International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

COPY RIGHT

ELSEVIER SSRN

IJIEMR Transactions, online available on 6th Nov 2022. Link
:http://www.ijiemr.org/downloads.php?vol=Volume-11&issue=Issue 11

DOI: 10.48047/IJIEMR/V11/ISSUE 11/03

Title ELECTIC DRIVE TECHNOLOGY IN ELECTRIC VEHICLES

Volume 11, ISSUE 10, Pages: 15-23

Paper Authors
Jarjana Murali Krishna , Jallepalli Prasanth

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

ELECTIC DRIVE TECHNOLOGY IN ELECTRIC VEHICLES

Jarjana Murali Krishna* ,Jallepalli Prasanth*

GMR Institute of technology

Rajam, Vizianagaram, AndhraPradesh, India

ABSTRACT:

The combustion of fossil fuels produces hazardous emissions and greenhouse gases (GHGs) The principal reason of rapid environmental change is GHG emissions. The United States Energy Department (DOE) has declared training and professional for light-duty electric cars in cooperation with the automotive sector. Electric Automobiles (EVs) have been proposed as a substitute for automobiles. powered by internal combustion engines. The electric vehicle has nil carbon pollution, a substantially lower cost, and increased safety. Some challenges for electric vehicles include cost, reliability, battery life, and thus the life of the electric vehicle, the number of charging stations for batteries, fast charging stations for batteries, and so on. Public transportation systems, self-driven two-wheelers, three-wheelers, four-wheelers, hybrid electric vehicle (HEV) technology, and other opportunities exist for electric vehicles. This paper discusses the various drives used in EVs and HEVs. Depending on the power supply, either an OC or an AC drive is used. The most common are three phase permanent magnet synchronous motors (PMSM) are used. Induction motors with three phases (IM), as well as Motors with switched reluctance (SRM), and brushless OC motors are also popular drives (BLDC). These motors are powered by various OC-OC converters are the examples of power electronic converters.

Keywords: *Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Permanent Magnet Synchronous Motors (PMSM), Induction Motors (IM), and Switched Reluctance Motors (SRM) ,Brushless DC Motors(BLDC),Power Electronic Converters, PMSM Drive with Single Source, PMSM Drive With Two Source.*

INTRODUCTION:

Hybrid and battery-powered autonomous motors (EV/HEV) are viable alternatives. for reducing pollution and conserving fossil fuels in order to provide a safe environment and long-term transportation. Drivetrain structure, transmitting category, electronic power converters, and storage

systems for energy are all important considerations. and all part of the hardware optimization. To meet To meet the EV requirements, the vehicle drivetrain should have high starting torque maximum speed, high power at higher velocities, and a broad speed control range. The shift to electric road transportation technologies necessitates enhanced performance and capabilities from electric traction drive systems. Multilevel inverters is a technology that allows for the creation of more environmentally friendly vehicles.[3] as well as the implementation of advanced electrical architectures to meet increased electric load demands. WBG semiconductor-based drives' recent evolution, with their high-temperature and high-frequency process capabilities, is a catalyst for increasing traction machine operating speed. The increased electrification and transformation of mobility are driving higher demand for more powerful and electrical drive systems that are efficient, likely to result in a higher fuel efficiency for a given charge cycle.[1] Electric vehicles are Plug-in hybrid cars (PEV) and hybrid cars (HEV) are the two types.

I. ELECTRIC VEHICLE TYPES

Electric vehicles are classified according to their powertrain; for example, electric dive is a key component of both PEV and HEV .

