATION FOCUSING ON THE DEVELOPMENT OF ADSORBENT MATERIALS

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ABSTRACT

Adsorption heat transformation (AHT) is an environmentally friendly energy-saving process applied for air conditioning purposes, that is, either for cooling (including also ice making and refrigeration), or heating. AHT is based on the cycling adsorption and desorption of a working fluid in a porous material. When the working fluid is driven to evaporation by the active empty sorbent material, the required heat of evaporation translates into useful cooling in thermally driven adsorption chillers. Driving heat regenerates the empty sorbent material through desorption of the working fluid. The heat of adsorption in the sorbent material and the heat of condensation of the working fluid can be used in the adsorption heat-pumping mode. Thus, adsorption heat transformation contributes to energy-saving technologies. Adsorbent development plays a critical role for the improvement of AHT technologies. Besides silica gel and zeolites as adsorbent materials, which are up to now used in the commercially available AHT devices; especially metal-organic frameworks (MOFs) are getting more attentions in recent years. Composite materials from salts with silica gels, zeolites and MOFs as well as activated carbons have also been researched to contribute to AHT technologies. Reduction of installation/production cost and enhancement of the efficiency of AHT devices need to be achieved to increase the wider usage of AHT.

Key words: AHT, MOF, refrigerator, etc

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ANALYSIS AND OPTIMIZATION OF A METHANOL REACTOR WITH THE ADSORPTIONOF CARBON MONOXIDE AND WATER

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ABSTRACT

Methanol is generally produced in adiabatic or Lurgi type catalytic reactors from syngas or pure carbondioxide and hydrogen. In this research, an innovative methanol reactor is analyzed and optimized,because sorbents for the capture of carbon monoxide and water are used. In particular, zeolite molecular sieves having high SiO2/Al2O3 are used to capture carbon monoxide while zeolites 4A are implemented to adsorb water molecules. No sorbents for the capture of carbon monoxide are suggested before. In this system, the two reactions in methanol production are both favored, then it is possible to increase them ethanol yield, reducing the outlet reaction temperature, compared to a traditional adiabatic reactor. AnANOVA analysis and a response surface methodology are also developed. Results show that the capture fraction is the most important factor with the aim to improve the methanol yield and to reduce there action temperature. Optimal operating conditions are found in order to have a nearly-isothermal system (493 K) maximizing the methanol yield (37%): the capture fraction, recycle of gases, inlet temperatureand reaction pressure must be respectively equal to 80%, 79.7%, 493.32 K and 55 bar. In thefuture work, an experimental reactor can be realized to verify the obtained results.

Keywords: carbondioxide,Sio,Al2o3,etc

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ENHANCEMENT OF HEAT TRANSFER IN ADSORPTION BED OF VACUUM-TUBE WITH FINS

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ABSTRACT

To improve the heat transfer in the adsorption bed that was applied in a solar adsorption cooling system, anexperimental study was conducted on the finned adsorption bed with the SAPO-34 zeolite–water as the workingpair. In windless and sunny weather conditions, the performance of the system wasinvestigated for differentcases of the fin number changing from 2 to 8, given a fixed fin height and fin thickness. The experimental resultsrevealed that not only the cooling capacity, but also the coefficient of the performance (COP) as well as thespecific cooling power (SCP) of the system, were improved obviously with the increment of the fin number. Withthe heat transfer enhancing effect of the inserted fins, the bed cooling time following the desorption process wasgreatly reduced. Although the solar energy input in the preheating and the desorption process was increased forthe fin-enhancing cases, the comprehensive result of the cycle performance was revealed to be profitable.

Keyword: SCP,COP,SAPO,etc

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DESIGN AND EXPERIMENTAL STUDY OF A SMALL SCALE ADSORPTION DESALINATOR

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ABSTRACT

Adsorption desalinators produce potable water from seawater using low-grade heat at 50–90 °C. The technology has been proven using several experimental systems, but their sizes are too large to allow efficient further development by testing novel adsorption materials and components. In this study, we introduce the world's most compact adsorption desalinator with a bed size of 0.2 kg silica gel. The system achieves a Specific Daily Water Production of 7.7 kgwater per kgsilica-gel and day. The performance is comparable to the best performing system todate proving that the downscaling is not detrimental. Moreover, the tests demonstrate the benefits of simple heat integration between the adsorbed bed, which reduces energy consumption by 25% and increases the Performance Ratio to 0.6. The importance of heat integration is further highlighted in an unprecedented thermal response experiment, which evaluates the partition of energy input in terms of sensible heat and heat of desorption.

Key words: Heat, ratio, performance, etc

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EXPERIMENTAL INVESTIGATION ON THE PERFORMANCE OF AN ADSORPTIONSYSTEM USING MAXSORB III+ ETHANOL PAIR

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ABSTRACT

The performance of an adsorption system using Maxsorb III + ethanol pair is investigated for practical heat pump applications. An adsorption system using a single bed with a single evaporator/condenser is employed and the performance of the system is assessed for various regeneration temperatures (80°C, 70°C and 60°C). The impact of the adsorption time on the performance of the selected pair is further evaluated. The potential application of the present adsorbent + adsorbate pair is the automobile air-conditioning system where the exhaust waste heat will be recovered to operate the adsorption system. Thus, antifreeze fluid is employed as the heat transfer medium for the adsorber and the evaporator/condenser heat exchanger. A mathematical model is developed to estimate the uptake amount. The sensible heat change (thermal mass), the superheating of the refrigerant in the adsorber, the adsorber heat leak and the heat rejection to the heat transfer medium are accounted for. The uptake amount is further verified using the classical p-T-q diagram. For operation using 30° C adsorber coolant inlet and 15° C chilled water inlet, the cooling capacity of the present system ranges from 15 to 35W for the adsorption times of 600 s and 300 s, respectively. It is observed that the regeneration temperature significantly influences the net uptake of the system. The maximum net uptake is recorded to be about 0.995 kg/kg for the regeneration temperature of 80° C. The system is further assessed using the ratio of the cooling capacity to the adsorption heat.

Key words: Heat, ratio, performance,temperature, etc

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EXPERIMENTAL INVESTIGATION OF A SOLAR-POWERED ADSORPTION REFRIGERATION SYSTEM WITH THE ENHANCING DESORPTION

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ABSTRACT

The paper proposes a novel solar adsorption refrigeration system employing an active enhancing mass transfer method based on the typical basic cycle. In essence, the new method is to drop the internal pressure of the system in the desorption process. The working principle of the hypothesis and the cycle description are explained in detail and analyzed by laboratory experiments. The novel solar adsorption refrigeration system prototype withactivated carbon-methanol as working pair was designed and built. Some different comparative tests under different weather conditions were conducted to prove the hypothesis and evaluate the performance of the novel adsorption refrigeration system. The experimental results show that the system employing an active enhancing mass transfer method will increase the mass of desorbed refrigerant by about 20% if compared with a natural desorption refrigeration system. It was also proved that the novel method is very effective for low adsorbent temperature operation, which may help to obtain a COP solar increase of at least 16.4%. And about one and half-hours can be saved by enhancing desorption refrigeration system to get the same desorbed refrigerant with the natural desorption refrigeration system. The results of experiments show that the novel system has improvements in the coefficient of performance, the mass of desorption and desorption rate, and the characters of the solar adsorption refrigeration system can be a benefit to further application.

Key words: COP,solar,Cycle,etc

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PERFORMANCE COMPARATIVE STUDY OF A SOLAR-POWERED ADSORPTION REFRIGERATORWITH A CPC COLLECTOR/ADSORBENT BED

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ABSTRACT

Solar adsorption refrigeration has many advantages. However, solar radiation has a relatively low energy density and requires much time to heat an adsorbent bed. In addition, the coefficient of performance (COP) of an adsorption refrigeration system is relatively low. In this paper, a new solar adsorption refrigeration prototype, which uses a compound parabolic concentrator (CPC) adsorbent bed with activated carbon-methanol as the working pair, was proposed and built to shorten the cycle time and improve performance. Laboratory experiments were conducted to evaluate and compare its performance and characteristics to those of a conventional solar adsorption refrigeration system. The experimental results show that the speed of the temperature increase of the adsorbent bed was boosted by employing CPC collectors. Compared with a conventional refrigeration system, the desorption period of the new system was reduced by one-third over one cycle. The desorption rate of the adsorption refrigeration cycle was notably improved. By using the CPC collector in a solar adsorption refrigeration system, the COP increased by 27%. The experimental results also show that applying solar concentrating technology in adsorption refrigeration is a promising approach for improving solar adsorption refrigeration performance and achieving a fast and continuous refrigeration cycle.

