Optimization of load frequency controller with automatic regulator to enhance the Iraqi power system station

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Abstract

Load frequency control or automatic generation control is one of the main operations that take place daily when considering a modern power system or not. The objectives of load frequency control LFC are to maintain power balance between interconnected areas and to control the power flow in the tie-lines. In addition, an automatic voltage regulator (AVR) is an electronic device that maintains a constant voltage level to electrical equipment on the same load. The AVR regulates voltage variations to deliver constant, reliable power supply. The main disadvantages of AVR are mechanical drive components, brushes and contractors require regular maintenance and/or replacement. Frequent overloads can damage brushes. Speed of voltage correction correct may not be fast enough for electronic loads. Also, the variation of frequency controller causes high harmonics as results increase the losses. To enhance the system performance, ANN artificial neural network is used to optimize the system based on matlab Simulink.

Keywords: LFC, AVR, Matlab, ANN

I INTRODUCTION:

In recent years, power system stability has been recognized as an important problem. It is a known fact that the electrical power system demand and system load is not constant but keep on changing. For effective operation of the power system, the power generated should change in accordance with the load perturbations. In an interconnected system, every subsystem is required to regulate the power output of its installed generators in response to changes in system frequency and/or establish interchange with other areas within predetermined limits. This process is termed Load Frequency Control. It is also necessary to maintain the terminal voltage of a synchronous generator at a specified level. This is accomplished with the use of Automatic Voltage Regulator. [1][2]. Thespeed governor in the generating stations is to adjust the

frequency and real power and hold their values at the specified limits. In other hand each generator in the generating station is equipped with an excitation control to regulate the voltage magnitude and reactive power at the nominal values. The frequency control and voltage control is possible simultaneously and independently because there is negligible cross coupling between the LFC block and the AVR block. The reason for negligible cross coupling between the blocks is due to the fact that the time constant of the excitation system is much smaller than the time constant of the prime mover and also the transient of excitation system decay much faster and does not affect the LFC dynamic. Research in AGC system span in various areas. For instance, some papers focus on reducing the Area Control Error (ACE) to zero, some on controlling the frequency

bias factor while some papers discuss the role of decentralized generation. Apostolopoulou et at. have provided a detailed systematic way to determine the power allocated to each generator participating in AGC in real time [3]. Daburet al. presents AGC of a four area interconnected thermal power system with demand side management to reduce the total load demand of power systems during periods of peak demands in order to maintain the security of the system [4]. Zwe-Lee Gainghas designed a novel technique to implement Particle Swarm Optimization algorithm for optimal tuning of PID controllers used in the AGC system. The author has also compared the PSO based controller design with the Genetic Algorithm [5]. Kouba et al. provided a optimal PID controller tuning technique based on Particle Swarm Optimization. The authors have provided a comparison of their technique with the traditional Ziegler-Nichols method. Zwe-Lee Gainghas designed a novel technique to implement Particle Swarm Optimization algorithm for optimal tuning of PID controllers used in the AGC system. The author has also compared the PSO based controller design with the Genetic Algorithm [5]. Kouba et al. provided a optimal PID controller tuning technique based on Particle Swarm Optimization. The authors have provided a comparison of their technique with the traditional Ziegler-Nichols method, Genetic Algorithm and Bacterial Foraging optimization [6]. Parmar et al. have implemented LFC of a two area power system with a DC link in parallel with AC tie line [7]. The proposed LFC and AVR loops in this paper contribute to the satisfactory operation of the power system by maintain the frequency and terminal voltage of the synchronous generator at prescribed limits. Soundarrajan et al. used PSO based tuning of PID controller for the LFC and AVR system of a single area power system. The authors have also compared the use of PSO based PID controller with conventional PID, Fuzzy and GA based controllers [8]. Jeevithavenkatachalam et al. used PSO technique to optimize the integral controller gains for the AGC of the interconnected two area power system. The authors have considered the integral square of the error and the integral of time multiplied absolute value of the error performances indices of the system. The authors have also provided a comparison of their work with artificial intelligent controller [9].