1. Plug in Electric vehicle (PEV):

The most fundamental design is a plug-in electric vehicle, consisting of a battery, converter, motor, and gear system. AA power supply is used to store electricity, which is then transformed to direct current or alternating current based on the road going used to power the automobile. The motor could be an asynchronous motor, such as an induction machine, a direct current motor, or a brushless direct current motor, or a high-efficiency synchronous motor, such as a synchronous permanent magnet motor. An electric vehicle is a zero-emission vehicle that is environmentally friendly. Because these PEVs' batteries discharge faster, they are not used on a large scale because they cannot travel long distances.[1]

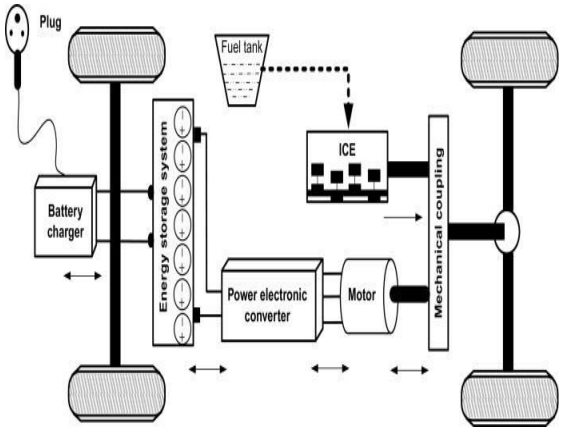

Fig.1 Plugin Electric Vehicle

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

1. Hybrid Electric Vehicle (HEV):

A engine with an electric motor is one that has an electrical motor and an extra energy source, such as an internal-combustion engine or another electrical generator to power it with a different energy source. Hybrid electric vehicles are powered by both electric and other energy systems. engines promise to reduce while preserving vehicle performance and performance, emission levels and fuel consumption. Major automakers have already begun mass production of hybrid electric vehicles. Because of their excellent gas mileage and low emissions, these vehicles are becoming increasingly popular among consumers.[1]

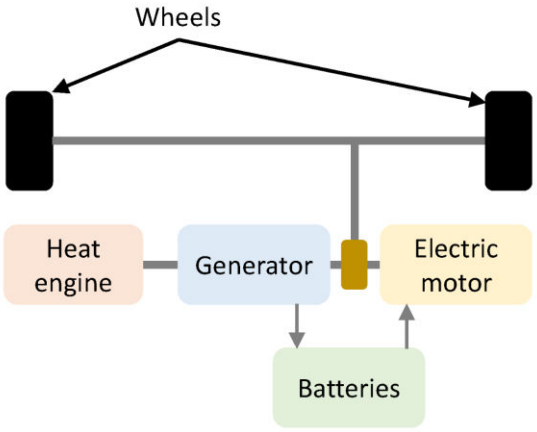

Fig.2 Hybrid Electric vehicle

The HEVs are further categorized according to the role that electric drive plays in the vehicle.

1) Series Hybrid Electric vehicles
2) Parallel Hybrid Electric Vehicles
3) Dual Mode Hybrid EV (Series-Parallel mode):

- Series Hybrid EV:

In a series HEV layout, only the motor is linked to the drive train, so the vehicle is driven entirely by the electric motor. The IC engine drives an electric generator, which provides power to the vehicle and charger pack.[1]

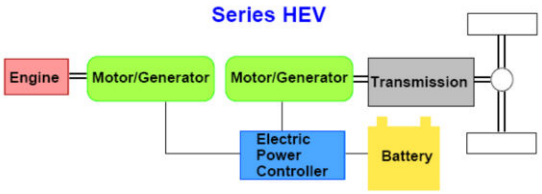

Fig.3 Block Diagram of Series HEV

- Parallel Hybrid EV:

In the parallel HEV configuration, the drive train has two energy paths, one from the machine and one from the electric engine. Short trips can be powered by the electric motor .The vehicle can be powered by the IC engine over long distances. As a result, the vehicle can operate in one of three modes: only the engine, or a mixture

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

of the two. An electric motor can also improve engine performance when climbing hills or accelerating a vehicle.[1]

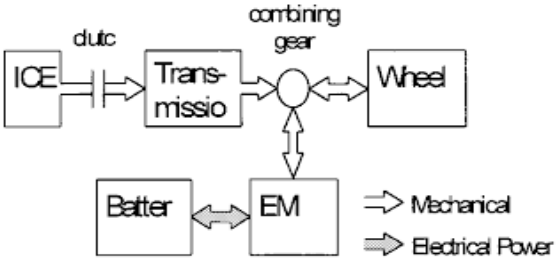

Fig.4 Block Diagram of Parallel HEV

- Dual mode HEV (Series-Parallel mode):