Key words: COP, solar, Cycle, refrigerate, etc

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SYNTHESIS AND CHARACTERIZATION OF SILICA GEL COMPOSITE WITH POLYMER BINDERS FOR ADSORPTION COOLING APPLICATIONS

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ABSTRACT

The motivation of the present paper is to synthesis high packing density and thermal conductivity consolidated composite using silica gel powder (SGP) almost without affecting its porous properties. The effect of packing density, binder type and amount on porous properties as well as thermal conductivity was studied. Four types of binder, namely Hydroxyethyl cellulose (HEC), Polyvinyl alcohol (PVA), Polyvinyl pyrrolidone (PVP) and gelatine were chosen. SGP composite with PVP 2wt% as binder showed better performance for both porous and thermal properties. Thermal conductivity for PVP 2wt% composite was found 32% higher than SGP. Adsorption uptake of water onto SGP and PVP 2wt% composite at 30 to 70 ºC adsorption temperatures were measured using gravimetric method. Tóth equation is found suitable to fit the isotherm data. Results showed that there is no change in water adsorption uptake between SGP and PVP 2wt% composite whereas the volumetric uptake increased by 12.5% for the composite. The studied composites were found to be suitable for designing high performance adsorption cooling systems.

Key words: SGP,PVP, HEC, Cycle, etc.

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ANALYSIS OF HEAT TRANSFER CHARACTERISTICS WITH TRIANGULAR CUT TWISTED TAPE (TCTT) AND CIRCULAR CUT TWISTED TAPE (CCTT) INSERTS

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Abstract

The paper represents the numerical investigation of heat transfer characteristics in a pipe provided withtwisted tape inserts is analyzed. The heat transfer was analyzed in a swirling flow conditions using CFDsimulation. A commercial CFD package was used for analyze twisted tape for circular tube fitted with triangularcut twisted tape and circular hole cut twisted tape inserts. The twisted tape system allows a significantincrease of convective heat transfer coefficient by introducing the swirl flow motion. The swirlflow motion provides greater heat transfer rate extracted from the solid surface of the tube. The depthof cuts for triangular cut 5 mm and depth of hole cut 5 mm twisted tapes were used for simulation generation.In this paper CFD analysis was used for enhancement of heat transfer rate of fluid of laminar flow.The experimental investigation were conducted in double pipe heat exchanger and these value of plaintwisted tape, triangular twisted tape and circular hole cit twisted tape were taken for used simulationanalysis. The performance of heat transfer rate was enhanced 1.1–1.3 times compared that the plaintwisted tape and circular cut twisted tape. The data obtained from the simulation correlations for triangularcut twisted tape and circular hole cut twisted tape; and these data were correlated with plaintwisted tape.

Keywords: Circular cut twisted tape, Triangular cut twisted tape, Computational

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CFD SIMULATION OF HEAT TRANSFER ENHANCEMENT IN CIRCULAR TUBE WITH TWISTED TAPE INSERT BY USING NANOFLUIDS

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Abstract :

Heat transfer enhancement using nano-fluids has gained significant attention over the past few years.Nano-fluids are potentially applicable as alternative coolants for many areas such as electronics, automotive,air conditioning, power generation and nuclear applications. Heat transfer coefficient and the frictionfactor characteristics of SiC/water nanofluid will have been numerically investigated using ANSYSFLUENT 14.0. The Nanofluid was employed in a circular tube equipped with modified Horizontal WingTwisted Tapes (HWTT) with different twist ratio (y = 2.0, 4.4, 6.0) were used for simulation and comparedwith Plain Twisted Tapes (PTT). The results of CFD investigations of heat transfer Coefficient and frictioncharacteristics are presented for the HW-TT with Different twist ratio in comparison with the P-TT case.

Keywords :Plain Twisted Tapes,Horizontal wing twisted tapesNanofluidsHeat exchanger, CFD

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ENHANCEMENT OF HEAT TRANSFER IN SIX-START SPIRALLY CORRUGATED TUBES

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Abstract

The utilization of corrugation for improvement in heat transfer is increasingly becominginteresting recently due to its combined advantages such as extended surfaces, turbulators aswell as roughness. This study employed the use of both numerical as well as experimentalsettings on the water flowing at lower Reynolds numbers in a corrugated tubes with spiral shapeto evaluate the performance of heat in a newly designed corrugation style profile. The totalperformance of the heat for the corrugation tubes were determined and the mathematicalinformation generated from both the Nusselt number and the factors of friction were equatedwith those of the experimentally generated outcome for both standard smooth as well as the corrugated tubes. Analysis of the dat generated revealed improvements in heat transfer ranges of (2.4–3.7) times those obtained from the smooth tubes with significant increase in the frictionfactors of (1.7–2.3) times those of the smooth tubes. Based on the findings of study, it wasconcluded that for extended period and extensive range use, tubes with severity index values at36.364×10–3 could produce better heat performance (1.8–3.4) at Reynolds numbers rangingfrom 100 to 1300. This was an indication that the geometric expression with spiral corrugationprofile could significantly enhance the efficiency of heat transfer with significantly increasedfriction factors.

Keywords: Enhancement of heat transfer,Spirally corrugated tube,Six–starts,Friction factor etc.

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EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER IN A TUBE HEAT EXCHANGER WITH AIRFOIL-SHAPED INSERT

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Abstract

In this present study, the novel insert for heat exchanger is presented. The airfoil-shaped insert,Modified NACA0024, is chosen to improve the heat transfer performance in the tube. This experimentis performed to study and investigate the thermal and fluid flow behaviors. The straighttape which Modified NACA0024 are mounted on the both sides generates the longitudinal vorticesin the tube. The Reynolds number based on tube diameter of 4196 to 8125 are selected to bethe desired test range. Main major parameter, inclination angle (IA=0°, 30° and 45°), is considered.The experimental investigation indicates that maximum values of heat transfer ratio,friction ratio, and heat transfer enhancement performance can be found at Reynolds number of4196. The Modified NACA0024 with inclination angle of 45° can present the best heat transferaugmentation approximately 3 times over the plain tube and the maximum heat transfer enhancementperformance (HTEP) of 1.45.

Keywords : Airfoil shape ,Straight tape, Modified heat transfer enhancement

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NANO-ENHANCEMENT OF PHASE CHANGE MATERIAL IN A SHELL AND MULTI-PCM-TUBE HEAT EXCHANGER

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Abstract :

The fundamental defect of PCMs in discharging process is their low conductivity which results in long solidificationtime. In this study distribution of a PCM in a multi-tube heat exchanger is conducted numerically toreduce the solidification time. Therefore, the PCM mass is distributed in the inner and outer tubes betweenwhich a heat transfer fluid (HTF) passes through. Various volume fractions of copper nanoparticles are added tothe PCM and the consequences of the conductivity enhancement is observed. Moreover, the variation of Stefannumber (Ste) is considered to evaluate the effect of this parameter on the solidification process. In addition, it isshown that the distribution of the PCM is greatly effective on the heat transfer enhancement. Proper PCM massdistribution leads to 62% reduction in the solidification time. Results also indicates that by increasing the nanoparticlesvolume fractions to 4% and Ste to 0.45, the solidification time reduces 15% and 26%, respectively inthe best case.

Keywords : Solidification,Phase change material,Mass distribution,NanoparticleShell and tube heat exchanger

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EXPERIMENTAL STUDY ON THE EFFECT OF TIO2–WATER NANOFLUID ON HEAT TRANSFERAND PRESSURE DROP

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Abstract :

An experimental study performed to investigate the effect of nanoparticle volume fraction on the convection heat transfer characteristics and pressure drop of TiO2 (30 nm)–water nanofluids with nanoparticle volume fraction between 0.002 and 0.02, and Reynolds number between 8000 and 51,000. The experimental apparatus is a horizontal double tube counter-flow heat exchanger. It is observed that by increasing the Reynolds number or nanoparticle volume fraction, the Nusselt number increases. Meanwhile all nanofluids have a higher Nusselt number compared to distilled water. By use the nanofluid at high Reynolds number (say greater than 30,000) more power compared to low Reynolds number needed to compensate the pressure drop of nanofluid, while increments in the Nusselt number for all Reynolds numbers are approximately equal. Therefore using nanofluids at high Reynolds numbers compared with low Reynolds numbers, have lower benefits.

Keywords : TiO2–water nanofluid, Nanoparticles diameter, Nusselt number,Pressure drop,Turbulent flow.