II SIMULATION RESULTS

The Simulink of proposed method is shown in figure 1and 2. The simulation results of the LFC and AVR based on ANN is shown if figures 3, and 4 respectively.
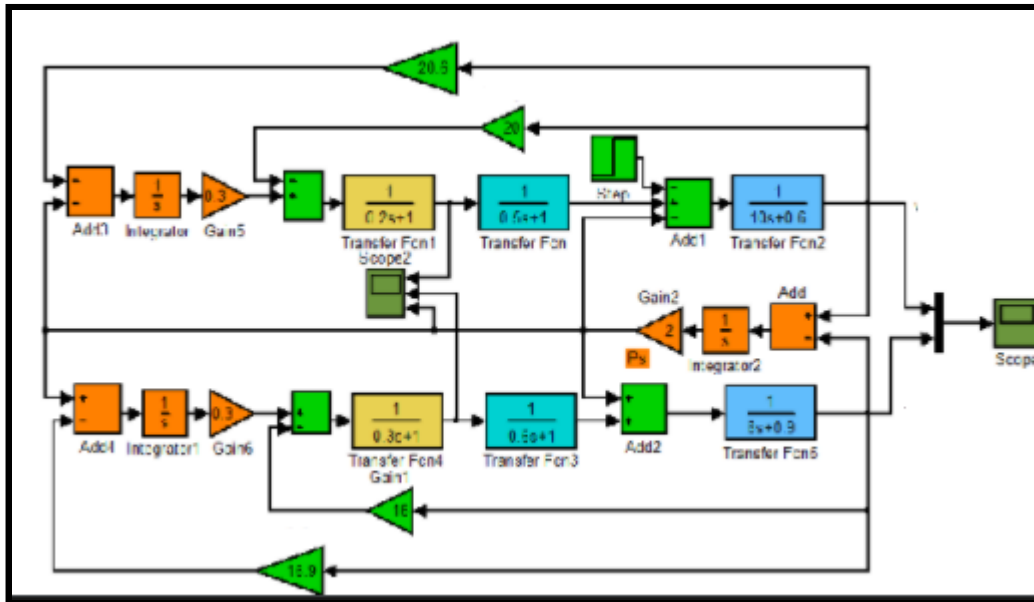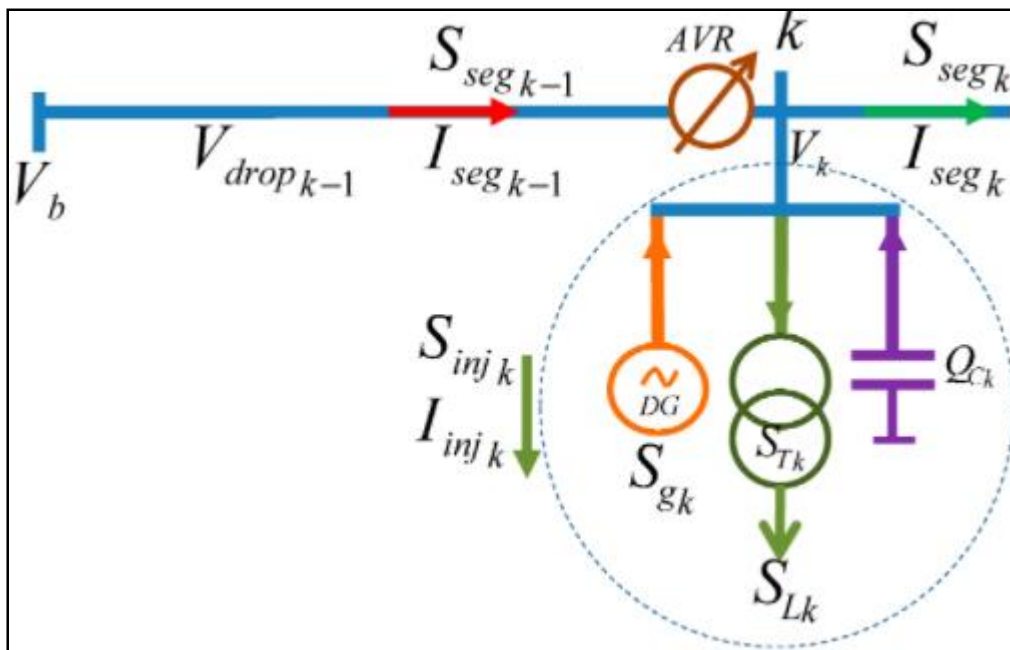