Dual operating modes Parallel hybrids and hybrid vehicles are not the same thing. charging the battery in the manner in which The IC engine is powered by an alternator (generator) ,The IC engine turns both during normal operation. The electronic control unit controls the powertrain and generator, which power the battery pack The electric motor is powered by the battery and aids the IC engine in reaching the desired speed during full-throttle acceleration. Using a Full-Size Electric Motor that only charges the battery and turns the wheels on occasion Because of the dual capability of this configuration, it is identified as a dual mode HEV configuration.[1]

I. ELECTRONIC VEHICLE MOTORS:

- Permanent Magnet Synchronous Motor (PMSM)
- Induction Motor (IM)
- Switched Reluctance Motor (SRM)
- Brushless DC Motor (BLDC)

Smaller automobiles Brushless dc motor (BLDC) of 60kW or alternating current (AC) motor of 27kW (IM). DC power supply for small and medium-sized vehicles A 28kW motor with a torque of 180Nm or a 40kW AC motor can be used, but a HEV with an AC motor capable of 180kW at 500Hz is required for city buses. In a small vehicle, such as a car, a PMSM motor with a power rating of 65 kW is used.[4]

i. PERMANENTMAGNET SYNCHRONOUS MOTOR:

A permanent magnetic synchronous machine (PMSM) is a cross between an induction machine and a BLDC motor with a higher density of power than an induction motor. Because of their advantages, permanent motor drives are a plausible approach in electrical drives.[5]

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

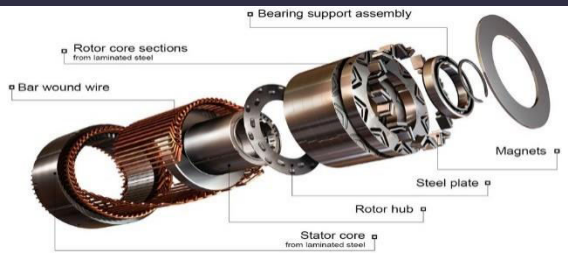

Fig.5 Permanent Magnet Synchronous Motor

ii. INDUCTION MOTOR :

An induction motor, also known as an asynchronous machine, is a type of pulsating dc (AC) electric motor in which the rotor's electric charge is obtained from the magnetic field of the stator winding via electro magnetic induction. As a result, an induction machine without any electrical wiring to the rotor can be built. An induction motor's rotor can be wound or squirrel-cage.[6]

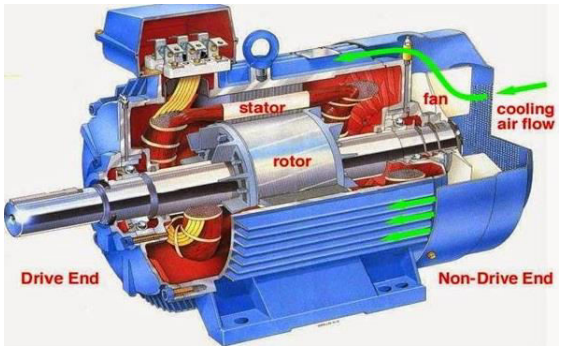

Fig.6 Induction Motor

iii. SWITCHED RELUCTANCE MOTOR:

SRM (switched reluctance motor) electric motors use reluctance torque to operate Unlike conventional brushed DC motors, power can be directed to windings within the stator rather than the rotor.. This motor is also known as VRM (Variable Reluctance Motor).[5]

