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Two Area Systems for Restructuring and Deregulation in Load Frequency using Fuzzy PID Controller

Vikas Pandey, N. K. Sharma, A. N. Tiwari, Prabhakar Tiwari

Abstract*: In this research paper, a fuzzy PID method has been used to improve the Load frequency problem (LFC). This technique will help in correcting the system performance. The two area system is used to describe the load frequency problem using Fuzzy PID Controller. To support the proposal, two areas have been considered. They have been modelled in MATLAB Simulink and accordingly simulated results have been obtained.

Keywords: Load Frequency control, PID Controller, Fuzzy PID Controller, tie line.

I. INTRODUCTION

The generation, transmission and distribution systems were bundled together before restructuring and deregulation. This was probably the best way to serve the consumers with minimum cost operation objective. This system was well utilized till late sixties, but violation of financial principles, increasing cost and unrealistic subsidies made this prototype system unsustainable. The changing scenario throughout the world initiated restructuring and concurrent reregulation of the systems which was dominated by liquidation of the restrictive rules called deregulation. Deregulation was initiated by chile in 1982 and opted by most of the countries in the world by the end of the twentieth century. Indian power system was also undergoing through a very bad phase caused by huge subsidy, sub-optimal operation and poor control of the system, big AT & C losses dominated by theft and above all bad pricing system due to which utilities were not able to achieve their financial closure. To check this imbalance, central government made amendment in the electricity Act, which stated generation with establishment of two utility companies NTPC and NHPC. But it was not sufficient an step. The government formulated policy in 1991 to encourage greater participation by privately owned enterprises in generation but the promoters failed to get their financial targets and thus the further growth of sector was hindered badly whereas demand continued to increase with growth of population and other sectors. The ministry of power came in to operation as an independent department in 1992 but major changes came through Electricity laws (amendments) act 1998, which included change in bulk power tariff to power tariff that is known as Availability Based Tariff (ABT). The 1999 followed by State Electricity Regulatory Commissions (SERCs) in the states. The CERC with the objective of facilitating grid discipline introduced the new concept of pricing known as Availability Based Tariff(ABT) vide its order dated January, 2000 which has already proved its miraculous effect to transform the operation of the system to normal. This step was very crucial outcome of the long exercise for further development as it was going to show the way to reforms in this sector. The prior problems of the Indian power system was not only shortage of power, there was very big difficulty in grid operation due to indiscipline in the prevailing system which caused severe frequency disturbances resulting in tripping of generators, transmission lines and interruption.

Indian power system is now deregulated and participation of the private utilities is increasing at a very fast rate. But, with this growth of the system various issues are arising to address in the system which includes:

1) Disbalance of operation due to inappropriate generation
2) Aging of Transmission and Distribution system
3) Theft of power
4) Effectiveness of regulatory reforms
5) Role of Regulatory Bodies
6) Issue of Tariff in deregulated environment

The proposed work shall be an attempt to research on various issues listed above. The outcome of the research shall be to reach at solution to mitigate the problems.

II. RECENT RESEARCH WORKS: A REVIEW

Shree *et al.* [21] developed a neuro fuzzy control for automatic control. It is used in restructured power system. It is modern structure of power system.

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* Correspondence Author

Vikas Pandey*, (Correspondence Author) Research Scholar, Electrical Engineering Department, IFTM University,Moradabad,India/ Assistant Professor, Electrical Engineering Department, B.B.D. University, Lucknow, U.P., India. (e-mail: 04.pandey@gmail.com)

N.K.Sharma, Director Engineering Program at Mukesh Patel School of Technology Management and Engineering, NMIMS, Shirpur, Dhule, Maharashtra, India. (e-mail: drnikhlesh@gmail.com)

A.N.Tiwari, Professor, Electrical Engineering Department, Madan Mohan Malaviya University of Technology, Gorakhpur (U.P.)India.(e-mail:antiwari2012@gmail.com)

Prabhakar Tiwari,Associate Professor,Electrical Engineering Department, Madan Mohan Malaviya University of Technology, Gorakhpur (U.P.)India(e-mail: profptiwari@gmail.com)

Arya *et al*. [22] it works on multi area power system. In multi area system works on Fuzzy PID controller. It controls of Load Flow control.

Kumar *et al*. [23] was presents Automatic Generation control. It developed multi area system. Multi area systems are connected to tie line.

