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LOAD FREQUENCY CONTROL OF MULTI AREA POWER SYSTEM CONTROL UNDER INTELLIGENT CONTROLLER

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Abstract: Thepurpose of this study is to present well load frequency control (LFC) for multi area hybrid power system. The aim of load frequency control (LFC) are to reduce the transient deviations in these variables (tie-line power interchange and area frequency) and to confirm their steady state errors to be zeros.The proposed controllers are Established with goal to reduce frequency deviation while reducing transient state time which are combined in three area interconnected hybrid power system involving non-reheat, re-heat and hydro power generating units.frequency variation of a three area thermal-hydro power system due to 1% disturbances in loading. MATLAB SIMULINK software is used for designing system. The system is first evaluated for without controller then response of the system likeoscillations and settling time are very high that is not acceptable result. After that we analyzed the response of the system with artificial neural network (ANN). The comparative study between with and without ANN controllers the result shows that ANN controller performance better than without controller and also advances the settling time and oscillations.
Keywords: LFC, Automatic Generation Control, Artificial Neural Network.

I. INTRODUCTION

Frequency difference is one of the most necessary factor of power system Network. It approves excellence of power supply is dependable and satisfactory. Load frequency control is very critical facet in the operation of power system safeguarding the good and dependable supply of power in sufficient quantity to the consumer.Automatic generation control (AGC) system specifies an applicable way to hold a control over the frequency and tie line power flow. It is a system which is designed to respond load changes and create a balance in demanded and generated power and minimize the frequency deviation. The balance can be calculated by measuring frequency, if frequency of the system increases that means the excess power is generated and drop in frequency indicated the lack of power. AGC thus control the generating unit by deploying the proper control signal which causes the generator to increase or decrease generating power.

The continuous growth in difficulty and size of interconnected power systems, along with both area tie-line and frequency interchange. The aim of load frequency control (LFC) is to reduce the transient deviations in these variables (tie-line power interchange and area frequency) and to confirm their steady state errors to be zeros. Load frequency control is the key function in power system stability and exceeding beyond certain limit can cause the permanent damage and domino effect to power system network and the model uncertainties of the power system position big challenges for controller design. The main purpose of load frequency control (LFC) is to tolerate frequency of the system under set limits and check the oscillations on tie-line loading in case of multi area power system. The balance can be calculated by measuring frequency, if frequency of the system increases that means the excess power is generated and drop in frequency indicated the lack of power. AGC thus control the generating unit by deploying the proper control signal which causes the generator to increase or decrease generating power. LFC characteristics chastely depend on the generating unit reaction. Frequency control is slow control when compared to the voltage control because the frequency is directly related to the power angle which is related to the generator rotor. Turbine generator has large mass rotor, when these high mass rotor rotates it has some stored kinetic energy. Due to increased load these stored kinetic energy helps to increase mechanical power outputs turn out the increased power generation same happens when load decreases causes the decrease in frequency. So the rotor speed is directly proportional to the system frequency. Thus the load frequency control problem is renovated into the turbine speed control problem. Past year Automatic generation control (AGC) system specifies an applicable method to hold a control over the tie-line power and frequency. Different methods have been suggested for Load Frequency Control. Modern control technique based on network Fuzzy Logic based Controller (FLC),Artificial Neural Network (ANN), and genetic algorithm crafted are assessed for LFC problem. Yet bountiful exertion have been made for optimizing predictable LFC but very less exertion for designing intelligent controller for multi area power system. This paper shows the two different conditions designing method falls in same group one is without controller and other controller is ANN made on back prorogation process. In this process trained to adjust the non-linear control situation and provide acceptable increase complete frequency variation & tie line power flow. This paper is ordered in the different parts, the paper will be show basic details of Load Frequency Controlin section I and give the system investigation in the section II. III Section isgiving the details of controller.IV shows the results of tie line power and frequency deviation for all area after simulation and section V is result & conclusion.

II. SYSTEM INVESTIGATION

A multi area system contains of three single area power systems, linkedover a link called tie-line. Three area interconnected power system is shown in Fig 1. Where area 1 has three generating station and two load station, area 2 has two generating unit and a single load and area 3 has two generating unit and two load center.