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HEAT TRANSFER PERFORMANCE OF A NANO-ENHANCED PROPYLENE GLYCOL:WATERMIXTURE

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Abstract

Propylene glycol:water mixtures are usually employed as heat transfer fluids because of their protection againstlow freezing temperatures and non-toxicity. They are used as working fluids in different applications, like thosebased on renewable sources such as solar thermal or geothermal energy. In this work, the convection heattransfer coefficients and the pressure drops of various functionalized graphene nanoplatelet nanofluids with apropylene glycol:water mixture at 30:70% mass ratio as base fluid have been experimentally determined. Thus,the heat transfer performance of nanoadditive mass concentrations up to 1.0% at different working temperaturesfrom (298.15–313.15) K and flow rates from (0.2–0.7) m3 · h−1 has been evaluated by means of an experimentalsetup whose main element is a double pipe heat exchanger of stainless steel. Enhancements of the convectionheat transfer coefficient reaching 15.3% have been found for the 0.75% mass concentration. Furthermore, adimensionless analysis has been carried out and new correlations were provided in order to predict Nusseltnumber and friction factor as a function of other dimensionless parameters. Maximum deviations for Nusselt

number and friction factor of 2.5% and 1.5% were achieved, respectively. Finally, thermal performance factorswere also obtained for each condition with the aim of evaluating the thermal effectiveness of all the preparednanofluids with respect to the base fluid.

Keywords : Nanofluid,Propylene glycol-water,Graphene nanoplatelets,Heat transfer etc

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AN EXPERIMENTAL INVESTIGATION ON HEAT TRANSFER CHARACTERISTICS OF GRAPHITE-SIO2/WATER HYBRID NANOFLUID FLOW IN HORIZONTAL TUBE WITH VARIOUS QUADCHANNEL TWISTED TAPE INSERTS

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Abstract :

Turbulent heat transfer characteristics of Graphite-SiO2/Water hybrid nanofluid flow in a horizontal smoothtube with and without quad-channel twisted tape (QCTT) inserts is investigated experimentally. The hybridnanofluid is obtained using two different nanoparticles: Siliciumdioxid (60%) and Graphite (40%) with purewater as base fluid. Experiments are conducted for two different volume concentrations, 0.5% and 1%, respectively.The length of quad-channel twist tape inserts are between 0 and 42 cm with constant twist ratios of 5.The Reynolds number is varied from 3400 to 11,000. According to the results, Nusselt number of the case withhybrid nanofluid increased with increasing mass flow rate and volume concentration. Also, heat transfer coefficientincreased with increasing length of twisted tape insert. Moreover, friction factor increases with increasingvolume concentration for increasing Reynolds number whereas and friction factor increases with increasing thelength of tape inserts. Pressure drop increases with increasing mass flow rate and increasing volume concentration.Finally, the regression equations are found to be well-matched with the experimental data within thedeviation band of±5% for Nusselt number and ± 10% for friction factor, respectively.

Keywords : Hybrid nanofluid,Twisted tape insert, Friction factor etc

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LAMINAR FORCED CONVECTION PERFORMANCE OF NON-NEWTONIAN WATER-CNT/FE_3O_4 NANO-FLUID INSIDE A MINICHANNEL HAIRPIN HEAT EXCHANGER: EFFECT OF INLET TEMPERATURE

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Abstract :

This numerical study aims to focus on the effect of difference between the inlet temperatures ofworking fluids onthe hydrothermal characteristics of a counter-current minichannel hairpin heat exchanger. The water flows inthe annulus side and the water based hybrid nano-fluid containing Fe_3O_4 and carbon nanotubes (CNTs) passesthrough the tube side of heat exchanger. Temperature-dependent thermal conductivity and viscosity are consideredfor the non-Newtonian hybrid nano-fluid. The effects of Fe_3O_4 and CNT volumefractions aswell as the Reynoldsnumber on the performance metrics of the heat exchanger are also assessed. The results revealed that theincrease of difference between the inlet temperatures ofworking fluids leads to the augmentation of heat transferrate, overall heat transfer coefficient (except at Reynolds number of 500), heat exchanger effectiveness and PEC;while the pumping power diminishes with the increase of inlet water temperature.

Keywords :Hybrid nano-fluid,Hairpin heat exchanger,Heat transfer,Inlet temperature,Carbon nanotube

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IDENTIFICATION OF THE OPTIMAL CONVERTER TOPOLOGY FOR SOLAR WATER PUMPING APPLICATION

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Abstract

This paper envisages to identify an optimal topology of DC-DC converter for the solar pump application, by comparing the performance indices of the three advanced non-isolated converters namely Landsman converter, Luo converter and Zeta converter. The identified best topology of the non-isolated DC-DC converter, which basically operates in the mode of buck-boost converters cascaded to a three phase voltage source inverter (VSI), which is connected to a permanent magnet brushless DC (PMBLDC) motor. The whole system is front ended to a PV panel. In order to obtain the maximum power transfer to the load, a popular maximum power point tracking (MPPT) technique, Perturb and Observe (P&O) has been implemented. The whole system is simulated under the environment of PSIM.

Keywords: PV system, Perturb and Observe, MPPT, PMBLDC, DC-DC converter.

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CFD MODELING OF TURBULENT FORCED CONVECTIVE HEAT TRANSFER AND FRICTION FACTOR IN A TUBE FOR FE_3O_4 MAGNETIC NANOFLUID IN THE PRESENCE OF A MAGNETIC FIELD

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IIT GUWAHATI.

Abstract

Computational fluid dynamics (CFD) tool is used to study numerically a nanofluid mixture of water and Fe 3 O 4 with MHD effect. The simulation is performed in order to determine the turbulence forced con- vection heat transfer in a circular tube. This is implemented by using the single and two phase mixture approaches with assumption that the particles are spherical and diameter equal to 36 nm. The simulation output data compared with an experimental literature data from other study and found matching. The result shows that Nu and friction factor at fixed Reynolds number is proportional to the magnetic field.

Keywords :CFD Convective heat transfer Turbulent Magnetic Nanofluid

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HEAT TRANSFER AUGMENTATION BY NANO-FLUIDS AND SPIRAL SPRING INSERT IN DOUBLE TUBE HEAT EXCHANGER – A NUMERICAL EXPLORATION

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Abstract :

The efficiency of the most of the thermal devices can be improved by increasing the heat transfer. Someprocess industries like power plant, automobile demand the heat transfer augmentation in either heatingor cooling or evaporation on the devices like air conditioning, radiators, refrigerators, condensers etc. Theavailable methods can be classified in to two category namely passive and active techniques. The objectiveof the research to improve the heat transfer in double pipe heat exchanger by passive techniques. Thefluid mediums like water, titanium dioxide nano-fluid, Beryllium oxide or beryllia nano-fluid, zinc oxidenano-fluid and copper oxide nano-fluids are considered for analysis with the aim of increasing the thermalconductivity of fluid medium. The Spiral Spring insert used for offering the flow resistance andspread the fluid to surface to enhance the heat transfer. The numerical study is investigating the thermaland flow fields utilizing various types of nano-fluids with Spiral Spring insert in the double pipe heatexchanger. The Finite volume method employed for solve the continuity, momentum and energy equationsthe ANSYS 15.0 employed for conducting the numerical analysis.

Keywords : Numerical analysis,Heat transfer,Titanium dioxide nano-fluid dtc

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HYBRID NANOFLUID TO ENHANCE HEAT TRANSFER UNDER TURBULENT FLOW IN A FLAT TUBE

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Abstract :

The heat transfer enhancement by utilizing hybrid nanofluid is a new class of heat transfer enhancement.In this paper, CFD model with commercial software adopting the finite volumemethod and SIMPLE algorithm has been conducted. Mixture of Aluminum Nitride (AlN) andalumina (Al2O3) nanoparticles into water as a base fluid is considered as a new concept of hybridnanofluid for enhancing heat transfer. It was performed the simulation procedures with thevolume fraction (1, 2, 3 and 4%) and Reynolds number are changing from 5000 to 17000. Theheat flux applied along the elliptical tube is 7000 w/m2 and the nanoparticles size diameter isfixed at 35 nm. The validation of computational results has been performed with experimentaldata available in the literature. The results indicated that the hybrid nanoparticles of AlN - Al2O3suspended in water as a base fluid tends to enhance heat transfer significantly.

Keywords : HybridNanofluid,PerformanceTurbulentCFDANSYS

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NANOPARTICLE-ENHANCED PHASE CHANGE MATERIALS (NEPCM) WITH GREAT POTENTIAL FOR IMPROVED THERMAL ENERGY STORAGE

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Abstract :

Improved functionality of phase change materials (PCM) through dispersion of nanoparticles is reported. The resultingnanoparticle-enhanced phase change materials (NEPCM) exhibit enhanced thermal conductivity in comparison to the base material.Starting with steady state natural convection within a differentially-heated square cavity that contains a nanofluid (water plus coppernanoparticles), the nanofluid is allowed to undergo solidification. Partly due to increase of thermal conductivity and also lowering ofthe latent heat of fusion, higher heat release rate of the NEPCM in relation to the conventional PCM is observed. The predictedincrease of the heat release rate of the NEPCM is a clear indicator of its great potential for diverse thermal energy storage applications.

