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AN EVOLUTIONARY COMPUTING APPROACH FOR PID OPTIMIZATION FOR AUTOMATIC VOLTAGE REGULATOR

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ABSTRACT

The primary objective of reactive power control is to develop the generator excitation control system that can be obtained by using automatic voltage regulator. It maintains the generator voltage and reactive power demand by observing the error signals. The PID controller for AVR gives better results in term of speed and steady state error. The identification of the optimum PID coefficient is cumbersome process. An evolutionary computing approach for determining the optimal values of the PID (Proportional-integral-derivative) controller has been studied and presented in this paper. The comparative analysis of the different techniques like, Particle Swarm Optimization (PSO), GA etc, are illustrated in this paper.

KEYWORDS: AVR system, Particle Swarm Optimization (PSO), GA, PID Controller, PID Controller Tuner, etc.

INTRODUCTION

The advent of automatic voltage regulators in the late 1950s, installation of AVRs on power generating units become a common practice. Unfortunately, high performance of these voltage regulators caused a destabilizing phenomenon on the power system. Most of the problems are associated with the low frequency oscillation in interconnected power systems, especially in the deregulated paradigm. The small magnitude and low frequency oscillation often remained for a long time. To provide fast damping for the scheme and thus improve the dynamic performance, a supplementary control signal in the excitation scheme and/or the governor scheme of a generating unit can be used. As the most cost effective damping controller, power system stabilizer has been widely applied to suppress the low frequency oscillation and enhance the system dynamic stability. In power system stabilizer contribute in maintaining reliable performance of the power system stability by providing an auxiliary signal to the excitation system.

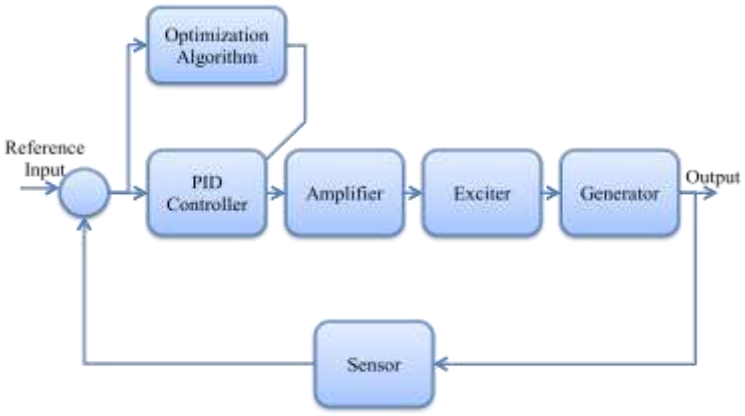

Fig: 1 Block Diagram of AVR with PID

This Paper presents a tuning method based on evolutionary computing approach to determine the PID (proportional-Integral-Derivative) controller parameters in Automatic Voltage Regulator (AVR). The main objective is to increase the step response characteristics and reduce the transient response of AVR systems. In this paper, different optimization method are described to determine the optimal PID controller parameters of an AVR system.

RELATED WORK

Srinivasan Sundhararajan and Anil Pahwa, study in this paper, the used optimization method for capacitor placement problem in distribution scheme. Loss sensitivity analysis and genetic algorithm is used for capacitor location and sizing in radial distribution network. A genetic algorithms (GA) are capable of handling both continuous and discrete variables efficiently without any change in the search mechanism [1].

P.Ua Pa Thi Reddy, this paper describes an approach for modelling of automatic voltage regulator using the forward/backward sweep-based algorithms for unbalanced radial distribution scheme. Power loss indices are first found at each branch except source bus and the bus that has the highest power loss index are picked as the best location for the voltage regulators. The tap position of the voltage regulators that maintain the voltages within the limits of the unbalanced radial distribution systems through minimizing an objective function, consisting of power loss. The Partial Swarm Optimization is used to find the selection of tap position of the automatic voltage regulators. This algorithm makes the initial selection, installation and tap position setting of the voltage regulators to provide a good voltage profile and to minimize power loss along the distribution channel. The effectiveness of the proposed method is illustrated on a test system of 25 bus unbalanced radial distribution systems [2].