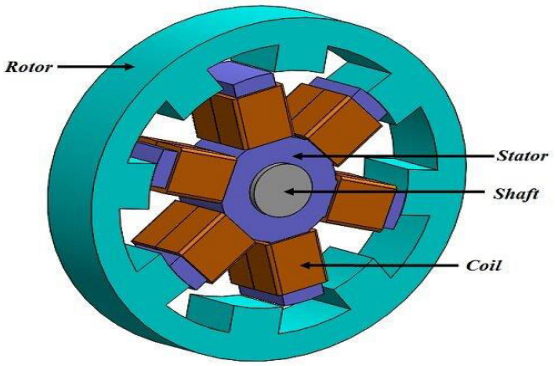

Fig.7 Switched Reluctance Motor

iv. BRUSHLESS DC MOTOR(BLDC):

Brushless direct current electric motors (BLDC) are electric motors that are powered by a direct current voltage source and commutated electronically rather than using brushes as in conventional DC motors.[5]

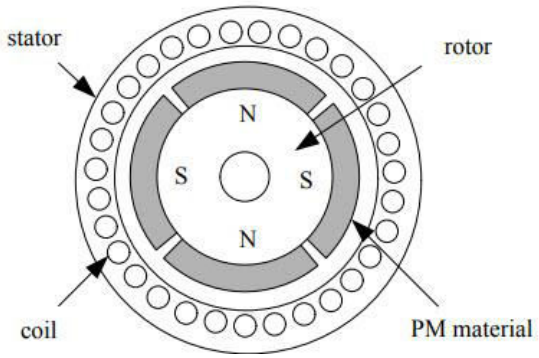

Fig.8 Brushless DC Motor

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

Power converters in EV's:

The key converters in EVs and HEVs are used to power the motor and can also charge the batteries. The batteries will charge while the vehicle is stationary.[4]

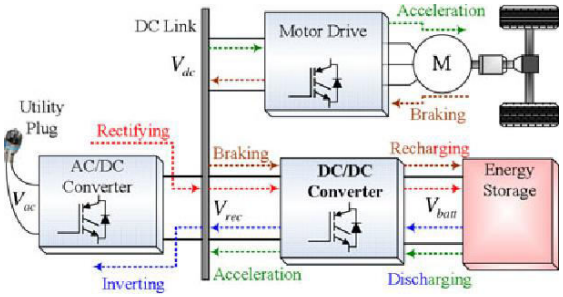

Fig.9 Power Electronic Interface In Electric vehicles

To power the motors in EVs and HEVs, three types of main circuits are used,

Direct Current Drive: The basic DC-DC converter with boost circuit is used in an EV or HEV with a DC drive to Increase the voltage level to the DC motor voltage.[4]

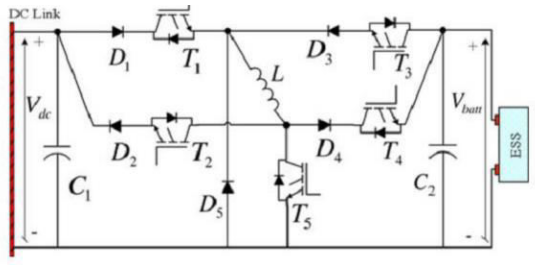

Fig.10 Universal DC-DC Converter

This global dc-dc converter can be used as a power converter when energy is going to flow from the power supply to the dc link and vice versa. Power is transferred from the dc link to the battery, it can be used similarly to a buck converter.[4]

AC Drive: The dual inverter drive is the latest recent developed technology, which depicts the PMSM with two inverters. It depicts dual inverter technology using a single voltage source.[4]

Table.1 Universal DC-DC converter states of operation

Direction	Mode	T1	T2	T3	T4	T5
$V_{dc-V_{batt}}$	BOOST	ON	OFF	OFF	ON	PWM
$V_{dc-V_{batt}}$	BUCK	PWM	OFF	OFF	ON	OFF
$V_{batt-V_{dc}}$	BOOST	OFF	ON	ON	OFF	PWM
$V_{batt-V_{dc}}$	BUCK	OFF	ON	PWM	OFF	OFF

