Comparative Study of Conventional and Traditional Controller for Two Equal Area Interconnected Power Plant for Automatic Generation Control

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Abstract— The load frequency control is a part of Automatic Generation Control system (AGC). The load frequency control of two area power plant (thermal and wind power plant) has been modeled with PI and PI with the algorithm PSO. We are considering two areas are tuned with and without PSO with the controller PI. The results are obtained from PI PSO are better than PI. The results are obtained from PI has transient disturbance. PI PSO does not have disturbances. It is shown through the Matlab simulink.

Key words: PSO, AGC

I. INTRODUCTION

Load frequency control is a part of power system.[1] Power systems are efficiently used to transfer mechanical energy /thermal energy/kinetic energy into electric power. Power grid and distribution system transfer electricity to factories and load centre to meet the demand all kinds of power required. To enhance the performance of electrical components, it is necessary to have the good quality of the energy i.e. is coming. When the transfer of electricity is doing then power both real (P) and reactive (Q) are present should be balance between generating unit and utilized unit the AC power.[2] By balancing these two powers we are getting the two equilibrium point: frequency and voltage. When from these two voltage and frequency changes than and reach at a new level then the equilibrium point will change their place (float). For maintain the better power quality of electric system that is necessary to keep frequency and voltage in its prescribed limit during operation.[3] When the balance between active and reactive will not occurred then the voltage and frequency will continuously change when the load is changing. When the load is changing continuously then we require some control system to maintain its frequency and voltage to its predefined limits.[4] The both powers are presents have the combined effect on the frequency and voltage; the control problem that is present in the system is decoupled. The frequency is present in the system is reliant on the active power and the voltage is directly proportional to the reactive power. Thus in the power system there are two issues present which are decoupled through each other. And in these two decoupled one present in system is frequency and real power and other present in system is the voltage and reactive power. Both frequency and real power are well known as load frequency control (LFC) [5]

II. INTERCONNECTED SYSTEM

The interconnected load frequency control is more vital as compared to the isolated system. Whereas the theory and knowledge are equally important of isolated system for view of interconnection of Power system. Nowadays the tie interconnections are present due to this load frequency control problems are more come into picture. Some basic working principle of an interconnected power system is written following:

1) Under normal conditions the load present is attempted is considered as its own area except the other member load of planned function as equally decided..
2) Each area should have to consent upon accepting, adaptable, control strategies and equipment which are helpful for both steady and dynamic conditions. [6]

III. PSO ALGORITHM

PSO is a broadly utilized population based optimization technique initially presented by Eberhart et al. Fundamental highlights of this Particle Swarm Optimization are basic execution and the way that no slope data (gradient information) is needed. It is very reliable scheme. Other optimization problems are solved by PSO method. PSO is based as an optimized method which is concern only about the group of swarm and trained them by their social nature of movement of swarm or bird or fish which are trained to find out their food source. Steps of PSO implementation are following:

- Step 1: Initialize an array of particles with random positions and their associated velocities to satisfy the inequality constraints.
- Step 2: Check for the satisfaction of the equality constraints and modify the solution if required.
- Step 3: Evaluate the fitness function of each particle.
- Step 4: Compare the current value of the fitness function with the particles previous best value (pbest). If the current fitness value is less, then assign the current fitness value to pbest and assign the current coordinates (positions) to pbestx.
- Step 5: Determine the current global minimum fitness value among the current positions.
- Step 6: Compare the current global minimum with the previous global minimum (gbest). If the current global minimum is better than gbest, then assign the current global.

IV. PROPORTIONAL INTEGRAL CONTROLLER (PI)

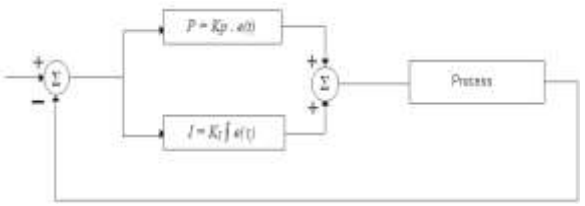

Fig. 1: Block diagram of PI controller

The output equation of this PI controller is as below:

$$K_p\Delta + K_I\int \Delta\, dt$$

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PI controller is useful when:

1) If only one energy storing device is working at that time either it is capacitive or inductive.
2) Quick reaction of the power system is not compulsory.
3) Huge turbulences and sound are existing while process is going on.
4) If number of intervals are present in the system. [8]