Keywords : Nanoparticles,Nanofluids,Phase change,Thermal storage,Natural convection,Freezing

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COMPARATIVE ANALYSIS OF HEAT TRANSFER AND PRESSURE DROP IN HELICALLY SEGMENTED FINNED TUBE HEAT EXCHANGERS

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Abstract :

Four different semi-empirical models of heat transfer and pressure drop for helically segmented finnedtubes in staggered layout were analyzed. The performance of a Helically Segmented Finned Tubes HeatExchanger on an industrial scale was obtained and the predictions were compared with experimentaldata. The method used for thermal analysis is the Logarithmic Mean Temperature Difference (LMTD).Comparisons between predictions and experimental data show a precision greater than 95% in heattransfer for a combination between the Kawaguchi and Gnielinski models at a flue gas Reynolds number,based on the outside bare tube, of about 10,000. In the case of pressure drop, there is a precision ofapproximately 90% for the Weierman model at a Reynolds number, based on the outside bare tube, ofabout 10,000. And so, the results show that the best flow regime in which heat transfer and pressuredrop are optimum, is for a Reynolds number (based on the outside bare tube) of about 10,000.

Keywords : Experiment,Compact heat exchangers,Segmented fins,Pressure drop,Heat transfer coefficient

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CFD ANALYSIS ON HEAT TRANSFER AND PRESSURE DROP CHARACTERISTICSOF TURBULENT FLOW IN A TUBE FITTED WITH TRAPEZOIDAL-CUT TWISTEDTAPE INSERT USING FE3O4 NANO FLUID

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Abstract :

Heat transfer and friction factor characteristics of a circular tube fitted with full length twisted tapetrapezoidal cut were studied for the Reynolds number range of 2000–12,000. The secured experimentaldata from plain tube were validated with standard correlations to make sure the authorization of experimentalresults. The thermal performance of trapezoidal cut twisted tape increase significantly than theplain tube. Performance ratio is more than unity is reasonable for trapezoidal cut twisted tape. Eventuallytwisted tape with water as the working fluid was compared with Fe3O4 Nanofluid as working fluid at avolume concentration of 0.06%.

Keywords :CFD analysisTwist ratioTrapezoidal cutAugmentationFriction factorPerformance ratio

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CFD ANALYSIS ON HEAT AND FLOW CHARACTERISTICS OF DOUBLE HELICALLY COILED TUBEHEAT EXCHANGER HANDLING MWCNT/WATER NANOFLUIDS

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Abstract :

Double helically coiled tube heat exchangers are used in different heat transfer utilization due to higher heattransfer capabilities and with their compactness. The double helically coiled tube heat exchanger increases theturbulence and enhances the maximum heat transfer rate than the straight tubes. In this investigation, the heattransfer and pressure drop of the double helically coiled heat exchanger handling MWCNT/water nanofluids havebeen analyzed by the computational software ANSYS 14.5 version. The computational analysis was carried outunder the laminar flow condition in the Dean number range of 1300–2200. The design of new shell and doublehelically coiled tube heat exchanger was done by using standard designing procedure and 3D modeling was donein Cre-O 2.0 parametric. The Finite Element Analysis software ANSYS Workbench 14.5 was used to perform CFDanalysis under the standard working condition. The MWCNT/water nanofluids at 0.2%, 0.4%, and 0.6% volumeconcentrations have been taken for this investigation. The major factors like volume concentrations of nanofluidsand Dean Number are considered for predicting the heat transfer rate and pressure drop. The simulation data wascompared with the experimental data. It is studied that the heat transfer rate and pressure drop increase withincreasing volume concentrations of MWCNT/water nanofluids. It is found that the Nusselt number of 0.6%MWCNT/water nanofluids is 30% higher than water at the Dean number value of 1400 and Pressure drop is 11%higher than water at the Dean number value of 2200. It is found that the simulation data hold good agreementwith the experimental data. The common deviation between the Nusselt number and pressure dropof CFD dataand the Nusselt number and pressure drop of experimental data are found to be 7.2% and 8.5% respectively.

Keywords : NanotechnologyComputational mathematicsVolume concentration of nanoparticle

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A CFD INVESTIGATION OF HEAT TRANSFER ENHANCEMENT OF SHELL AND TUBE HEAT EXCHANGER USING AL2O3-WATER NANOFLUID

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Abstract :

A multi pass shell and tube heat exchanger with 3 tubes modelling is done using CATIA and meshing has done using ICEM CFD software, simulations has done by using CFD-FLUENT software. Using Fluent, computational fluid dynamics software the pressure drop, heat transfer characteristics of Al2O3-water nanofluid, and Distilled water are analyzed under turbulent flow condition. Nanofluid such as Al2O3-H2O is used as cooling medium instead of Distilled water. Finally the CFD simulated results are compared with experimental results. The effects of Peclet number, volume concentration of suspended nanoparticles, and particle type on the heat transfer characteristics were investigated. Based on the results, adding of nanoparticles to the base fluid (Distilled water) causes the significant enhancement of heat transfer characteristics.

Keywords : Catia, multipass shell and tube exchanger,CFD fluent ,Al_2O_3-water nanofluid

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EXPERIMENTAL AND NUMERICAL INVESTIGATION ON AIR-SIDE PERFORMANCEOF FIN-AND-TUBE HEAT EXCHANGERS WITH VARIOUS FIN PATTERNS

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Abstract :

Air-side heat transfer and friction characteristics of five kinds of fin-and-tube heat exchangers, with thenumber of tube rows (N = 12) and the diameter of tubes (Do = 18 mm), have been experimentally investigated.The test samples consist of five types of fin configurations: crimped spiral fin, plain fin, slit fin, finwith delta-wing longitudinal vortex generators (VGs) and mixed fin with front 6-row vortex-generatorfin and rear 6-row slit fin. The heat transfer and friction factor correlations for different types of heatexchangers were obtained with the Reynolds numbers ranging from 4000 to 10000. It was found thatcrimped spiral fin provides higher heat transfer and pressure drop than the other four fins. The air-sideperformance of heat exchangers with the above five fins has been evaluated under three sets of criteriaand it was shown that the heat exchanger with mixed fin (front vortex-generator fin and rear slit fin) hasbetter performance than that with fin with delta-wing vortex generators, and the slit fin offers best heattransfer performance at high Reynolds numbers. Based on the correlations of numerical data, GeneticAlgorithm optimization was carried out, and the optimization results indicated that the increase of VGattack angle or length, or decrease of VG height may enhance the performance of vortex-generator fin.The heat transfer performances for optimized vortex-generator fin and slit fin at hand have been comparedwith numerical method.

Keywords : Fin-and-tube heat exchanger,Evaluation criteria,GA optimization

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EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER COEFFICIENT AND FRICTION FACTOROF ETHYLENE GLYCOL WATER BASED TIO2 NANOFLUID IN DOUBLE PIPE HEAT EXCHANGER WITH AND WITHOUT HELICAL COIL INSERTS

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Abstract :

Heat transfer coefficient and friction factor of TiO2 nanofluid flowing in a double pipe heat exchanger with and without helical coil inserts are studied experimentally. The experiments are conducted in the range of Reynolds number from4000 to 15,000 and in the volume concentration range from 0.0004% to 0.02%. The base fluid is prepared by considering 40% of ethylene glycol and 60% of distilled water. The heat transfer coefficient and friction factor get enhanced by 10.73% and 8.73% for 0.02% volume concentration of nanofluid when compared to base fluid flowing in a tube.Heat transfer coefficient and friction factor further get enhanced by 13.85% and 10.69% respectively for 0.02% nanofluidwhen compared to base fluid flowing in a tubewith helical coil insert of P/d = 2.5. The measured values of heat transfer coefficient and friction factor are compared with the published literature. Based on the experimental data, generalized correlations are proposed for Nusselt number and friction factor. The results are presented in graphical and tabular form. Uncertainty analysis is also carried out and the experimental error is in the range of ±10%.

Keywords : Heat transfer,Friction factor,Helical coil inserts,TiO2 nanofluid .