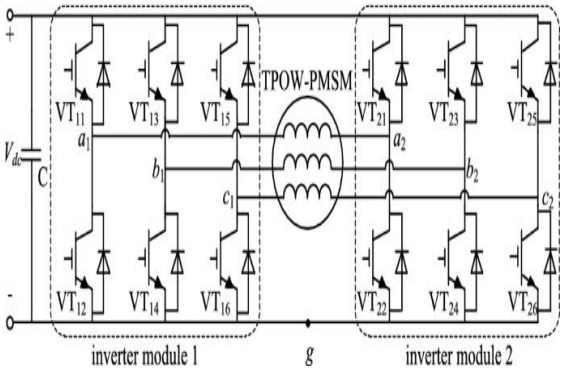

Fig.11 Drive a double inverter permanent magnet synchronous motor (PMSM) from a single source.

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

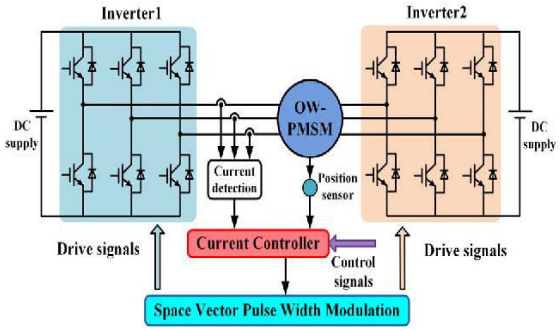

Fig. Permanent magnet synchronous motor (PMSM) dual inverter drive with two sources

If additional AC drives are A innovative Bidirectional Piled Matrix inverter that can be used for both PMSM and IM will be developed.[2]

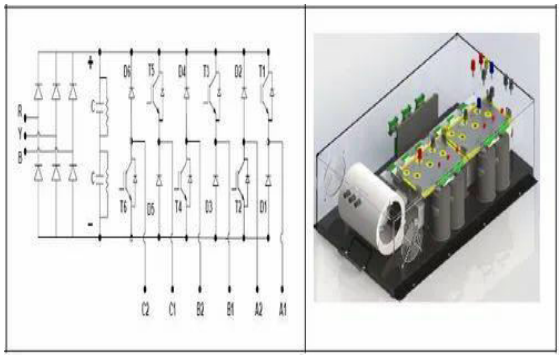

Fig.13 Stacked Matrix Inverter

The following is a block diagram of the newly developed fuel cell HEV.

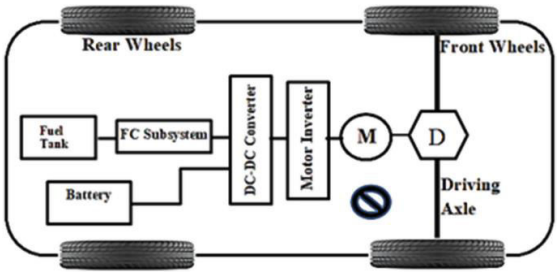

Fig.14 Power flow in AC Drive HEV

The installation of a variable DC-DC converter in a HEV It is suitable for use in HEVs that can operate either in the parallel or series mode. The diagram shows the bi - directional power dc / dc converter framework that is used to monitor and control the motor driver so that it can run in parallel or in series as a HEV.[2]

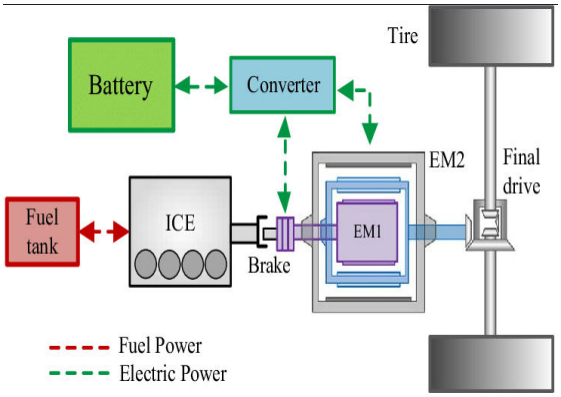

Fig.15 Power Train of HEV

CONCLUSION:

Numerous advanced inventions are being evaluated and implemented to improve EV and HEV efficiency. In this paper, we investigated and compared various motor derives used in EV and HEV, as well as the numerous advantages of PMSM is preferred over the other IM and SRM. The PMSM is currently a good EV and HEV solution, but it can be improved by developing a new inductive load with slightly increased torque and efficiency. A

deep bar rotor induction machine is used instead, powered by a simple PWM inverter could be used. Consideration should be given to efficient power conversion, energy conservation, and effective battery management systems.