III. SCOPE OF THE WORK

There are various model of the restructuring throughout the world. A research is needed based on the final outcome of the change in the structure and regulation of the system to further improve the existing systems. It may be decided based on the various operational issues that a particular deregulated system might be able to address. Thus the proposed work has a lot of scope in the power industry for further actions regarding policy decisions.

IV. IMPORTANCE OF STUDY

Electricity is the basic need of every individual. It may be domestic, commercial or industrial consumer, any change in the power system structure or regulations affect the compete nation. Electricity is regarded as workhorse of the growth of national economy. Thus the proposed research work has a very good importance and direct impact on our power systems in particular and society in general.

V. METHODOLOGY OF THE RESEARCH WORK

Two type of system are used in this proposed work: wind, Hydro-Thermal. These two area systems are connected through the tie line. This proposed system increase stability condition. Two area System in Figure1

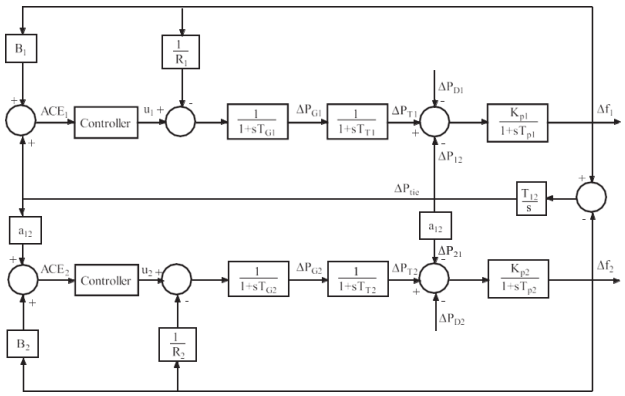

FIG.1 Two Area Power Block Diagram

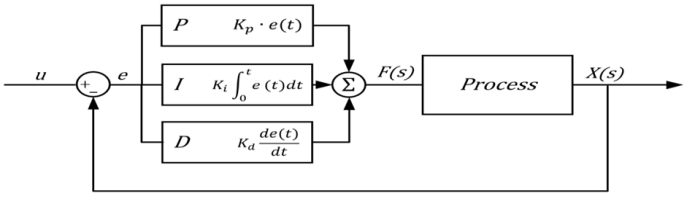

FIG.2 PID Controller block diagram

PID Controller output equation is:

$$U_{PID}(S) = \left(K_P + \frac{K_i}{S} + K_d(S)\right) \quad (1)$$

In this research work, we will use Fuzzy and PID for control the load frequency. According to rule, if load is changed then frequency is also change.

VI. RESULT AND SIMULATION

The results obtained after the simulation.

(i) Fuzzy logic control system:

The membership function is:

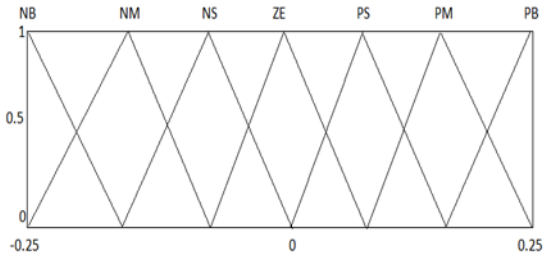

FIG. 3 Fuzzy membership function

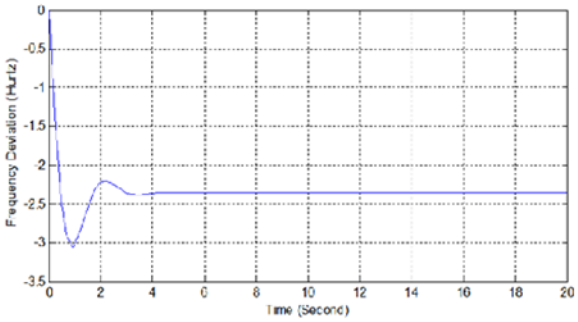

FIG.4 Frequency-Time Uncontrolled

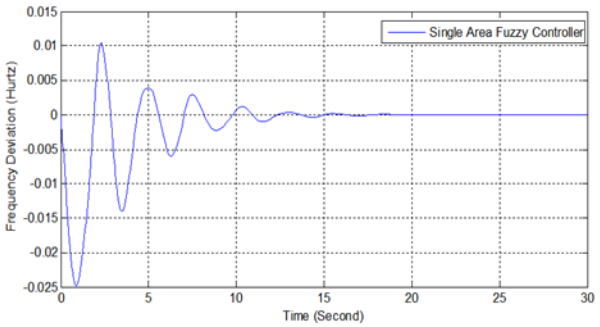

FIG.5 Fuzzy Controller for Single Area

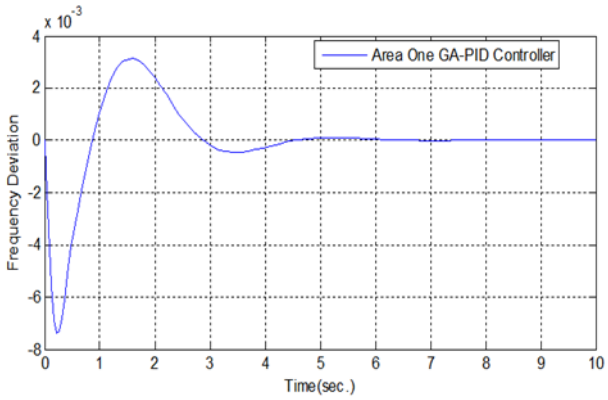

FIG.6 Fuzzy-PID Controller for Single Area

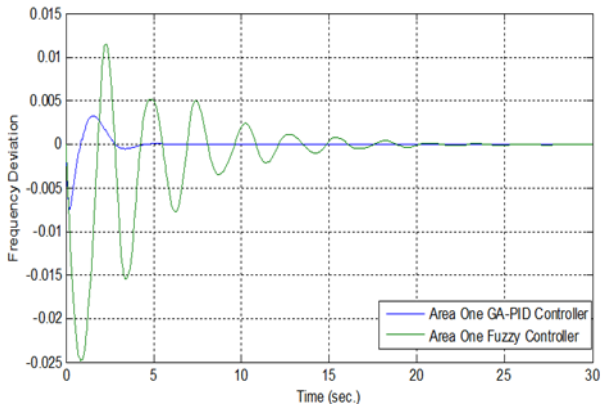

FIG.7 Comparison between fuzzy logic controller PID Controllers

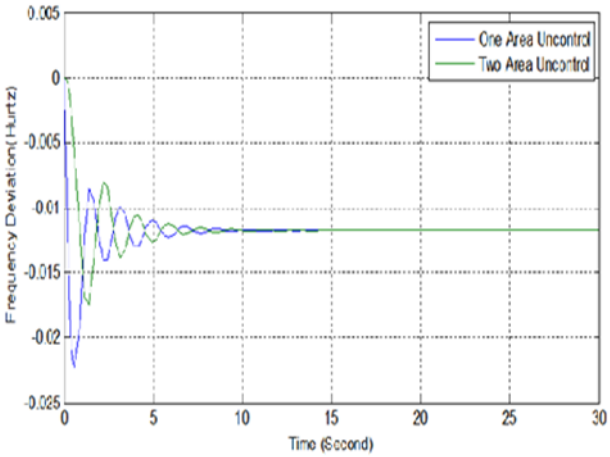

FIG.8 Two Area Uncontrolled

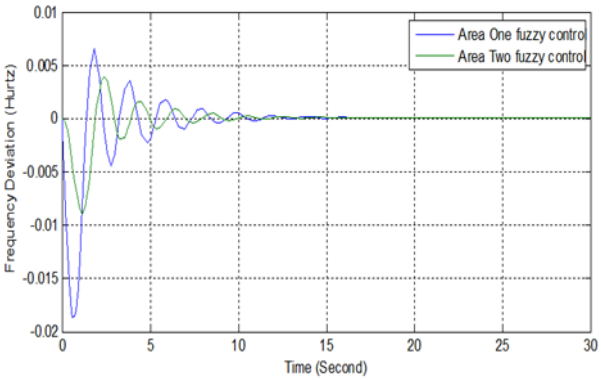

FIG.9 Fuzzy Logic Controller for Two Area

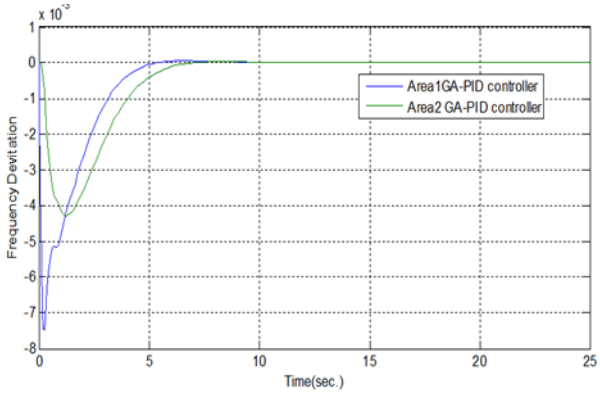

FIG.10 Fuzzy -PID Controller for Two Area

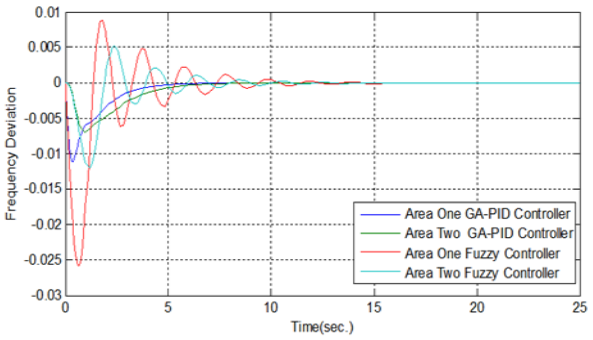