Figure1: Simulink system

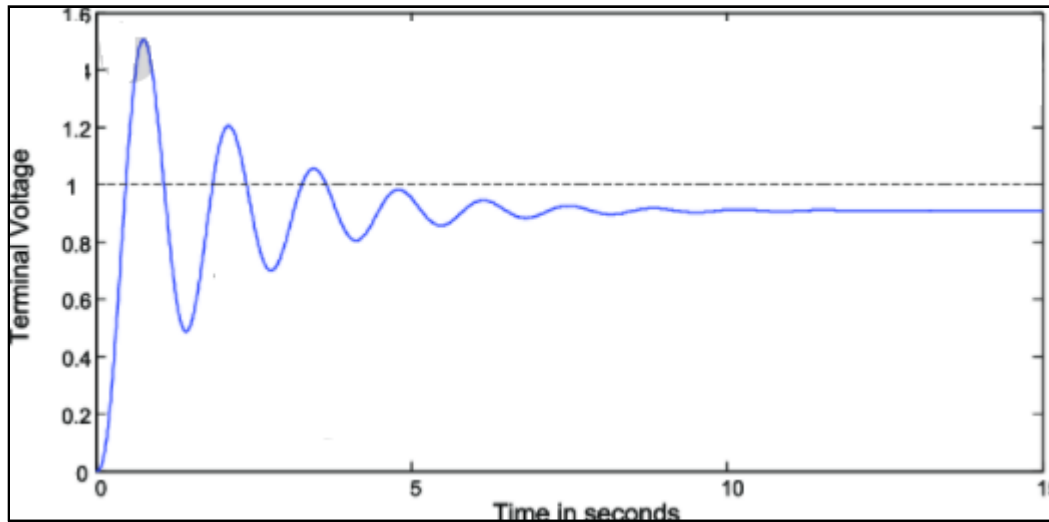**Figure 2: Block Diagram of AVR**
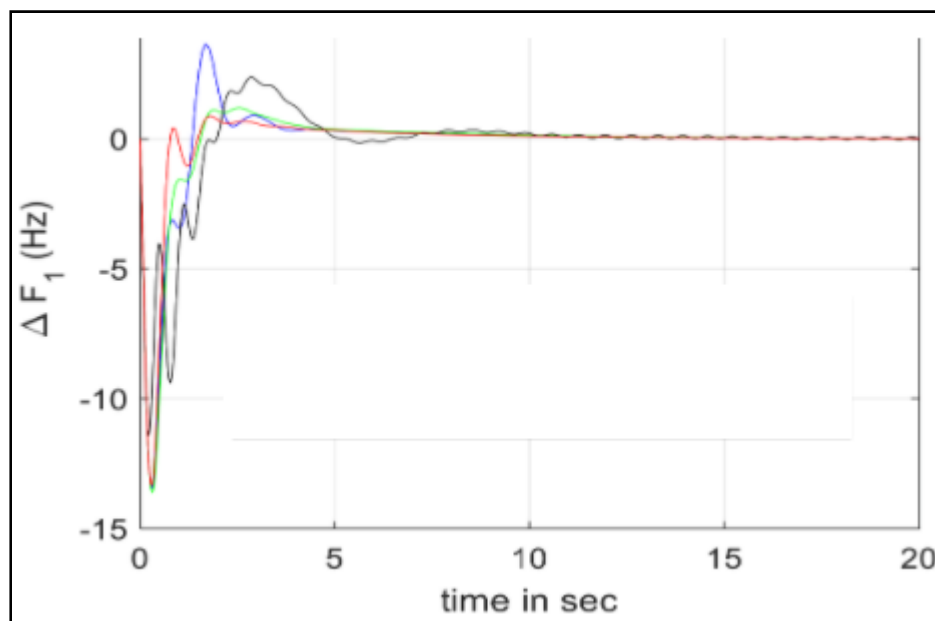
Figure 3: AVR

Figure 4: LFC

CONCLUSION

The proposed system by using NN is more effective and efficient as compare with classical system based on LFC with AVR IN POWER SYSTEM

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