REFERENCES:

1. M. Lulhe and T. N. Date, "A technology review paper for drives used in electrical vehicle (EV) & hybrid electrical vehicles (HEV)," 2015 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), 2015, pp. 632-636, doi: 10.1109/ICCICCT.2015.7475355.
2. C. H. T. Lee, W. Hua, T. Long, C. Jiang and L. V. Iyer, "A Critical Review of Emerging Technologies for Electric and Hybrid Vehicles," in IEEE Open Journal of Vehicular Technology, vol. 2, pp. 471-485, 2021, doi: 10.1109/OJVT.2021.3138894.
3. I. Husain et al., "Electric Drive Technology Trends, Challenges, and Opportunities for Future Electric Vehicles," in Proceedings of the IEEE, vol. 109, no. 6, pp. 1039-1059, June 2021, doi: 10.1109/JPROC.2020.3046112
4. A. Emadi, S. S. Williamson and A. Khaligh, "Power electronics intensive solutions for advanced electric, hybrid electric, and fuel cell vehicular power systems," in IEEE Transactions on Power Electronics, vol. 21, no. 3, pp. 567-577, May 2006, doi: 10.1109/TPEL.2006.872378.
5. R. M. Pindoriya, B. S. Rajpurohit, R. Kumar and K. N. Srivastava, "Comparative analysis of permanent magnet motors and switched reluctance motors capabilities for electric and hybrid electric vehicles," 2018 IEEMA Engineer Infinite Conference (eTechNxT), 2018, pp. 1-5, doi: 10.1109/ETECHNXT.2018.8385282
6. W. Xu, J. Zhu, Y. Guo, Y. Li, Y. Wang and S. Wang, "Performance analysis of electric machine drives for plug-in hybrid electric vehicles," 2009 International Conference on Applied Superconductivity and Electromagnetic Devices, 2009, pp. 60-63, doi: 10.1109/ASEMD.2009.5306696.

7. A. Emadi, Y. J. Lee and K. Rajashekara, "Power Electronics and Motor Drives in Electric, Hybrid Electric, and Plug-In Hybrid Electric Vehicles," in IEEE Transactions on Industrial Electronics, vol. 55, no. 6, pp. 2237-2245, June 2008, doi: 10.1109/TIE.2008.922768.
8. A. M. Bazzi, "Electric machines and energy storage technologies in EVs and HEVs for over a century," 2013 International Electric Machines & Drives Conference, 2013, pp. 212-219, doi: 10.1109/IEMDC.2013.6556255.
9. Yuan Cheng, Fuyi Duan and Shumei Cui, "The design principle of electric motors and drive systems for electric vehicles," 2005 International Conference on Electrical Machines and Systems, 2005, pp. 802-805 Vol. 1, doi: 10.1109/ICEMS.2005.202647.
10. Cui Shu-mei, Tian De-wen and Zhang Qian-fan, "Study of hybrid energy control strategy for hybrid electric drive system in All Electric Combat Vehicles," 2008 IEEE Vehicle Power and Propulsion Conference, 2008, pp. 1-5, doi: 10.1109/VPPC.2008.4677639.
11. M. Ehsani, K. V. Singh, H. O. Bansal and R. T. Mehrjardi, "State of the Art and Trends in Electric and Hybrid Electric Vehicles," in Proceedings of the IEEE, vol. 109, no. 6, pp. 967-984, June 2021, doi: 10.1109/JPROC.2021.3072788.