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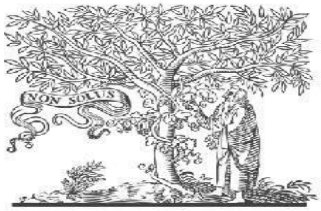

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Title **PARTICLE SWARM OPTIMIZATION BASED AUTOMATIC GENERATION CONTROL OF TWO AREA INTERCONNECTED SYSTEM**

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Particle Swarm Optimization based Automatic Generation Control of two Area Interconnected System

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Abstract
Generally, for a twoarea interconnected system, the frequency and the tie line power changes due to change in load at variable time. The change in the frequency is not desirable for any interconnected system which leads to damage of elements causing severe problems. Hence Automatic Generation Control is used to stablethe frequency and tie line power of the system. However, the Automatic Generation Control of the system takes certain time to settle the values which is called Settling time. Aiming to reduce the settling time of the change in the frequency, The Particle Swarm Optimization is used. The Particle Swarm Optimization recursively optimises the values of the parameters of the controllers used in the twoarea interconnected system using fitness function. The values of the parameters that are obtained in the recursive process at the maximum time provided are considered the final values with least error. The Particle Swarm Optimization employs in reducing the settling time of the frequency. The settling time in Particle Swarm Optimization based automatic generation control is less when compared to conventional Automatic Generation Control. In this technique, the parameters of PID Controllers are set to distinct variables such that the values changes and converges towards the optimal value for every iteration. The demonstration and comparison of Automatic Generation Control using PSO algorithm and conventional control is done through this project.The results of the proposed method are demonstrated through MATLAB simulations.

Keywords: Particles, Controller, PSO Algorithm.

Introduction

Electricity evolves as a major component and fundamental requirement in many fields such as health, defense, research, household, industries, entertainment and in innovation.As the demand increases the electrical systems are also increasing. The connection between the electrical systems of two areas is done as they have several advantages. The advantages include Exchange of peak loads, use of older plants, ensures economical operation and increase in reliability of the supply. The interconnection between the electrical systems of two areas helps in the reduction of plant reserve capacity. Due to change in the loads in the two regions, the frequencies of the interconnected system may vary. The change in the frequency of any system is not desirable hence using the Automatic Generation Control is used to stable the frequency. By the application of the particle swarm optimization, The settling time at which the frequency and the tie – line power becomes stable is reduced. The comparison of the conventional and PSO based automatic

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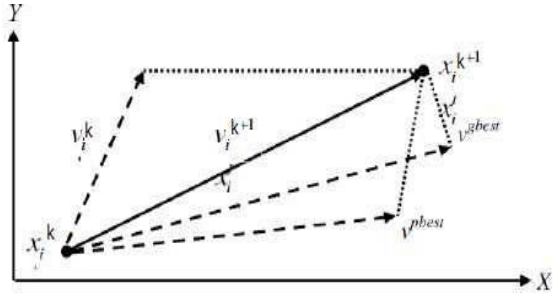
generation control best describes the difference between the settling times in both cases. The fitness function is used to calculate the absolute error. Detail information of this project is as follows.

Particle Swarm Optimization

Particle Swarm Optimization is a special technique that helps to reach the solution for a particular problem in less time. There are various methods in the field of optimization. Particle Swarm Optimization converges to the solution through several iterations by reducing the amount of the error for every iteration. All the possible solutions of the problem are collectively called Particles. The solution for every iteration is declared based on the position of the local best. Based on a simple formula, the particles move around the space(Search – Space) and around the local best position. The swarm(population) is being guided by the improved position(the positions with least errors). This method is proposed by Kennedy and Eberhart in the year 1995. The figure below best describes the technique of Particle Swarm Optimization.



Consider a flock of birds, as they search for food, we consider random points to be solutions.

PSO Controller design

Step – 1: The specifications of controller such as maximum and minimum gain limits are specified based on conventional PI controller. The initial matrix is defined with a size of N rows and 8 columns.

