Optimization Technique of Load Frequency Controller PID, Fuzzy logic For Interconnected Power System

RAJBIR[1]
[1]Department of ECE, Amity University Haryana

Abstract- In this paper the performance of conventional controller, Genetic algorithm for inter-connected system. The response result shown here are in form of dynamic responses of each area frequencies and the power of tie line, for the two area power system model. Different controller can be used in this model but I am using PID, Fuzzy controller, Genetic Algorithm.

Keywords: Fuzzy logic, PID, Power System Control.

I. Introduction

The power systems means, it is the interconnection of more than one control areas via tie lines. In a control area the generators always vary their speed together (speed up or slow down) for protection of frequency and the relative power angles to the predefined values in the both dynamic and static conditions. If there is any sudden change in load occurs in a control area of an interconnected power system then the frequency deviation as well as tie line power deviation will be occurs.

Time consumption and inaccurate methods such as GA becomes a very usable and helpful tool for the tuning of control parameters in AGC systems. Genetic algorithm (GA) that is a numerical optimization algorithm, and capable of being used to a wide range of problem related to optimization The algorithm starts with a set of initial random population described in chromosomes; each one is consists some genes in the form of binary bits. These binary bits are easily decoded to give proper solution for the optimization problem. First Genetic operators behave as a initial population and then regenerate the new population to meet at the fittest function. A function which is used to assistance regeneration of new population from the older population i.e initial population , is called the fitness function. Fitness function define a value to each chromosome for specify its fitness. Based on the fitness values, the results are calculated and group of series are used to generate a new population through the useful operators. The GA uses selection, crossover and mutation operator to meet at the global optimum.

Selection is a stage in which individual chromosomes are collected from the population for the later recombination i.e crossover. The fitness values are calculated by dividing each one by the sum of all fitness values. The chromosome which have higher selection probability, to be selected first so on other chromosome are selected according to their selection probability.

2. MODEL OF A TWO AREA THERMAL NON-REHEAT POWER SYSTEM:

The block diagram model of two area (thermal non reheat) power system with integral controller is shown in Fig. 1.
The state space equations of the two area power system are obtained with the help of the transfer function from blocks named 1to 7. From the block diagram model we can see that there are two control inputs one is u_1 and other is u_2.This block diagram is show that there are two control area which are connected to each other through the tie line. Both of the control areas of the power system are contracted similar. As both the control areas used the thermal non reheat turbine. From the block diagram it is clearly mentioned that the control area are build up by the three block with an integral controller block. These three block are known as governor block, turbine block and the power system block that is actually the load block.

Implementation of advanced control technique used in LFC of power systems is a great idea. Now days the power systems are more complex and required operation in less structured and uncertain environment. Similarly innovative and improved control is required for economic, secure and stable operation. Advance control techniques are having the ability to provide high adaption for changing conditions

3. TWO AREA POWER SYSTEM

If there is interconnection exists between two control areas via tie line that is called a two area interconnected power system. Below fig shows a two area power system where each area supplies to its own area and the power flow between the areas are allowed by the tie line.

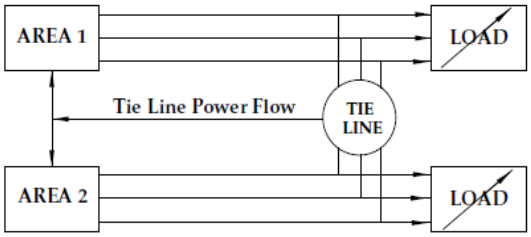

Figure.1. Two area power system.

Diagram of two area power system:

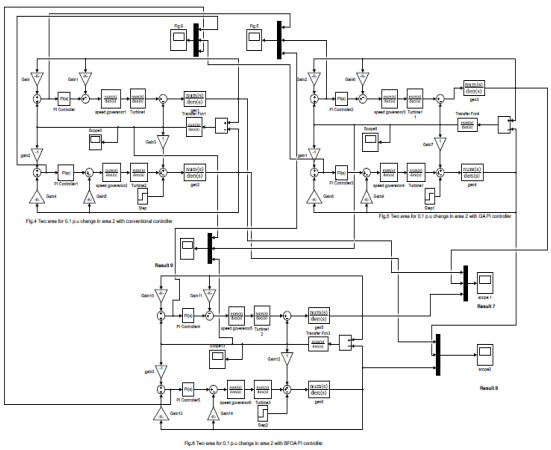

Figure .2. Two area power system simulation model when load disturbance applied to different areas.
The equations for control input can be written as below:

For area 1 (at block 8)

$\dot{u}1 = -K_T(ACE_1) = -K_T(B_1x1+x7)$

For area 2 (at block 8)

$\dot{u}2 = -K_T(ACE_2) = -K_T(B_2x4+x7)$

Where,

ACE_1 = Area control error of area 1

ACE_2 = Area control error of area 2

K_T = Integral gain for both the area

4. RESULTS AND DISCUSSION

Various Figures are shown below which are design the simulation model of two area by using PID controller, Fuzzy Controller. Here we are taken the load disturbance ($\Delta P_{D)}$ equal to 0.1 p.u in each area. By using simulation models we can got the performance characteristics of the power system very easily and quickly for analysis purposes. There are the various type of systems Simulink models with their respective responses characteristics draw against time(t) equal to 30 seconds. Here we are taking two area of power system.

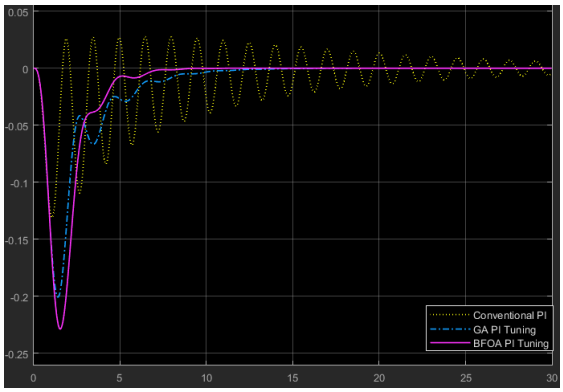

Figure.3. Change in frequency of first area for 0.1 p.u change in area.

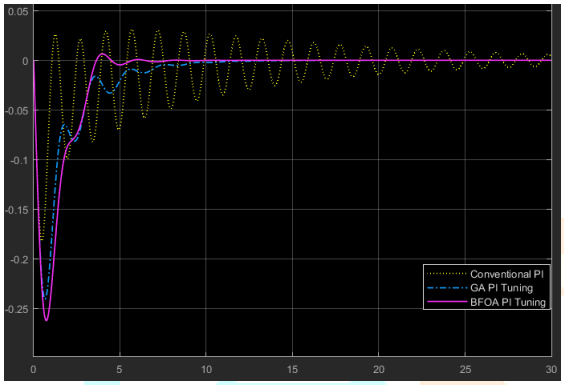

Fig. 4. Change in frequency of second area for 0.1 p.u change in area 2

5. SCOPE FOR FUTURE WORK:

1. In this present work the load disturbances Pd_1 and Pd_2, are used as constant innature. Therefore, in future the work could be extended to time varying load disturbances.

2. The parameters used in this work has been assumed constant for the whole operation. But there may be parameter incertitude due to wear and tear, temperature variation, fault of component, aging effect, environment changes etc. Therefore during controller design the variation of parameter may be taken in to consideration.

6. References

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