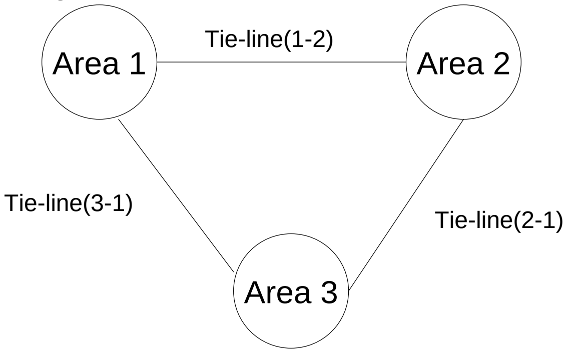

Fig.1. Three area interconnected power system with tie-line

In a typical organization for load frequency control of three area system contains the basic component likegenerator,turbine, speed governor, and controller. The controller normally used in the power system industry is Proportional-Integralcontroller.

The representation of interconnected three area system with and without re heater and hydropower system is show in Fig. 2. The block diagram of model has been considered for demonstration and exploration of frequency deviation in different cases. Result of control skillsimportant for selected to improve system dynamic presentation and stability.

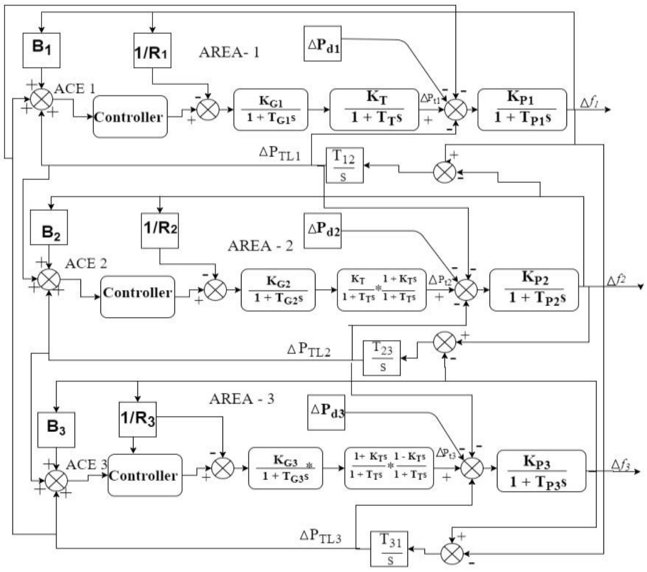

Fig.2. Block diagram of three area interconnected power system

A Simulink model based on the block diagram is designed in MATLAB to understand the tie-line power and frequency deviation in the power system area. Simulations are done for the controlled area .system frequency and power deviation for each area, only with primary loop and also with primary loop in containing the secondary loop with the ANN controller.

In MATLAB the neural network tool can be get into by using Neural Network tool box in Simulink library. After generating the data for input and target data we create a Simulink block to be used in simulation.

CONTROLLER DESIGN METHODOLOGY

III. SIMULATION AND RESULT ANALYSIS

three area closed loop system are used for Simulation of ANN controller are carry out on equal loading condition that is variation of step load is 1% arise at 1 sec and all other parameter is constant. The fig from fig 5 to fig 7 show frequency variation for without and with ANN for all three areas respectively. It is find the settlingtime is approximately ten seconds.

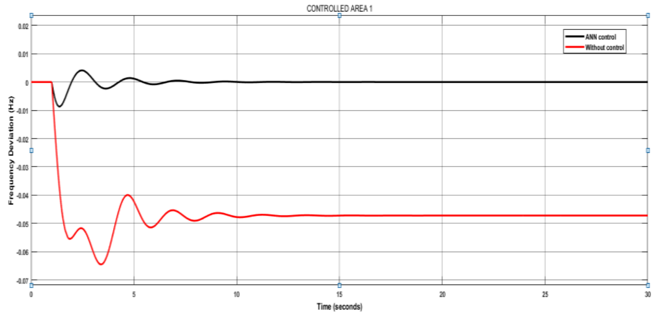

Fig. 5. area 1 frequency deviation with respect to time without controller and with ANN controller

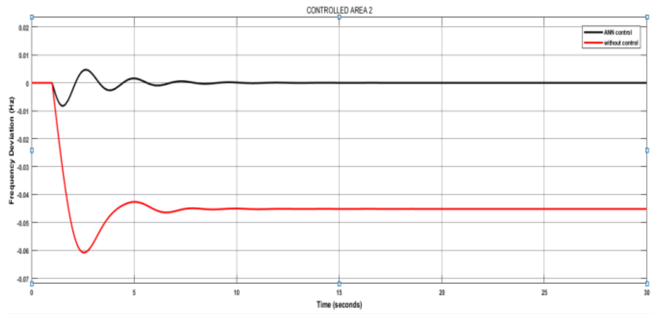

Fig. 6. area 2 frequency deviation with respect to time without controller and with ANN controller)