Step – 2: Zero is assigned to the initial velocity and population.

Step – 3: Maximum number of iterations and initial value K is determined.

Step – 4: By the simulation of the load frequency control block, the initial value is determined.

Step – 5: Local minimum of each particle is initialized.(P_{best})

Step – 6: The particle best(G_{best}) is defined

Step – 7: The evaluation of iteration is started.(iter=1).

Step – 8: Velocity updation through the formula.

Velocity(V_i^{k+1}) = C* ($W*V_1^k$ + C_1rand x ($pbest_i$ – S_i^k) + C2rand x (G_{best}–S_i^k))

$w=w_{max} – ((w_{max} – w_{min})/iter_{max})iter$.

Step – 9: The new particle is updated velocity.

Step – 10: The new particle is updated if the old particle is out of the limit of search space.

Step – 11: Update the local best position.

Step – 12: Update G_{best} and performance index.

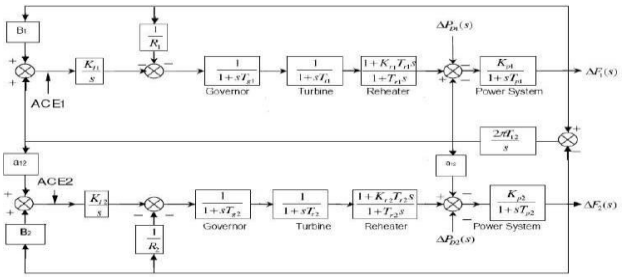
Step – 13: gen=gen+1

Step – 14: If gen>max gen

Repeat step – 7.

Step – 15: The G_{best} is the required output.

SIMULATION



The above is the basic diagram of two area interconnected system. The simulation is done by the adding the required blocks into the workspace. We used many blocks such as gain block, step block, turbine block, adder, controllers such as PID controllers, scope, Absolute block, multiplier block, constant block, clock, integrator block etc…The simulation is connected accordingly with specific values. The scope blocks are connected to visualize the frequncy of the single area, tie line power, relative visualisation of the two area interconnected system with controllers based on PSO

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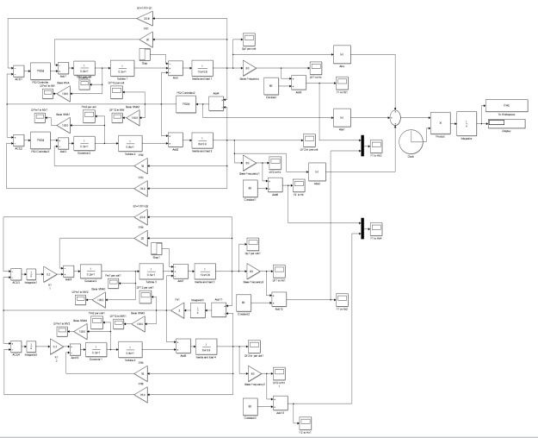
algorithm and with controller basedon the conventional Automatic Generation Control. The clock is used to set a specific time, in this project we set a time about 50 seconds. Here the fitness function consits of the integration hence we added a integrator block. You can predict a system's behaviour with the use of simulation tools. By the usage of simulation software, you can develop new designs, recognizing issues with past designs, and examine the system in various challenging environment. A mathematical model of your system, which might be presented in various models like a block diagram,orcode, is required to perform a simulation. The model's behaviour is computed by the simulation programme as conditions change with time or as events take place. In order to monitor the simulation as it is running, simulation software also incorporates visualisation features like data displays and 3D animation.The integral time absolute error(ITAE) is