V. RESULT AND DISCUSSION

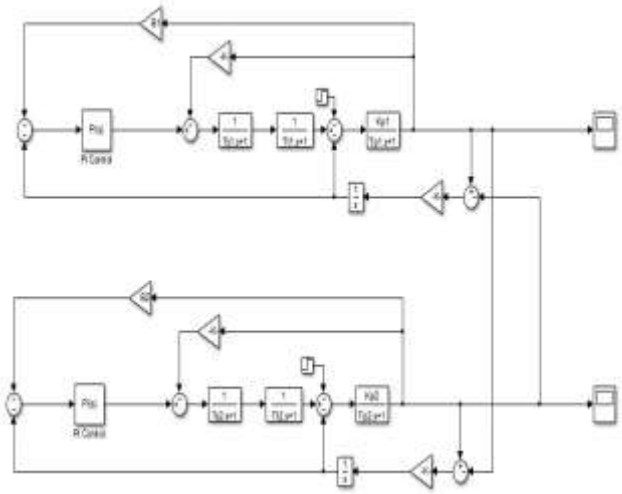

Fig. 2: PI controller without PSO

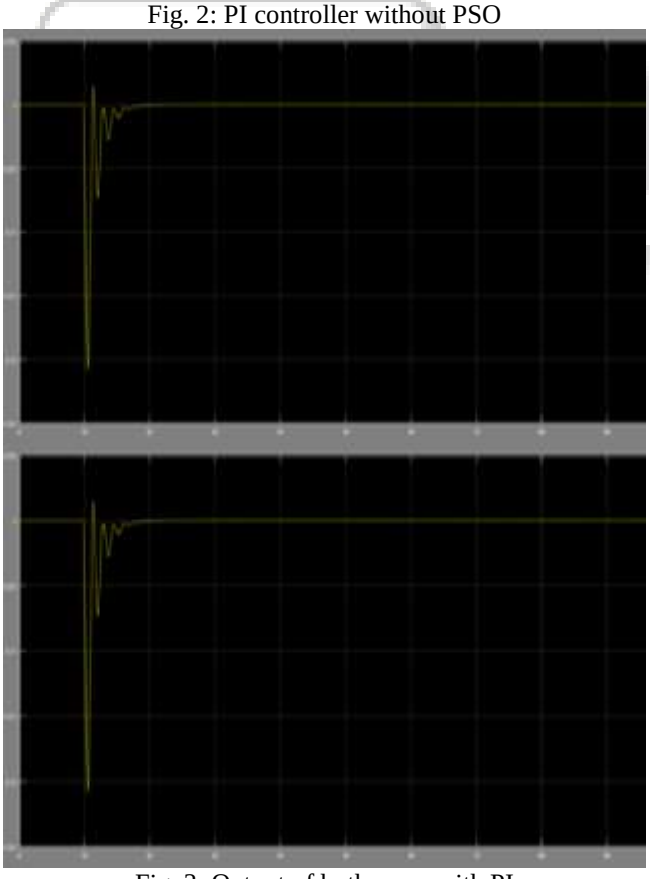

Fig. 3: Output of both areas with PI

Parameters of both the areas are same. But these have the transients and high value of settling time and maximum overshoot. The fig. 3 are between the frequency and time.

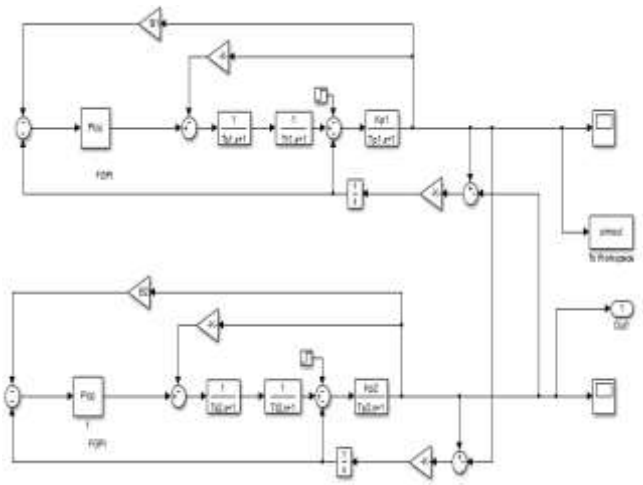

Fig. 4: PI controller with PSO

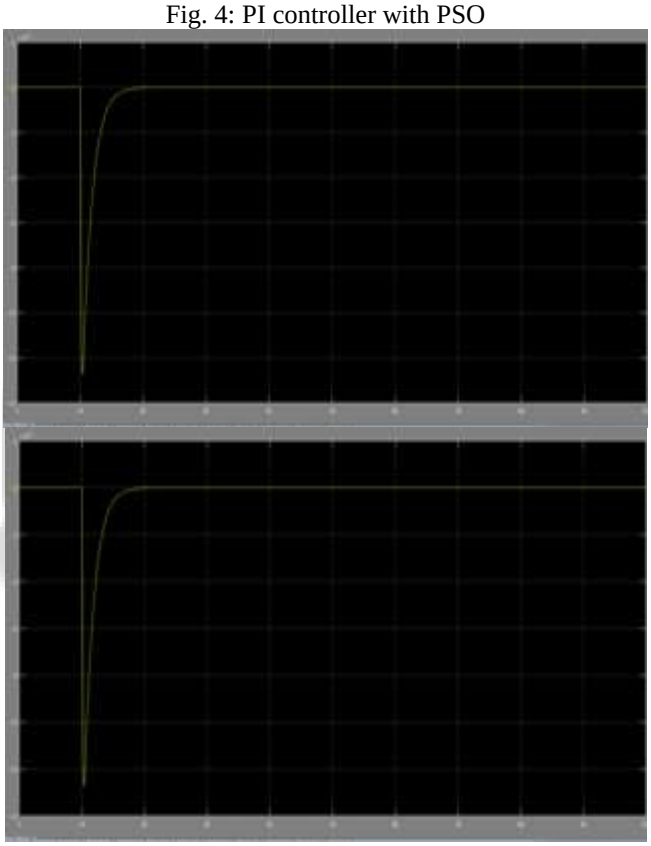

Fig. 5: Output of both areas PI controller with PSO

Fig 5 has less settling time and maximum overshoot. It is less as compare to shown above in Fig 3 and also it does not contain any transients. From these two comparisons we can show that the output of PI with PSO is better.

VI. CONCLUSION

Author has considered the two areas which are equal in parameters for load frequency control. Both the areas are tuned with PI and PI PSO. as the results are obtained from PI has disturbances and has high settling time and maximum overshoot. The PI PSO has less settling time and the transient disturbances are removed. From these comparisons we can say that PI PSO has better results. Stability obtained from PI PSO is better.

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