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THERMAL CONDUCTIVITY ENHANCEMENT OF AL2O3 NANOFLUID IN ETHYLENE GLYCOL AND WATER MIXTURE

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Abstract

The ability of nanofluids that exhibits enhanced thermal performance is acknowledged by researchers through studiessince decades ago. However, the observation of thermal properties for nanofluids in water and ethylene glycol basedis not fully explored yet. Hence, this paper presents the thermal conductivity of water and ethylene glycol (EG) basedAl2O3 nanofluid. The 13 nm sized Al2O3 nanoparticles were dispersed into three different volume ratio of water: EGsuch as 40:60, 50:50 and 60:40 using a two-step method. The measurement of thermal conductivity was performedusing KD2 Pro Thermal Properties Analyzer at working temperatures of 30 to 70 oC for volume concentration of 0.5to 2.0 %. The results indicate that the thermal conductivity increases with the increase of nanofluid concentration andtemperature. While the percentage of ethylene glycol increase, the range of thermal conductivity decreases due toethylene glycol properties. The measurement data of the nanofluids give maximum enhancement of thermalconductivity at condition 2.0 % volume concentration, temperature of 70 oC and for all base fluid.

Keywords : Nanofluid, aluminium oxide, thermal conductivity enhancement, water :EG mixture

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NUMERICAL STUDY TO PREDICT OPTIMAL CONFIGURATION OF FIN AND TUBE COMPACT HEAT EXCHANGER WITH VARIOUS TUBE SHAPES AND SPATIAL ARRANGEMENTS

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Abstract

The study aims at numerically evaluating the thermal hydraulic performance of fin tube heat exchangerswith circular, oval and flat tubes having inline and staggered arrangement. Three performance evaluationcriteria (PECs), namely, area goodness factor (PEC1), heat transfer rate per unit fan power consumption(PEC2) and heat transfer rate per unit total power consumption (PEC3) are considered. Furthermore,the MOORA (multi-objective optimization on the basis of ratio analysis) method is employed to obtainthe order of performance and that order is compared with the conventional PECs (performance evaluationcriteria), showing good agreements. From the overall optimization study finally, it has been observedthat the oval tube having highest axes ratio is the optimum configuration based on the considered PECs. Itshows an increase in heat transfer coefficient by 13.99% at lower airside Reynolds number of (Re = 400)and 4.99% at higher airside Reynolds number (Re = 900). Also, the pressure drop is reduced by 39.94% athigher Reynolds number (Re = 900) compared to the circular tube shape with the inline arrangement.

Keywords : Compact heat exchanger,Pressure drop penalty,Hydraulic performance,MOORAOptimization

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MODIFICATION OF MICROENCAPSULATED PHASE CHANGE MATERIALS(MPCMS) BY SYNTHESIZING GRAPHENE QUANTUM DOTS(GQDS) AND NANO-ALUMINUM FOR ENERGY STORAGE AND HEAT TRANSFER APPLICATIONS

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Abstract

MPCMs and their suspensions, acting as the thermal storage, heat transfer or temperature constancymediums, have gained concerns in various energy related sectors. However, problems involving highsupercooling degree, low thermal conductivity and suspensions instability are barriers for their energystorage applications. The present study focuses on such properties by adding GQDs/nano-aluminum intoMPCMs particles. Paraffin was selected as core material and ureaemelamineeformaldehyde polymer asshell to prepare 10 MPCMs samples (no modifiers, GQDs, nano-aluminum, GQDs & nano-aluminum) viain situ polymerization. The morphology, thermal conductivity, thermal property and MPCM/suspensionsstability were characterized. It was found, the selected modifiers didn't impact on the microcapsulesmorphology, but GQDs can make particle size smaller and distribution more uniform. Adversely, themean particle size can be increased by nano-aluminum. GQDs are much more effective than nanoaluminumin improving thermal conductivity. GQDs can suppress supercooling effectively, however,nano-aluminum has no obvious effect on supercooling suppression. The MPCMs suspension modified bythe selected amount of GQDs and nano-aluminum (Al-GQDs(4.5e2)) achieved a high physical stability.No structure instability of modified MPCM sample was observed. To sum up, the combined effort of GQDsand nano-aluminum enabled MPCMs to be more applicable in energy storage applications.

Keywords : Microencapsulated phase change materialGraphene quantum dotsNano-aluminum

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FUNCTIONALIZED MULTI-WALLED CARBON NANOTUBES BASED NEWTONIAN NANO FLUIDS FOR MEDIUM TEMPERATURE HEAT TRANSFER APPLICATIONS

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Abstract

Functionalized multi-walled carbon nanotubes (f-MWCNTs) were synthesized anddispersed in the organic heat transfer fluids (OHTFs) to improve the thermo-physicalproperties of the medium temperature stable Nano thermic fluids (MNTFs). The preparedMNTFs showed an enhancement in thermal conductivity especially at high temperaturescompared to the base OHTFs with addition of low quantities of f-MWCNTs. Based on therheological studies, the Newtonian behaviour of the synthesized MNTFs have beendemonstrated over a wide range of shear rates at various temperatures. The present study thusconfirms the potential of developed MNTFs with desired rheological properties, high thermaland mechanical stability, high flash point, high specific heat capacity and high thermalconductivity for medium temperature heat transfer applications.The developed MNTFsfound to exhibit high and stable dispersion even after centrifugation with a speed of 5,000rpm for 30 min.

Keywords : Functionalized MWCNTs,Nano fluids,Medium temperature heat,etc

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HEAT ENHANCEMENT OF HEAT EXCHANGER USING ALUMINIUM OXIDE(AL_2O_3), COPPER OXIDE(CUO)NANO FLUIDS WITH DIFFERENT CONCENTRATIONS

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Abstract :

Active and passive heat transfer techniques are commonly employed for heat transfer augmentation in fluids.Conventional heat transfer fluids like water, oil, and glycols have poor heat transport capabilities and they hardlymeet the present day requirements of high heat dissipation rates in compact heat exchangers. Design of Compactheat exchanger and miniaturizing of high energy devices are possible only with the fluids having better heat transfer performance.The nano fluids are considered to be new generation fluids characterized by better heat transfercapabilities over traditional heat transfer fluids. The nanofluid is an emerging area of research and has lot ofpotential in heat transfer applications. Particles of size less than 100nm exhibit properties different from those ofconventional solids. Nano materials have unique mechanical, electrical, optical, magnetic and thermalproperties.Thermo physical properties of Al_2O_3 and CuO with water as base fluid have been experimentallydetermined at different volume concentrations. Present study is aimed at estimating the heat transfer enhancementfor different Reynolds number in turbulent range at volume concentration of 0.1%, 0.25% and 0.4%.

Keywords : Heat transfer enhancement,Al_2O_3,CuO,Water,heat transfer coefficient,Thermal conductivity

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HEAT TRANSFER ANALYSIS OF A NON-NEWTONIAN FLUID FLOWING THROUGH A CIRCULAR TUBE WITH TWISTED TAPE INSERTS

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Rajiv Gandhi University of Knowledge Technologies

Abstract :

In this paper, the moment and heat transfers of a non-Newtonian fluid flowing in steadylaminar regime through a circular tube with a twisted tape at constant wall temperature is studied

using CFD. The effect of different twist ratios of the tape on the convective heat transfer and thepressure drop are investigated over the Reynolds number range of 0.2-600. It was found that atwisted tape induces a swirling flow, which increases the velocity gradient at the tube wall andconsequently generates an enhancement in heat transfer. Data reduction is applied to CFD data; andit is found a good agreement between the calculated Reynolds and Fanning friction numbers and thetheoretical relationship (f = 16/Re). A novel formulation for evaluating the thermo-hydraulicperformance was developed. The results indicate that the thermo-hydraulic performance increaseswhen the twist ratio decreases and the Reynolds number increases.

Keywords :non-Newtonian flow,circular tube with a twisted tape,heat transfer coefficient

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EXPERIMENTAL INVESTIGATION ON FORCED CONVECTIVE HEAT TRANSFER COEFFICIENT OF A NANO FLUID

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Abstract :

Nano fluids are used in broad range of engineering applications due to their improved thermo-physical properties such as thermalconductivity, thermal diffusivity, viscosity and convective heat transfer coefficient. In this paper Al2O3Nano fluid has beenprepared by using sonicator and the size of nanoparticle is 28 nm diameters. The property changes of Nano fluids depend on thevolumetric fraction of nanoparticles, shape and size of the nanomaterial. This paper presents an experimental investigation onforced convective heat transfer coefficient of a Nano fluid flowing in a single pass and multi tubes counter flow shell and tubeheat exchanger under turbulent flow condition. In this we are taking different volume concentrations (0.1%, 0.2%, 0.3% and0.4%). The results observed the heat transfer performance and characteristics of an Al203/water Nano fluid estimated.Heattransfer coefficient for forced convection is higher than the water at the same flow velocity and inlet temperatures of both hot andcold fluid conditions. The other properties of the Nano fluid such as its thermal conductivity, specific heat, density, and viscosity,tube diameter also calculated.

