Scientific Journal of Impact Factor (SJIF): 3.134
ISSN (Online): 2348-4470
ISSN (Print) : 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2, Issue 1, January -2015

REVIEW ON LOAD FREQUENCY CONTROL TECHNIQUES FOR MULTI AREA POWER SYSTEM

Nitiksha P. Pancholi[1], Naresh C. Kumavat[2], Rashmi R. Patel[3]

[1]*P.G student,Electrical Department, MGITER,Navsari, nitiksha7690@gmail.com*
[2]*Assistant Prof.,Electrical Department,MGITER,Navsari, kumavat_nareshkumar@gtu.edu.in*
[3]*P.G student, Electrical Department, MGITER,Navsari,rashmi_3111@yahoo.com*

Abstract —*The main goal of load frequency control (LFC) or automatic generation control (AGC) in multi area power system is to maintain the frequency of each area and tie-line power flow within specified tolerance. Load frequency can control by adjusting the MW outputs of LFC generators so as to accommodate fluctuating load demands. Various methods are used for load frequency control. In this paper, different types of load frequency control (LFC) techniques are shown for multi area power system.*

Keywords*-Load frequency conrol(LFC),Classical control technique, Artificial intelligent techniques*.

I. INTRODUCTION

Load frequency control (LFC) is important in electric power system design and operation.Subjected to any disturbance, the nominal operating point ofa power system changes from its pre-specified value.As a resul tthe deviation occurs about the operating points such as nominal system frequency,scheduled power exchange to the other areas which is undesirable[1]. In this advance control methodology such as optimal control, variable structure control, adaptive control, self-tuning control, robust and intelligent control were applied in LFC problem.

This survey paper highlights the LFC problems in conventional power system. A comprehensive review on conventional power system as single area, multi-area is presented.

A.Types of power system models:

The conventional power system is mainly dominated by hydro, thermal and nuclear power generation which is integral component of the conventional power system.

1. Single area thermal power systems
2. Single area hydro power systems
3. Two area power systems
4. Three area power systems
5. Four area power systems
6. Power system with HVDC-link
7. Deregulated power systems
8. Distributed generation power systems

II. CONTROL TECHNIQUES

Load frequency control techniques can be classified as classical control technique and soft computing techniques.

A. Classical control techniques:

1. Linear quadratic regulator (LQR) based controlling technique
2. Proprtional Integral (PI) controlling technique
3. Proportional, Derivative, Integral (PID) controlling technique
4. Integral controlling technique

1) Linear quadratic regulator (LQR) based controlling technique

Optimal control is concerned with operating a dynamic system at minimum cost.The case where the system dynamics are described by a set of linear differential equations and the cost is described by a quadratic functional is called the LQ problem. The optimal control problem for a linear multivariable system with the quadratic criterion function is one of the most common problems in linear system theory [2].

