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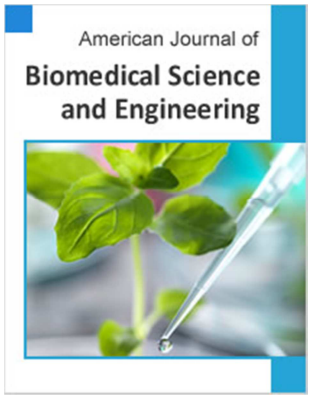

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Enhancement of Automatic Voltage Regulator and Load Frequency Control Performance Based on Radial Bases Neural Network to Optimize Terminal Voltage and Frequency Deviation

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Abstract
In this paper, radial bases neural network RBNN is proposed to optimize the voltage and frequency response in the power system stations. The conventional automatic voltage regulator AVR causes high overshoot and undershoot with oscillation. In addition, the main problem of the load frequency control LFC is that slow response to reach steady state. Therefore, the proportional- integral- derivative PID controller and the RBNN are used separately on behalf of the integral block of LFC and AVR. The simulation results shows that the proposed method of RBNN- AVR and RBNN- LFC is effectiveness and fast response with more stability as compared with PID- AVR, PID- LFC and conventional system.

1. Introduction

In the modern years the electrical energy has been used to power more complicated and technical complex manufacturing process. These products and process are more sensitivity on the quality of power supply like voltage terminal and frequency.

Many researchers are doing a lot of researchs to improve the LFC and AVR performance to achieve high stability of power system station. The PID controller was proposed to enhance the whole system but still have oscillation with low steady state [1] [2] [3]. The conventional LFC and AVR demonstrated poor dynamic performance with frequency oscillation [4] [5] [6].

To overcome the problem of conventional AVR with LFC, particle swarm optimization PSO was used to enhance the PID controller in a single area of power station [7] [8] [9]. In addition, PSO proposed to auto tuning of PID controller to get the desired voltage and frequency [10]. Furthermore, auto tuning of PID controller was applied based on Ziegler –Nickols ZN method to obtained optimal value of proportional and derivative gain [11].

The aim study of this proposed method via RBNN is to optimize the value of target voltage and frequency in double area of power system station and to remove frequency oscillation.

2. Theoretical Background

The aims of load frequency control to maintains the actual power stability in the power system by means of frequency control. When the real power change, the frequency change also. The frequency change is amplified and sent to governor.

Therefore, the governor is used to balance between the input and output. The automatic voltage regulator is used to maintain the voltages between limits by adjust the excitation of the equipment.

3. Proposed Method of RBNN-LFC and RBNN-AVR

In this proposed method, The Matlab toolbox is used to operate this simulink. The radial bases neural networks consists of radial bases function and activated function. In addition, RBNN consists of three layers: input layer, hidden layer with nonlinear RBF, and output linear combination layer. In this study, RBNN is used with load frequency control LFC and AVR to enhance the system. Figures 1 and 2 show the SIMULINK of proposed method for RBNN-LFC and RBNN-AVR respectively. In figures 1 and 2, the RBNN is used to optimize the frequency and voltage and to remove the overshoot and undershoot.