Keywords : Heat exchange,Al2O3Nano fluid,Forced convection.

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NUMERICAL STUDY OF NANOFLUID FLOW IN FLAT TUBES FITTED WITH MULTIPLE TWISTED TAPES

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Rajiv Gandhi University of Knowledge Technologies.

Abstract :

In this paper, while numerically simulating the Al2O3–water nanofluid flow in flat tubes fitted withtwisted tapes, the effects of three different Heat Transfer Enhancement (HTE) methods are also separatelyevaluated and compared. These three HTE mechanisms include the use of nanofluid instead of the basefluid, use of flat tubes instead of circular tubes and the use of twisted tapes inside the tubes. The obtainedresults indicate that although all the three mentioned mechanisms improve the heat transfer within thetubes, the HTE due to the use of twisted tapes is greater than that caused by the other two mechanisms.After discovering that the simultaneous use of the three mentioned mechanisms can considerablyincrease the amount of heat transfer, three different arrangements of the twisted tapes in thenanofluid-containing flat tubes are also evaluated and compared. These three arrangements includethe use of one twisted tape, use of two twisted tapes in the same direction and the use of two twistedtapes in different directions. The obtained results indicate that the use of two twisted tapes in differentdirections leads to the highest amounts of heat transfer and pressure drop in flat tubes.

Keywords : Multiple twisted tapes,NanofluidFlat tubes,Two phase model,Mixture model

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PREPARATION, CHARACTERIZATION AND HEAT TRANSFER ANALYSIS OF NANOFLUIDS USED FOR ENGINE COOLING

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Abstract :

The car radiators or any vehicle engine thermal management system is evolving since its beginning, to achieve a sustainable, energy efficient stage. In this peculiar journey, the nanofluids playing a vital role of coolants to enhance the exchange rate of heat transfer to make the radiator cooling system effective. The current article is summarized and talk over radiator cooling of engine in vehicles using nanofluids. The nanoparticles present in the nanofluids have higher thermal properties which contributes to higher heat transport. The article opens with the introduction of the nanofluids, coolants and a summarized evolving history of a car radiator. The next sections include the overview of synthesis and characterization of nanofluids based on engine coolant followed by the heat transfer analysis. Effects on the thermophysical property (Thermal conductivity and Viscosity) of fundamental parameters which can be avoidable while selecting parameters are discreetly discussed. The fundamental of convective heat transfer and the mechanism behind the change in convective heat transfer is discussed with non-dimensional numbers. A number of suggestion and guidelines are reported for the better performance and results with nanofluids. The article provides an essential assessment of the nanofluids in the radiator cooling and the paper also provide a detail guideline for the development of amicable future of nanofluids in the heat transfer application.

Keywords : NanofluidsCar radiatorEngine coolingCoolant etc

NUMERICAL INVESTIGATIONS FOR THE OPTIMIZATION OF SERRATED FINNED-TUBE HEAT EXCHANGERS

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Abstract

Helical serrated finned-tubes are well established in many thermal systems. This paper presents theresults of numerical calculations carried out for the performance improvement of these devices. Thework is divided into three main investigations conducted for Reynolds numbers upto 2600. The first investigation shows the effect of the fin serration, where a comparison betweenperformances of finned tubes with and without fin serration is presented. Another main investigation isconducted on the effect of fin twisting of the outermost part of the fin on the performance of the serratedfinned-tubes. Here, twisting angles considered are between 0 to 25 degrees. The third investigation dealswith the effect of the number of fin segments per period.

Keywords : Heat exchangers,Heat transfer enhancement,Serrated finned-tubes etc

PERFORMANCE OF TRANSMISSION LOSS ON HYBRID MUFFLER BY USING ROCK WOOL AND GLASS FIBER AS A ABSORBING MATERIALS

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Abstract

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Muffler is categorized in two broad manners as absorptive muffler and reactive muffler. A Muffler (silencer) is an important noise control element for reduction of machinery exhaust noise, fan noise, and other noise sources involving the flow of gases. Reactive mufflers which reduce noise by reflecting sound energy back to its source, and absorption mufflers, which absorb sound due to the energy dissipated in the sound-absorbing material. The attenuation levels of these types of muffler are dependent on the frequency of the noise source. Investigations on absorption mufflers have indicated that these have fairly good noise attenuation over a relatively wide frequency band. The combination of both reactive and absorptive muffler is termed as hybrid muffler. Hybrid muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Experimental Two load setup and Wave 1-D is used to predict the transmission loss of hybrid muffler. Hybrid muffler generally includes the number of perforated tubes, number of perforated baffles with absorptive materials like asbestos, rock wool, bensoil, powertex & advantex etc. Transmission loss measurement using hybrid muffler is discussed in this paper. Various sound absorption materials that are currently used for noise reduction are used. This paper shows the acoustic performance of packed dissipative muffler with the variation in packing density of absorptive material. Here easy available absorptive materials glass fiber & rock wool is used with same space. This study is performed by taking four designs to observe the transmission loss performance by applying different absorptive materials with different packing density.

Keywords: Transmission Loss (TL), Hybrid Muffler, Sound Absorptive Materials, Two Load Method, Wave 1-D.

EFFECT OF CHANGE IN DIAMETER ON MUFFLER TRANSMISSION LOSS USING COMSOL

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Abstract

Muffler analysis is always challenging task due to complex design, shape and size limitation for specific application. In this paper the inlet diameter of muffler is varied for comparison. Two finite element methods (FEM) Results are compared using COMSOL 5.0 software. Two different muffler configurations are considered, representing the effects of adding absorptive lining and without absorptive lining to increase the transmission loss (TL), from computational analysis it is observed that for 40 mm inlet transmission loss is more compared with 30 mm inlet diameter.

Keywords – Transmission loss (TL), Acoustic liners.

Design, Assessment and Optimization of Automotive Muffler.

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ABSTRACT

Mufflers are important part of engine system and commonly used in exhaust system to minimize sound transmissions caused by exhaust gases. Design of mufflers is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Therefore muffler design becomes more and more important for noise reduction. The objective of the paper is to propose a design of simple reactive muffler for effective sound attenuation and for getting highest transmission losses. The paper contains two optimization problem to get optimize model which can further optimize by using Taguchi method. The problem were built and analysed by using 'COMSOL MULTIPHYSICS' in pressure acoustic analysis domain for getting Maximum Transmission Losses and minimum Sound Pressure Level (SPL). First optimization problem contain muffler in which perforation diameter and pipe diameter are varied which again optimizes by eliminating perforation and by varying pipe lengths in second optimization problem. Among the best problem is further optimized by using Taguchi method.The effect of SPL on the walls of the muffler is not considered. The material of the muffler is also not considered. This optimized model of elliptical muffler is manufacture and then validate with the experimental analysis.

KEYWORDS: Transmission Losses, Sound Pressure Level, Acoustic, Optimization.

Investigation of Exhaust System- 'Semi Active Muffler'

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Department of mechanical engineering
Vignan foundation for science and technology
(Deemed to be university)

ABSTRACT

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Main drawback of I.C. engines working is that it is a major source of noise pollution. That is why the reduction of exhaust noise generated from engine is in today's world an important issue. Attaching a muffler in the exhaust pipe is the good option for reducing noise. But muffler requires specific design and construction considering various noise parameters produced by the engine. Since early development of mufflers, the main objective of design was attenuation of sound in regular mufflers. Which causes a great amount of back pressure at the exhaust port thus losing power,increasing fuel consumption and piston effort to exhale the gases out. For high performance engines the free flow exhaust is made in which the sound level is not important but zero or less back pressure is. There is no intermediate muffler type in between both these, so semi active muffler is an step between these two, in which it attenuates sound when engine is running at low rpm , and converts in free flow when engine at higher revs.

KEYWORDS: CFR-cylinder firing ratio, EFR-engine firing ratio, Semi active muffler, Vm-volume of muffler.

INVESTIGATION OF FLOW FIELD AND PRESSURE LOSS FOR FORK TRUCK MUFFLER BASED ON THE FINITE VOLUME METHOD

Loknath, Sumit kumar and Hujare

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ABSTRACT

Having the premise of the certain acoustic performance, a muffler should make the pressure loss as small as possible. A simulation model of a fork truck muffler with a complex structure is established. Based on the finite volume method, multidimensional numerical simulation regarding velocity field and pressure field of steady flows for a muffler is performed using CFD (computational fluid dynamic method). Flow characteristics and pressure distribution of the muffler are analyzed. It is found that the vortex inside the muffler creates a great pressure loss. With the increases of inlet gas flow rate , the pressure loss of the muffler increases gradually. The internal structure of the muffler is redesigned for obtaining the optimized structure on the basis of analysis. The influences of the inner tube length on the flow and pressure loss of muffler are researched. The study will provide a theoretical basis for designing a complex muffler.

