To Study and Implementation of an Intelligent Load Frequency Control for Multi area System using BFOA

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Abstract: Our power system is interconnected one where no of generators are connected together and run in unison manner to meet the demand. The lopsidedness between Generation& demand must be within a few micro seconds to avert frequency discrepant, which lead to problems in stability and security of power system .Control of frequency is paramount to counterbalance the power system by oversee the changes in frequency and load. In this paper we are using GA(genetic algorithm) for load frequency control. There are some conventional techniques for load frequency control among them Ziegler Nichols is a traditional technique remaining two (genetic algorithm, LMI and PSO) are advance techniques. The above techniques are validated through simulations.

Keywords*: Load Frequency Control (LFC),Ziegler -Nichols Approach, Genetic Algorithm, Linear Matrix Inequalities, PI Controller.*

I. INTRODUCTION

In a slavish trust power system, if a load demand change haphazardly, metamorphosis in power flow in tie line and the frequency takes place. The objective of frequency control is to minimize the evanescent variations and their steady state errors to zero. Many modern control techniques are developed and implemented for a reliable controller. The control techniques main objective is to achieve power quality and reliability of system, by maintaining both voltage and frequency within permissible range. Frequency and voltage of a system get affected, Whenever there is a variance in real and reactive power. Because of that this status quo are controlled separately. The Frequency is vastly reliant on Active power where as voltage is counting on Reactive power. Therefore the control can be segregated into two independent functions, first one is Active power and frequency control while other is Reactive power and Voltage Control. Disproportion betwixt load & generation not beyond few seconds, to eschew deviations in frequency for the steadfastness and vigil of the system. The frequency changes influence many aspects of system the speed of A.C motors, the turbines run at speeds corresponding to ±3Hz frequency which may lead to the damage of blades of the turbines. The transformer operation is degraded if it work at below rated frequency. With reduced frequency the blast by ID fans and FD fans decrease, which lead to complete shutdown of the plant. The predicament of regulating the frequency in power systems by harmonizing, generator units fructification in reverberation to the changes in the load is called load frequency control (LFC).The intention of frequency control are dispense zero steady-state errors of frequency and power, It also diminish the damping of frequency oscillations and overshoot of the disturbance to avoid disquietness of the system. The wonted LFC control algorithm was refined by N. Cohn in 1971. The algorithm embroil in designating the term 'area control error' (ACE), which is the summation of change in power of tie-line and the manifolding of the frequency error amidst a frequency bias constant.

In this paper genetic algorithm is used to solve this non-liner optimization problem which will cause a fast response to two-area interconnected power system load frequency controllers with determining optimal gains in LFC feedbacks. This paper is catalogued as follows: In section II three ascendancy strategies and dynamic models are given. Simulation results of control technique is explained in section III.

II. CONTROL STRATEGIES

The two areas are assumed to be identical with system parameters given by: Tps1=20s; TT1=0.3s; T12=0.545p.u; R1=2.4Hz/p.u MW; TG1=0.08s; Kp1=120Hz/p.u MW; a12= -1; b1=0.425p.uMW/Hz Tps2=8s;TT2=0.6s;

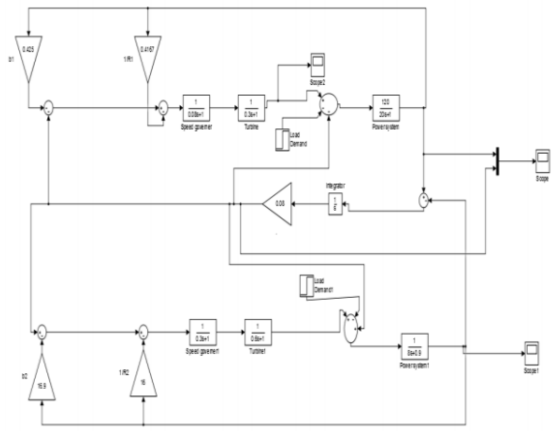

Figure 1: Floor plan of two area system without controller.

II. GENETIC ALGORITHAM

GA is very powerful and faster technique, it uses parallel searching. Due to its eminent potential for global optimization, GA has acquired great contemplation in control system such as search of optimal PI controller parameters. In this paper we used GA programming for optimization

$$\Delta Pc1(s) = -\left(Kps + \frac{Ki1}{s}\right) \times ACE1(s)$$

$$\dot{X}8 = \left(2\pi T_{12} + K_{i1}b_1 - \frac{K_{p1}b_1}{T_{ps1}}\right)x_1 + (K_{ps1}/T_{ps1})x_2 - 2\pi T_{12}K_{p1}x_4 + (K_{i1} - \frac{K_{p1}b_1K_{ps1}}{T_{ps1}})x_7 - (\frac{K_{p1}b_1K_{ps1}}{T_{ps1}})w_1$$

$$x_8 = \Delta Pc1$$

By applying differentiation and Laplace Transform we can obtain the ACE

$$ACE1(s) = -\Delta Pc1(s)/\left(Kps + \frac{Ki1}{s}\right)$$

$$ACE1(s) = \Delta P_{tie1} + b_1 \Delta f_1$$

GA programming done by selection fitness function and population and finally we obtained the gain value of PI controller as $K_{p1} = 0.954$, $K_{i1} = 0.543$