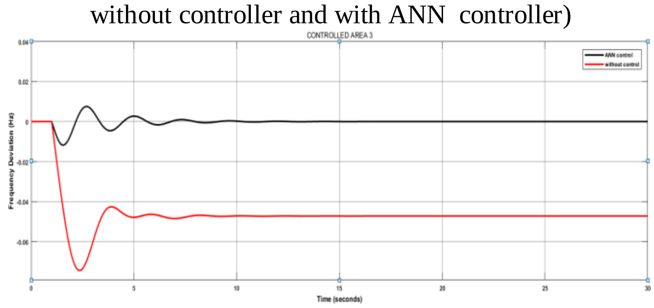

Fig. 7. area 3 frequency deviation with respect to time without controller and with ANN controller

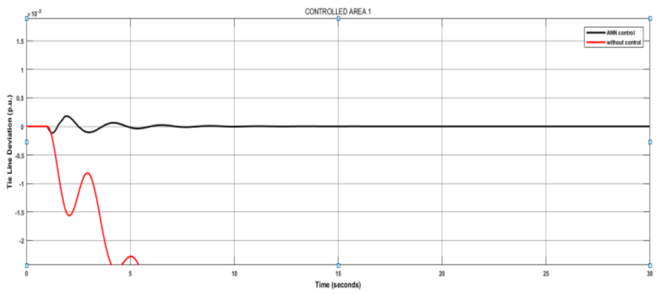

Fig. 8. tie-line power variation among area1 & area2 with respect to time without controller and with ANN controller

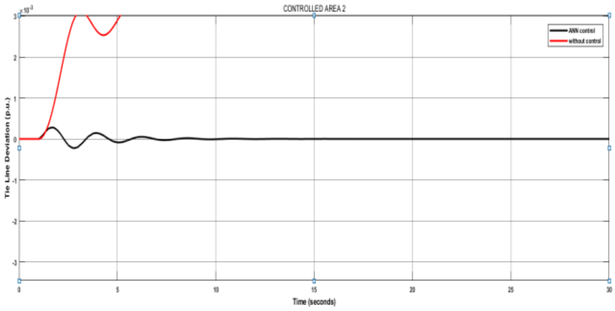

Fig. 9. tie-line power variation among area2 & area3 with respect to time without controller and with ANN controller

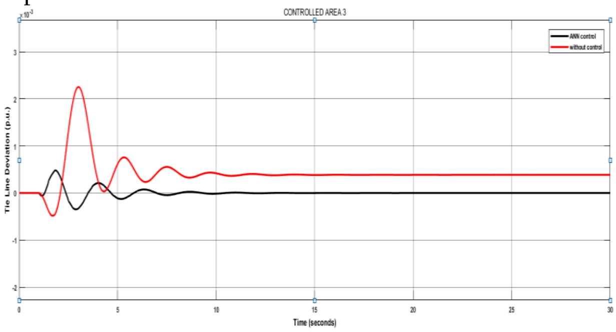

Fig. 10. tie-line power variation among area 3 & area1 with respect to time without controller and with ANN controller

Comparative study between without and with ANN controller with each area for varying variable,Fig.5 to Fig.7 shown frequency deviation waveform of area 1 to area 3 .The tie line power and load frequency show a more stable state Fig. 8 to Fig.10 shown the variation of handling ability in tie-line power for both conditions and waveform show for area 1 to area 3.

Table I: SETTLING TIME OF AREA 1 to AREA 3

Controller	**Δf Area 1(sec)**	**Δf Area 2(sec)**	**Δf Area 3 (sec)**	**ΔP_{tie} Area 1(sec)**	**ΔP_{tie} Area 2(sec)**	**ΔP_{tie} Area 3 (sec)**
ANN	7	8	10	9	8	8

For LFC controller work is to decrease the frequency oscillation and sustain the tie line power at preferred level. Studyof settling time is shown in Table I for tie line power deviation and frequency deviation. The ANN controller is better dynamic response then without controller.

IV. CONCLUSION

This research shows the necessary analysis in with and without controller. for multi area hybrids power system with help of artificial neural network Controller technique DesignedArtificial Neural Network (ANN),with the various loading condition in all area and controllers get hold of steady state error to zero.in this paper Comparative analysis of without and with ANN controller. The all comparative MATLAB simulation result of both the conditions indicate Artificial Neural Network (ANN) controller is faster and have much less troughs and peaks all through the transient time.

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