Keywords: Complex muffler, Velocity field, Pressure field, Structure improvement.

STUDY OF MULTI-CHAMBER MICRO-PERFORATED MUFFLFLER WITH ADJUSTABLETRANSMISSION LOSS

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Abstract:

The noise behavior of the blower used on fuel cell vehicles is measured and analyzed. According to the noise behaviors, the multi-chamber micro-perforated muffler with adjustable transmission loss is proposed for silencing. The adjustment is achieved by the change of the third chamber length. The relation model between the chamber length and the muffler resonant frequency is fitted. In addition, the muffler sample is manufactured for experiment. According to the study, the blower noise contains the wide band noise with frequency range of 500–1000 Hz and the narrow band harmonics with frequency range of 2000–3500 Hz. The experimental results show that the proposed muffler is effective and efficient to attenuate the low-medium frequency wide band noise and the narrow band harmonics simultaneously.

Keywords: Blower noise,Micro-perforated muffler ,Adjustable transmission loss ,Resonant frequency.

COMPARISON OF VARIOUS ALGORITHMS FOR IMPROVING ACOUSTIC ATTENUATION PERFORMANCE AND FLOW CHARACTERISTIC OF REACTIVE MUFFLERS

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Abstract

The parametric optimization of the reactive mufflers is researched by numerical analysis, regarding the performance of the acoustic and flow fields synthetically. The finite element

method, based on the Helmholtz equation and the Navier–Stokes equation respectively, is utilized in the analysis of the acoustic and flow fields. And the initial and boundary conditions are set up in the physical fields respectively. The weighting multi-objective function about acoustic and flow fields is formulated. In addition, the optimization results of multidisciplinary, obtained by the Nelder Mead algorithm (NMA) based on the sensitivity analysis, the Monte Carlo algorithm (MCA) and Genetic Algorithm (GA) based on the random sampling, are analyzed comparatively. The optimization results indicate that the NMA can maximize the transmission loss (TL) and minimize the pressure drop with the given weight factor. Finally, numerical optimization examples confirm the validity and reliability of the proposed optimization method in the acoustic-flow field.

Keywords: Transmission loss, Pressure drop, Reactive muffler, Multidisciplinary optimization

TOPOLOGY OPTIMIZATION OF A SUCTION MUFFLER IN A FLUID MACHINETO MAXIMIZE ENERGY EFFICIENCY AND MINIMIZE BROADBAND NOISE

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Abstract

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A suction muffler used in a fluid machine has three functions: noise reduction; minimizing pressure drop and improving energy efficiency using acoustic effects. However, no method of suction muffler design considers all three of these functions concurrently. Therefore, in this study, we attempt to provide an integrated design method of a suction muffler in a fluid machine that considers all three functions. The topology optimization method for acoustic and fluid systems was applied to an integrated design. However, the interaction between fluid and acoustic was not considered. In addition, the acoustic input impedance of a suction muffler was used for a specific acoustical resonance frequency to improve the energy efficiency of a fluid machine. Finally, the sequential optimization method based on physical investigations was proposed to satisfy several design criteria. The proposed method was applied to the suction muffler in refrigerator's compressor.

Keywords: Transmission Loss, Back Pressure, Compressor, Insertion Loss, Muffler.

FINITE ELEMENT ANALYSIS OF AN INDUSTRIAL REACTIVE SILENCER

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Abstract

Classical analytical models used for prediction of the performance of reactive silencers are limited to conditions where the dimensions of the duct and resonators are small compared to the wavelength of the sound. Finite Element Analysis does not suffer from such limitations and has therefore been used to analyse the design of a reactive silencer for the exhaust stack of a 980MW power station. To assist in the design process, resonators of various dimensions were analysed using FEA which has led to the derivation of expressions for the resonance frequencies of slot-type rhomboid shaped resonators as a function of the geometry. An important design issue is the influence that adjacent resonators have on the overall performance of the system. It was found that when resonators of similar resonance frequency are in close proximity, they can interact and lead to a decrease in the overall performance compared to that of a single resonator.

Keywords: Resonator, Silencer, Reactive Muffler, Transmission Loss.

LOW ANALYSIS OF REACTIVE MUFFLER USING CFD

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Abstract

Muffler design is traditionally a trial and error process. This paper describes the flow analysis of a reactive muffler using CFD simulation in order to improve its performance by reducing the back pressure created on the engine. The back pressure of the muffler is computed from CFD simulation. The CFD analysis is done to avoid the tedious experimentation. The flow simulation

is carried out using k-ε turbulent model as it is most suitable for turbulent flows having less converging time. Total four cases were analyzed including the base model muffler. Thus three modifications were done in muffler geometry. The modification with reduced baffle spacing produced least back pressure with reduction in back pressure by 8.59%.

Keywords: Back Pressure, Hybrid Muffler, Transmission Loss.

STRUCTURAL ANALYSIS FOR EXHAUST GAS FLOW THROUGH AN ELLIPTICAL CHAMBER MUFFLER UNDER STATIC AND DYNAMIC LOADING CONDITION

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Abstract

High pressure and temperature exhaust gases coming out from automobile engine are made to pass through muffler for reduction of sound resulting from propagation of these pressure waves. The mufflers may be of reactive, dissipative and resonating type. The present paper deals with an automotive muffler that is modeled based on practical dimensions of a 4-stroke 2-cylinder

MAHINDRA MAXIMO PLUS C.I. engine in CATIA V5software. The geometry adopted is elliptical in nature. Comparative static structural analysis for stress, strain and deformation along with modal analysis for deformation under dynamic loading has been performed for perforated and non-perforated design of the muffler using ANSYS Workbench 14.5. The effect of incorporation of perforation is studied on the corresponding static and dynamic behavior of the muffler.

Keywords:automotive muffler, dynamic loading, modal analysis, static loading, structural analysis.

DESIGN AND ANALYSIS OF PERFORATED MUFFLER IN AUTOMOBILE

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Abstract

A muffler is a device for reducing the amount of noise emitted by an automobile. To reduce the noise, the engine drain is connected via output pipe to silencer called muffler. The muffler

makes a major contribution to reduce the noise. Mufflers are connected to the exhaust pipe of internal combustion engine to suppress the acoustic flow of the engine in combustion process. Mufflers form an integral part of automobile. Mufflers are designed to increase the back pressure so as to reduce the noise level. In this study, attempt has been made to improve the design of muffler for reducing noise. The design of a muffler is to reduce the noise, for that an existed automobile muffler has modified and compared with the arrangement of plates inside the muffler where the noise emitted by the muffler gets changed and to improve the acoustic efficiency of the modified design. Modelling has performed by using CATIA V5.Analysis has to be performed in ANSYS Fluid Flow (Fluent)simulation, can be used to analyse the acoustic power level flow in the muffler, Pressure developed while air flows through the muffler, Velocity of air inside the muffler, Strain rate of the Muffler. By varying the muffler design parameters the flow will be analysed.

Keywords: Muffler, Catia modelling, Acoustic Power level, Back Pressure.

REVIEW PAPER ON DESIGN AND DEVELOPMENT OF MUFFLER TO OPTIMIZE TRANSMISSION LOSSES

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Abstract

New regulations and standards for noise reductions and emission compel the automobile industries to make some improvements in the design of silencer for attaining desired noise reduction. In this project, modifications are desired in the silencer design of upcoming Eicher tractor to fulfill the current standards. The current noise level at Operator Ear Level (OEL) is 97dB (decibels), it is desired to reduce it to 94 dB and below. Also the maximum backpressure

of 50 mm of Hg is to be maintained. New design should be analyzed with respect to both acoustics and back pressure. As per the various studies reactive mufflers with extended inlet and outlet pipes into muffler, which is not present in current design can significantly reduce the noise level. Helmholtz resonator can also be introduced to cancel the noise of dominating frequencies. Also a sound absorbing material like glass fibers and steel wool can be incorporated for better results. Further, the design modifications are to be verified for noise reduction by COMSOL Multi-physics software. Also the numerical results for transmission loss will be verified with experimentally measured results.