FIG.11 Comparison between fuzzy logic and PID Controller

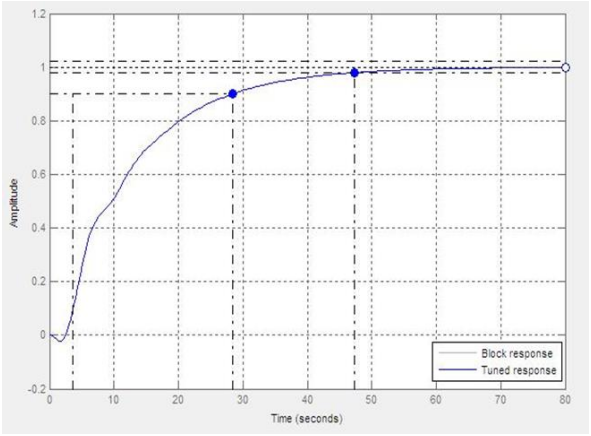

FIG.12 Amplitude Time Tuned Response

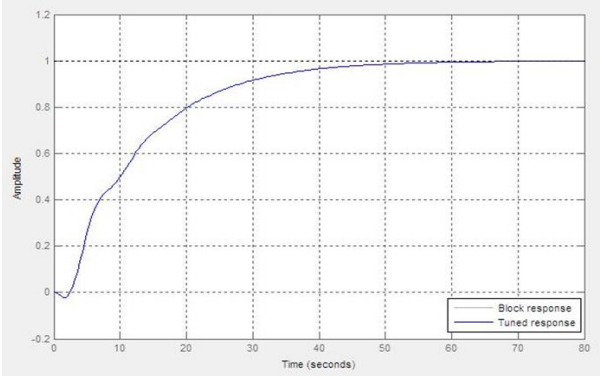

FIG. 13 Amplitude Time Tuned Response

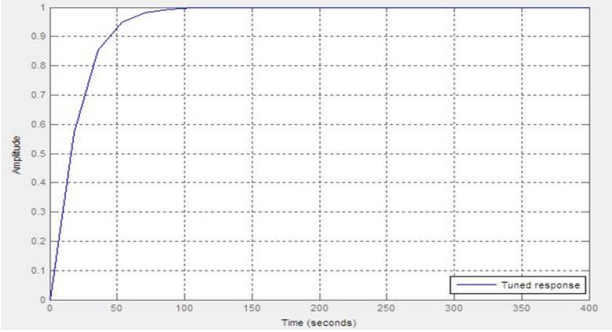

FIG. 14 Amplitude Time Tuned Response

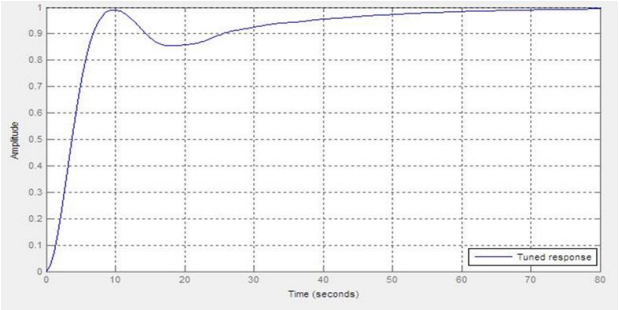

FIG. 15 Amplitude Time Tuned Response

VII. CONCLUSION

After the simulation it is clear that the stability of the system is visible and in the future, work will be done on three areas system to further improve this system. Many techniques was developed to improve load frequency control.

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