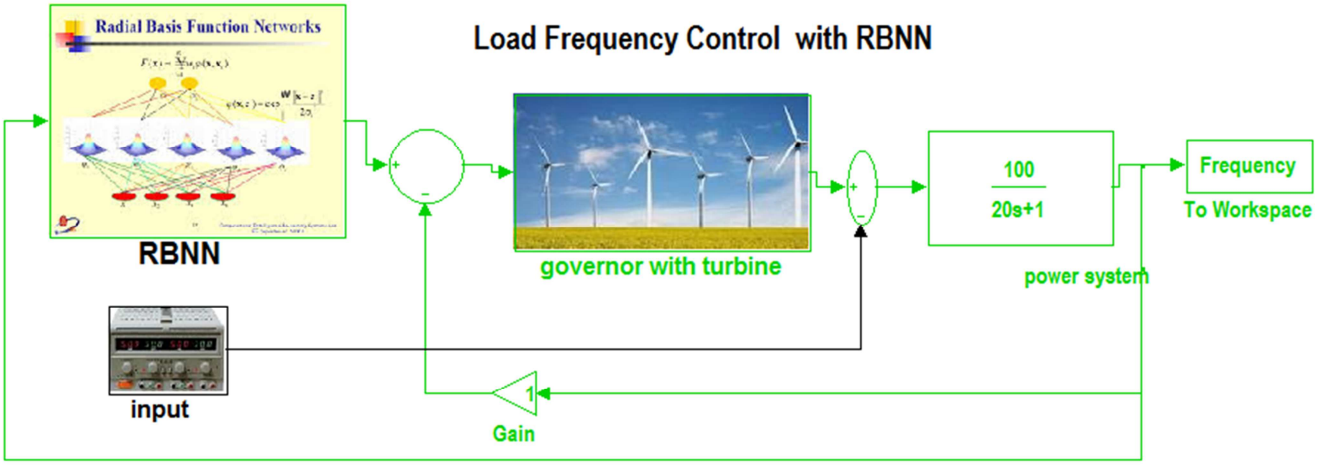

Figure 1. *Simulink of proposed RBNN with LFC.*

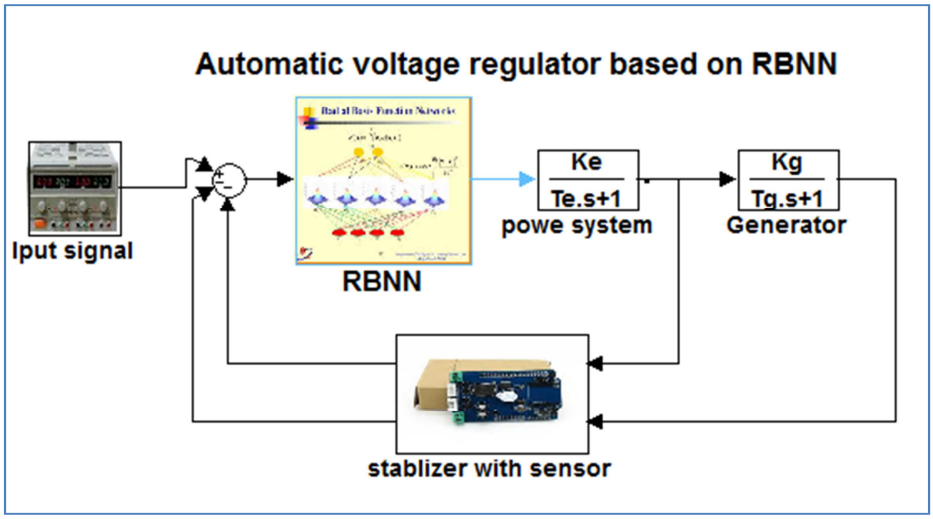

Figure 2. *Simulink of proposed RBNN with AVR.*

4. The Simulation Result

The simulation results is executed and drawing by using Maltab toolbox. From figure 3, it can be seen that the frequency deviation of proposed RBNN-LFC has low oscillation and fast response to steady state. In contrast, the PID-LFC and conventional LFC have high oscillation. Therefore, the proposed method is better as compared with PID-LFC and traditional LFC.

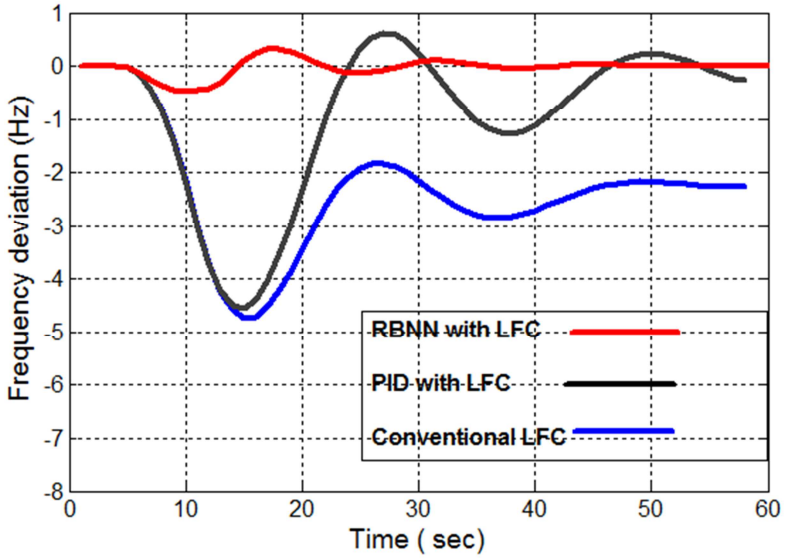

Figure 3. *The comparison results of frequency deviation between proposed RBNN-LFC, PID-LFC, and conventional LFC.*

Figure 4 shows that the terminal voltage of proposed RBNN-AVR is fast response and free of overshoot as compared with classical AVR.

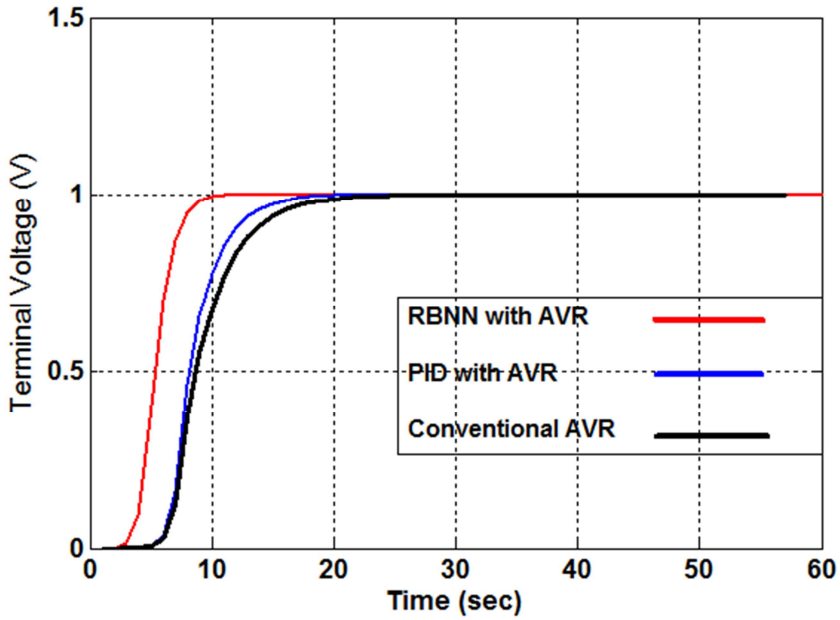

Figure 4. *The comparison analysis of terminal voltage between proposed RBNN-AVR, PID-AVR, and traditional AVR.*

5. Conclusion

The efficiency of power system station is determined by reliability of voltage and frequency. Therefore, the low frequency deviation and good terminal voltage are the feature of superiority of power station. The proposed RBNN-LFC have low frequency deviation and almost zero steady state error. Also, the RBNN-AVR provides suitable stability with free of overshoot. Finally, it is obvious from the simulation results of proposed method that the system is more efficacy under the vary of load and regulations.

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