Keywords: Operator Ear Level (OEL), backpressure, mufflers, COMSOL Multiphysics, transmission loss

CFD FLOW ANALYSIS AND OPTIMIZATION OF EXHAUST MUFFLER

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ABSTRACT

Silencer is an integral part of the exhaust system. The silencer serves the function of noise and vibration reduction. The exhaust gases in the combustion chamber which are at temperatures of around 1200K are released to the atmosphere at around 323K. Temperature reduction takes place efficiently as the flue gases flow through the exhaust system. In this study, flow analysis is carried out on various geometries and the geometries are checked for the pressure drop and temperature drop based on which the optimum geometry having minimum pressure drop and maximum temperature drop across the flow is selected and considered suitable. The entire flow analysis is done using ANSYS Fluent 18.0. Various Geometry combinations are used

considering the minimum pressure drop. These geometries are analysed for flow considering Standard Air, Air as Ideal gas and Real gas as the fluid material for each of the geometries. For all the load cases the geometry which is having minimum pressure drop and maximum temperature drop is considered suitable for structural analysis.

Keywords: Silencer, CFD, Fluent,ANSYS, Flow.

OPTIMAL TOPOLOGY OF REACTIVE MUFFLER ACHIEVING TARGET TRANSMISSION LOSS VALUES: DESIGN AND EXPERIMENT

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Abstract

A topology-optimization-based muffler design method for a reactive muffler is proposed and experimentally validated. In a reactive muffler design problem, rigid partitions should be located optimally inside the muffler to improve its acoustical attenuation performance in the target frequency range. In an optimal-performance muffler, the partition volume should be made as small as possible, and the transmission loss value in the target frequency range should be high enough for flow noise reduction in a duct. To this end, a partition-volume-minimization problem achieving target transmission loss values is formulated by using acoustical topology optimization. The formulated muffler design problem is solved for several target frequencies, and the effect of the initial values of the design variables on the optimal topology is

investigated. Numerical simulation results show that the proposed formulation requires a smaller volume of partition than the previous topology-optimization-based formulation. The calculated transmission loss curves of the optimal mufflers agree well with the measured transmission loss curves of mufflers made of acrylic.

Keywords:Muffler design Optimal muffler Topology optimization Transmission loss Finite element method

OPTIMAL PARTITION LAYOUT OF EXPANSION CHAMBER MUFFLER WITH OFFSET INLET/OUTLET

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Abstract

An optimal partition layout inside an expansion chamber muffler with an offset inlet/outlet is systematically designed by using topology optimization to achieve the desired characteristics in terms of acoustics and fluid mechanics. To that end, a partition volume minimization problem is formulated by applying acoustical and flow topology optimization methods. The partition volume is set as an objective function with constraints imposed on the target values of the transmission loss and pressure drop. The finite element method is employed for the acoustical and flow analyses. A design variable is assigned to each finite element such that it changes continuously between 0 and 1 to determine the state of the associated finite element. The design variables are updated during the optimization process and parameterized to converge to 0 or 1 at the end of the process. Finite elements with design variables of 1 build up rigid partitions which are optimally placed to achieve the target values of transmission loss and pressure drop.

Different optimal partition layouts are obtained depending on the target frequency, the target values of transmission loss and pressure drop, and the initial values of the design variables. An experiment-based validation strongly supports the validity of the proposed muffler design method.

KEYWORDS: Muffler design, Topology optimization, Transmission loss, Pressure drop

DESIGN AND ANALYSIS OF MUFFLER TO REDUCE THE BACK PRESSURE

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Abstract

The function of an exhaust muffler is to make the smooth path for flue gases emitted from the exhaust manifold while reduces the clam our build by the engine. Due to the twists and turns that the exhaust gas has to make to reach the atmosphere, there is a considerable amount of backpressure which restricts the free flow of the exhaust gases. It is necessary to reduce the backpressure as it reduces the fuel consumption of the engine. The major concern for a designer is to ensure that the backpressure is minimum. This project deals with four different models of chambered exhaust muffler and concludes the best possible design for least pressure drop. SolidWorks 2014 version was used to design the exhaust mufflers. Numerical analysis for backpressure testing was conducted by Flow Simulation of SolidWorks 2014. Heat balance test on single cylinder diesel engine was performed to know the mass flow rate of the exhaust gases. Flow trajectories are viewed to know the flow of exhaust gases through the muffler. The cut

plots for pressure and exhaust gas velocity are viewed. Pressure drop is calculated across the exhaust muffler by viewing the pressure distribution.

Keywords - *Back pressure, CFD analysis, Diesel engine, Muffler.*

PREDICTION OF COMPRESSOR MUFFLER FREQUENCY RESPONSE FUNCTION USING CFD

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Abstract

The acoustic filters of hermetic reciprocating compressors, also called mufflers, are usually developed through acoustic simulation solving the discretized wave equation to obtain the Frequency Response Function, which translates the acoustic response of the muffler. Nonlinear effects are neglected in this approach, which are attributed to flow patterns, as turbulence phenomena, which occur in the contractions, expansions and changing directions within the geometry. The main aim of this work is to investigate the influence of non-linear effects in the acoustic response of mufflers, solving the flow field by computational fluid dynamics (CFD). A discharge acoustic filter design was simplified for the study purpose and simulated using both CFD and Linear Acoustic techniques; the difference in the two approaches is made by comparing the Frequency Response Function (FRF). The flow effects are analyzed varying the compressor piston displacement and operating conditions. FRF predicted by CFD presents reasonable agreement with acoustics approach for lower frequencies identifying resonances and

anti-resonances. It was observed increased disagreement for higher mass flow rates due to the predominance of flow effects over acoustics vibrations modes.

Keywords: Resonance, CFD, Acoustic, Mufflers, Transmission loss.

TOPOLOGY OPTIMIZATION OF REACTIVE ACOUSTIC MUFFLERS USING A BI-DIRECTIONAL EVOLUTIONARY OPTIMIZATION METHOD

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Abstract

This article proposes an acoustic muffler design procedure based on finite element models and a Bi-directional Evolutionary Acoustic Topology Optimization. The main goal is to find the best configuration of barriers inside acoustic mufflers used in the automotive industry that reduces sound pressure level in the outlet of the muffler. The acoustic medium is governed by Helmholtz equation and rigid wall boundary conditions are introduced to represent acoustic barriers. The continuum problem is written in the frequency domain and it is discretized using the finite element method. The adopted objective function is Transmission Loss (TL). Increasing TL guarantees that the sound pressure level ratio between outlet and inlet of the muffler is reduced. To find the configuration of acoustic barriers that increases the Transmission Loss function of the muffler an adaptation of the Bi-directional Evolutionary Structural Optimization (BESO) method is used. Applying the proposed design procedure topologies in 2D models are reached, which raises the Transmission Loss function for one or multiple frequencies. Three examples are presented to show the efficiency of the proposed procedure.

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Keywords: Transmission lossBESO Acoustics Topology optimization Mufflers

DESIGN AND ANALYSIS OF MUFFLER FOR TWOWHEELER

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Abstract

Noise from automobiles is one of the components for noise pollution to environment. Exhaust noise is one of the main source of vehicle and exhaust systems are developed to attenuate noise meeting required levels and sound quality emissions based on environment norms. Muffler is important part of engine system and commonly used in exhaust system to minimize sound transmission caused by exhaust gases. So to deal with this problem, muffler should be modified. But again there is one problem that is selection of type of muffler either reactive or absorptive. Absorptive muffler has more weight than reactive type as it is consisted of wound material over perforated pipes. So in this study reactive type muffler is modified for 110 cm3 four stroke engine of two wheelers. But maximum noise reduction affect back pressure of engine. Also pressure drop is one of the parameter which influences back pressure of engine as minimum pressure drop indicates minimum back pressure. Depending on space availability for muffler on vehicle body, external dimensions of new muffler are kept same as that of existing one. In this paper, a muffler is analyzed for varying porosity of pipes and it's effect on pressure drop by simulation.

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Keyword : - Acoustic Analysis, Back pressure, Muffler, Noise Reduction, Transmission Loss.

DESIGN AND ANALYSIS OF AUTOMOTIVE MUFFLER

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Abstract

Noise pollution is a very crucial problem for today's life, so to reduce noise level sound proofing is necessary. Muffler is a very important part of the vehicle exhaust system to reduce the noise produced by engine combustible products when passing through the exhaust system. To achieve maximum noise reduction with the minimum pressure drop is very difficult. A conventional muffler of Maruti-Suzuki WagonR is taken as reference and depending upon parameters new muffler is designed and modelled in software and analysis will be done numerical codes. Analysis ease the design parameters to be change, so that an appropriate design can be generate and maximum amount of noise reduction and pressure drop takes place with minimum back pressure. Comparison of conventional muffler and proposed designed muffler is based on amount of noise reduction, pressure drop and muffler life. In experimental setup pressure drop calculated by the water manometer tube and sound intensity measured by Sound Level Meter (SLM) device.

Keywords: Pressure Drop; Back Pressure; Noise Reduction; Water Tube Manometer; Sound Level Meter(SLM)