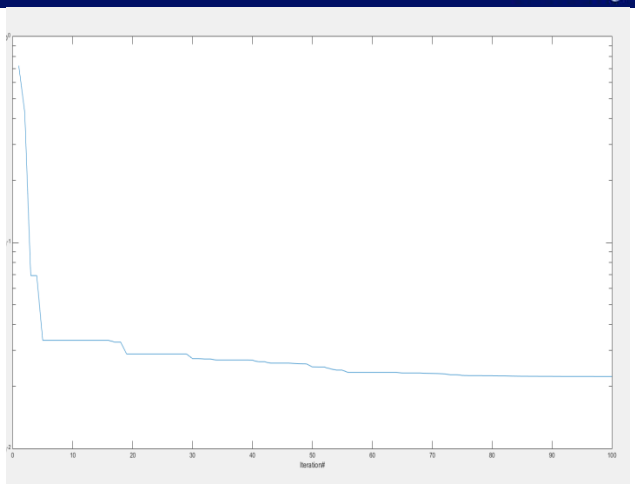
$$ITAE = \int_{t=0}^{t=final} \left(|\Delta f_1| + |\Delta f_2| + |\Delta P_{tie}|\right) \times t \times dt$$

The fitness function is defined in matlab:

```
function cost = tunning(kk)
assignin('base','kk',kk);
sim('mat');
cost= ITAE(length(ITAE));
end
```



Simulation



Weight – Iteration graph

Observations

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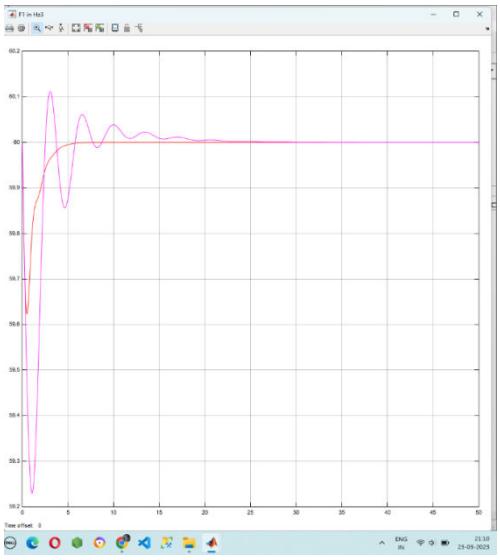
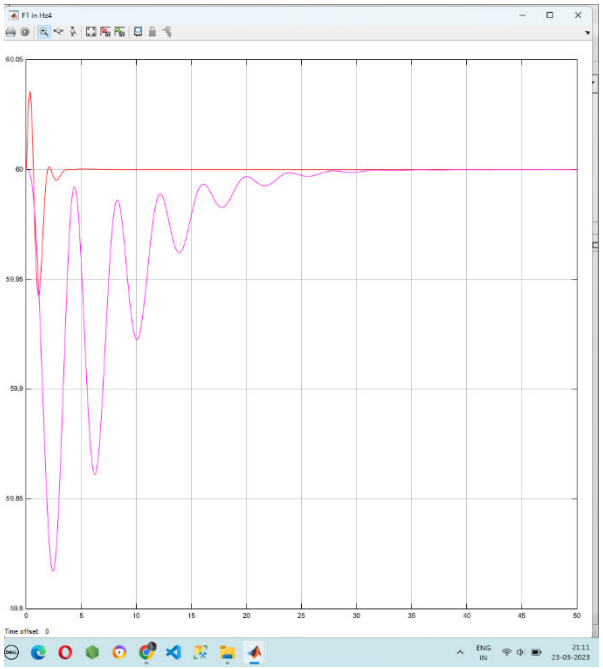
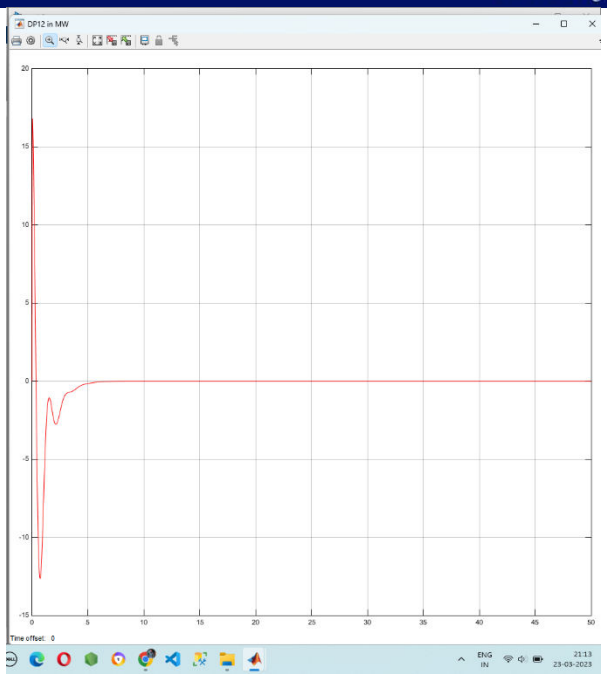