G. Madasamy, study the design and tuning of PID (Proportional Integral Controller) for Automatic Voltage Regulator (AVR) system to improve the dynamic performance and robustness of the system . The PID controller is the very commonly used compensating controller which is used in higher order scheme. This controller widely used in many different areas like Chemical process control, Aerospace, Automation and Electrical Drives and other. There are various soft computing techniques which are used for tuning of Proportional Integral Controller to control the voltage in Automatic Voltage Regulator technique. Tuning of PID parameters is important because, parameters have a great effect on the stability and performance of the control system. Bacterial Foraging Optimization techniques is one of the important techniques to tune the PID parameter in AVR technique. Numerical solution based on the proposed PID control of an Automatic Voltage Regulator for nominal system parameters and step reference of voltage input validates the good performance. The objective function of the proposed Bacterial Foraging Optimization algorithm is designed according to the required control characteristics of Automatic Voltage Regulator. The proposed Bacterial Foraging Optimization tuning method has better performance compared with the conventional ZN tuning method. The results of the simulating Automatic Voltage Regulator scheme is proved to be better than the tuning the controller after approximation or by any traditional existing methods [3].

Anil Kumar, proposed the design method for determining the optimal proportional-integral-derivative controller parameters of an Automatic Voltage Regulator system using the particle swarm optimization and Genetic Algorithm (GA). The design goal is to minimize transient response through minimizing overshoot, settling time and rise time of step response. The proposed approach had superior features, including easy implementation, and stable convergence characteristic, and good computational efficiency. Fast tuning of optimum Proportional Integral Controller parameters yields high-quality solution. First an objective function is defined, and then by minimizing the objective functions using real-coded Genetic Algorithm and PSO, the optimal controller parameters can be assigned. Compare the result of step response of AVR by using Particle Swarm Optimization (PSO) and Genetic Algorithm. The obtained result of the closed loop Particle Swarm Optimization -PID and Genetic Algorithm -PID controller response to the unit step input signal shows excellent performance of the Proportional Integral Controller (PID). The amount of overshoot for the output response was successfully decreased using the above two techniques. Genetic algorithm and Particle Swarm Optimization enabled the PID controller to get an output which is robust and has faster response. As the number of iterations (generations) in PSO Algorithm and also the no. of generations in GA went on increasing the performance of the system also went on improving. The performance characteristics of the PID controller by using PSO Algorithm give the better results as compared to Genetic Algorithm [4].

Vivek Kumar Bhatt, presented an evolutionary computing approach for determining the optimal values of the proportional-integral-derivative controller has been proposed. Proper tuning of such controllers is obviously a prime priority as any other alternative situation will require a high degree of industrial expertise. This paper demonstrated in detail how to employ the partial swarm optimization (PSO) method to search efficiently the optimal PID controller parameters of an AVR technique. The proposed algorithm has been applied in the PID controller design for the AVR technique. The MATLAB simulation has been performed and a comparative study between the proposed algorithms with the Proportional Integral Controller Tuner has been studied in the presented work. In continuation of this, the proposed method was indeed more efficient and robust in improving the step response of an AVR system. Comparison with recent work of PSO-PID controlled AVR technique: In, Gaing optimized the parameters of PID controller in AVR system using particle swarm optimization technique. The PSO used in has been termed as PSO in except the concept of selection ratio. The detailed algorithm has also been discussed. With the same input data and parameters as in and selection ratio = 0.3, AVR system, many performance estimation schemes are performed to examine whether the proposed method has better performance than the PID TUNER method in solving the optimal Proportional Integral Controller parameters [5].

OBSERVATION AND RESULT

The time is the major parameter on which the performance of different methods has been evaluated. The various results of different paper are summarized in the table below,

Table 1: observation diffrent method

S. No.	Name of Another	Methods	Time (Sec)
1	Srinivasan Sundhararajan	GA	…….
2	P.Ua Pa Thi Reddy	PSO	……..
3	G. Madasamy	BFO	3.3
4	Anil Kumar	GA	2.9
5	Vivek Kumar Bhatt	PSO	2.2

CONCLUSION

This paper presents a survey of the work published on the application of different optimization techniques applied to solve the problems of automatic voltage regulator. In various optimization techniques that tackled the problem are overviewed and classified with their advantages and limitations critically discussed. In this paper, an evolutionary computing approach for determining the optimal values of the PID (Proportional-integral-derivative) controller has been studied and presented in this paper. The comparative analysis of the different techniques like, Particle Swarm Optimization (PSO), GA etc.

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