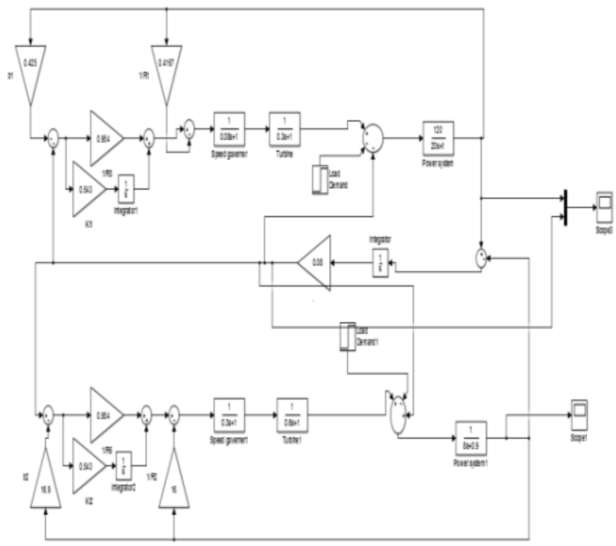

Figure 2: Block diagram of Two area system using GA

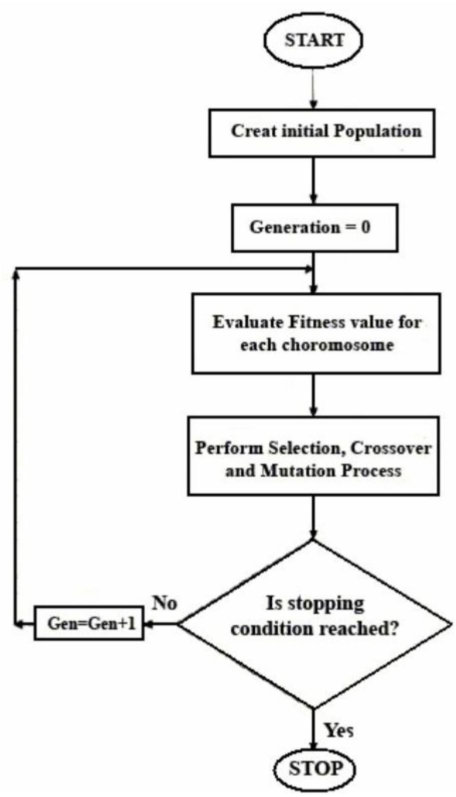

Figure 3: Flowchart of basic coded genetic algorithm

Table 1: Main GA parameters used in this paper

Option	Number / Type
Number of variables	2
Total number of generation	30
Population size	100
Cross over	Scattered
Cross over probability	0.4
Mutation probability	0.001
Fitness scaling	Rank
Elite count	2

Table 2: Sample two-area interconnected power system parameters

Parameter	Area 1	Area 2
T_T	0.3	0.3
T_G	0.08	0.08
D	0.8	0.4
H	5	2
R	0.05	0.05

III. SIMULATION RESULTS

For examining the efficiency and improvement, the presented model is developed in MATLAB, on a dual core 64 bit PC (2.7GHz & 8GB RAM), and is performed on a sample two-area interconnected power system with system parameters included in table 2 and a step load disturbance in one of these areas. Changes in frequencies after load deviation are illustrated on below figures for two areas when there is no LFC in system. As it is clear system can not compensate frequency deviation by its self.

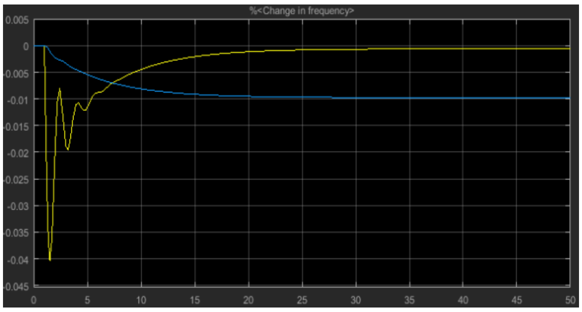

Figure 4: Change in frequency without controller

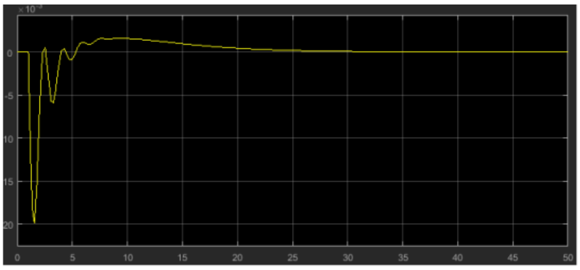

Figure 5: Change in frequency of area-1 with Controller using GA method

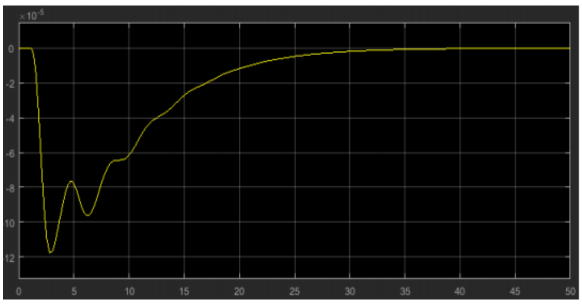

Figure 6: Change in frequency of area-2 with Controller using GA method

CONCLUSION

A new method for Optimal Load Frequency Control (OLFC) in interconnected power systems has been discussed in this paper which a real coded Genetic Algorithm used to solve this non-liner problem. Also suggested method implemented on a simple two-area interconnected system and the results showed reasonable fast response with no steady-state error to a step load disturbance. This is while, the efficiency and improvement of suggested method examined with comparing its results with correspondence methods for LFC. This investigation can be extended for optimizing the gains including penalty factors in fitness function for future investigations. These penalty factors can indicate some extra constraints such as governor saturation and can be model by means of "Maximum Speed" and "Maximum Rotation".

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