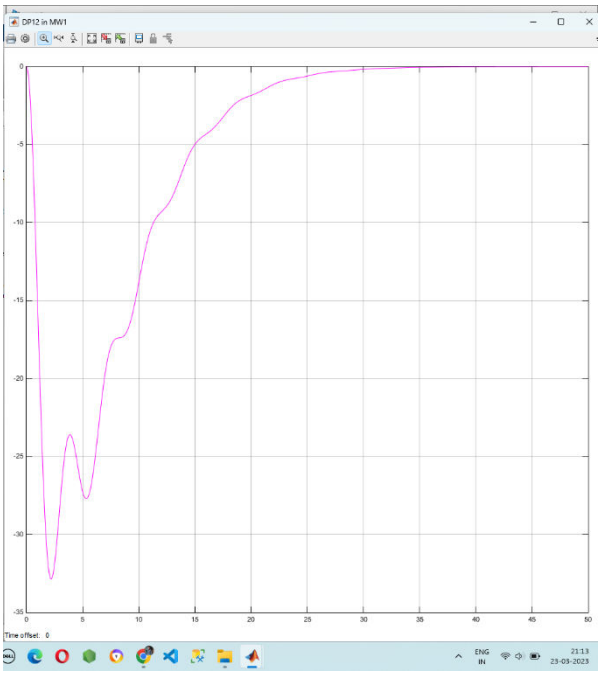
Area – 1 Comparison – with and without PSO Algorithm



Area – 2 Comparison – with and without PSO Algorithm



Tie – Line power with PSO Algorithm



Tie – Line power without PSO Algorithm

Conclusion

The present work describes the implementation of a control scheme for Automatic Generation Control of a two-area interconnected power system using the Swarm Optimization (PSO) technique. The study compares the performance of Proportional-Integral (PI) controller and

Integral (I) controller, and finds that the PI controller performs better.The study also calculates various parameters of the power system using PSO technique and demonstrates that the advantages of PSO based controllers is more than the general controllers. Specifically, the PSO based controllers result in a reduction in peak overshoot and settling time.Overall, this study highlights the potential benefits of using PSO algorithm for AGC in multi-area power system, and suggests that it can lead to improved performance compared to conventional controllers.

References

(A) Naimul Hasan, " Real-time Simulation of Automatic Control for the multi-areaInterconnected Electrical Power System"

(B) Akanksha Sharma and K.P. Singh Parmar "Automatic Control of two Area Power System using Artificial neural networkController",IJCST.

(C) AKHILESH," Non-SMES Automatic Control of the multi-Area Power System "

(D) Rajesh Abraham, Mr. Amit Patra and Dr. D. Das "Automated Control oftwo area Interconnected Power System along with Capacitive Energy Storage".

(E) T. S. Bhattiand Pawan Sharma and K.S. Rama Krishna, "AGC of an Interconnected Hydro-thermal system in Non-regulated Environment Considering constraints of Generation Rate ", IJEST Journal.

(F) A.N Jha and Panna Ram, "Automated Generation Control of an Interconnected multi-area electrical Power System" InternationalConference - 2010.

(G)C.Sundar and S.Sumathi, "PSO Based AVR and LFC of Autonomous Power Generating System".

(H) "AutomatedGenertion Control of Two Area Interconnected System" in youtube by Laghari.