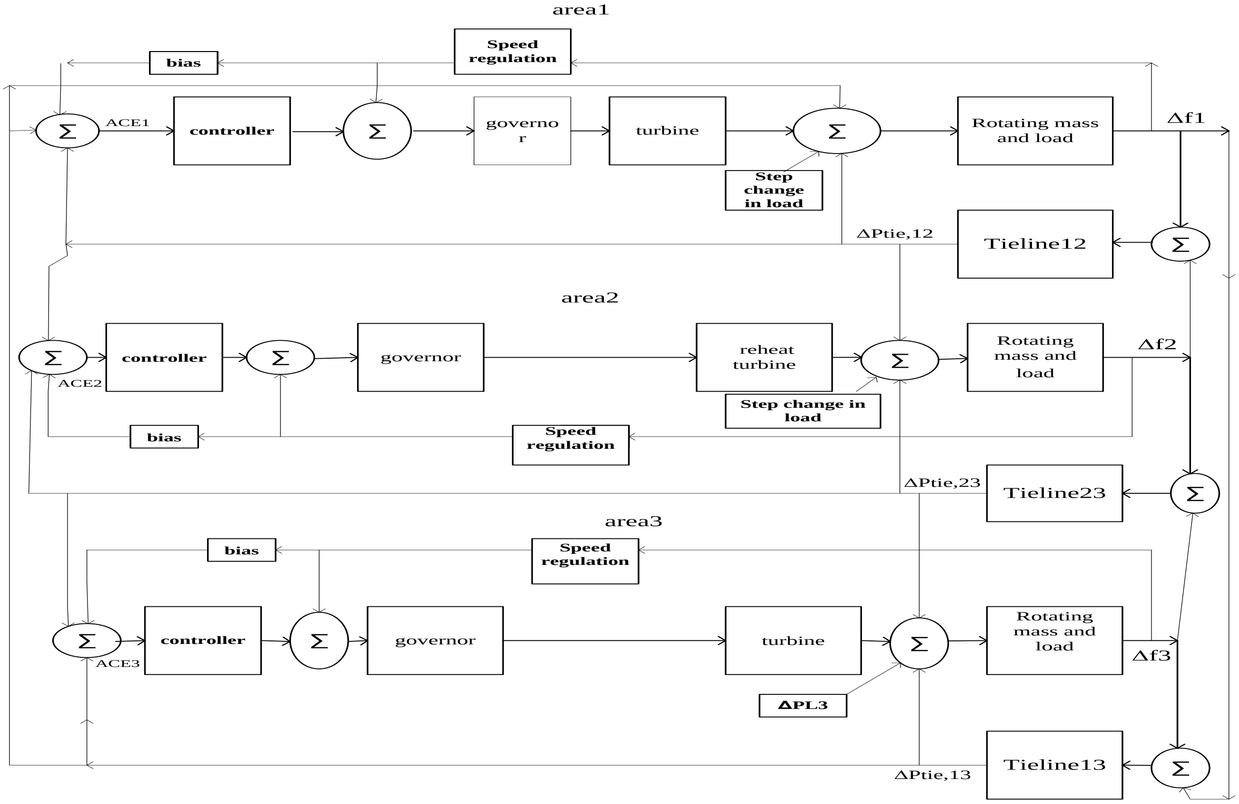

Figure 1. Block diagram of three area power system

2) Proprtional integral (PI) controlling technique

Among various types of load frequency controller, the PI controller is most widely used to speed-governing system forLFC scheme. An advantage of the PI control technique is to reduce the steady-state error to zero by feeding the errors in the past forward to the plant.

3) Proportional,derivative,integral (PID)controlling technique

A PID controller attempts to correct the error between a measured process variable and a desired set point by calculating and then instigating a corrective action that can adjust the process accordingly and rapidly, to keep the error minimal. The PID controller calculation involves three separate parameters; the proportional, the integral and derivative values. The proportional value determines the reaction to the current error, the integral value determines the reaction based on the sum of recent errors, and the derivative value determines the reaction based on the rate at which the error has been changing[2].

The PID controller output can be obtained by adding the three terms,[3]

$$G_c(s) = K_p + \frac{K_i}{s} + K_d s$$

4) Integral controllingtechnique

The speed changer setting be adjusted automatically bymonitoring the frequency changes. The system modifies to a proportional plus integral controller which gives the zero steady state error.

B. Soft-computing techniques :

1. Fuzzy logic control techniques
2. Neural network
3. partial swarm optimization
4. Genetic algorithm

1) Fuzzy logic control techniques

Fuzzy logic controller is designed to minimize fluctuation on system outputs[3].There are many studies on power system with fuzzy logic controller.FLC designed to eliminate the need for continuous operator attention and used automatically to adjust some variables the process variable is kept at the reference value. A FLC consists of three sections namely, fuzzifier, rule base, and defuzzifier[4].

2) Artificial neural network

PID controller has fixed constants for proportional, integral and derivative term.But during transient state controller effect can be made to perform better by variation of the constants. This is accomplished by ANN controller.ANN controller is trained with the set of data to determine the PID controller parameters[5].

3) Partial swarm optimization

PSO is initialized by a population of random solutions and potential solution is assigned a randomized velocity.Potential solutions, called particles,are then "flown" through the problem space. Each particle keeps track of its coordinates in the problem space,which are associated with the best solution or fitness achieved so far. The fitness value is stored and it is called as pbest and globaly best value is called gbest. Thus at each time step, the particle changes its velocity and moves toward its pbest and gbest; this is global version of PSO.

4) Genetic algorithm

The GA is a global search optimization technique based onoperation of natural genetics and Darw in a survival-of-the-fittestwith a randomly structured information exchange. The GAs havebeen widely applied to solve complex nonlinear optimization problems in a number of engineering fields in general and in the area of AGC of power systems[1].

C. Robust control:

The perturbation that can be treated in H-infinity (H∞) control theory, is non-structured perturbation and cannot be considered,then robust performance cannot be guaranteed in the (H∞) theory.On the other hand,the μ-synthesis technique that uses a structured singular value (μ) is a robust control method.[1]

III. CONCLUSION

In this paper, I have present a review of different techniques used by researchers in designing the load frequency control and also the study types ofthe power system models. These techniques could be classified as classical control, soft computing techniques,and robust control. Concluding that the load frequency can be controlled better by the soft computing techniques.

REFERENCES

[1] Shashi Kant Pandey, Soumya R. Mohanty, Nand Kishor, "A literature survey on load–frequency control for conventional and distribution generation power systems, "ELSEVIER Renewable and Sustainable Energy Reviews ,vol.25,pp.318–334,2013
[2] Ganesh, K.Vasu,P.Bhavana, "LQR Based Load Frequency Controller for Two Area Power System," IJAREEIE, vol.1, pp. 262-269, Oct.2012
[3] RishabhVerma, Shalini Pal and Sathans " Fuzzy Gain Scheduled Automatic Generation Control of Two Area Multi Unit Power System",IEEE, 2013
[4] H.D. Mathur and H.V. Manjunath, "Study of dynamic performance of thermal units with asynchronous tie-linesusing fuzzy based controller," Journal of ElectricalSystems,vol. 3-3, pp. 124-130, 2007
[5] Rajesh Narayan Deo, Shiva PujanJaiswal, M. VenkateswarluNaik, "Fuzzy Logic Based Automatic Load Frequency Control of Multi-Area Power Systems," IJEDR, pp. 13-17, 2013
[6] V.Shanmugasundaram, Dr.T.Jayabarathi, 'LoadFrequency Control Using PID Tuned ANN Controller inPower System," in IEEE International Conference onElectrical Energy Systems, pp. 269-274, 2011
[7] Ibraheem, Prabhat Kumar, and Dwarka P. Kothari, "Recent Philosophies of Automatic Generation Control Strategies in Power Systems," IEEE transection on power systems, vol.20, February 2005

