M. Tech (PE

Performance Improvement of PID Controller in Automatic Voltage Regulator of Generator

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ABSTRACT

AVRs are widely used in industrial applications to achieve stability and reliability in electrical devices. AVR controls alternator field excitation to get output. The AVR maintains voltage up to a predetermined load current despite changing generator speed and load. The synchronous generator's excitation control uses a silicon-controlled rectifier to improve overall efficiency. This improved the generator's performance. Excitation mechanism controls Voltage and reactive power. The generator excitation system is DC generators with slip rings and brushes or by AC generators with revolving rectifiers, known as brushless excitation. Both are synchronous machines. Controlling the excitation of the generator Reactive power is regulated by an automated voltage regulator (AVR). An AVR keeps a synchronous generator's terminal voltage constant.A control loop feedback mechanism (controller) known as a proportional-integral-derivative controller (PID controller) is one that is frequently utilized in industrial control system applications. A PID controller will determine an error value by taking the measured value of a process variable and subtracting it from the set point that the user has selected. The controller makes an effort to reduce the amount of mistake by making adjustments to the procedure by means of a controlled variable. First, classical PID tuning methods are presented, implemented, and their outcomes analyzed. Next, bio-inspired techniques are used to optimize PID parameters using a fitness function, and the results of the proposed algorithms are evaluated. Fitness and evaluation are reciprocals. Peak overshoot (Mp), rise time (tr), settling time (ts), and steady state error determine the fitness function (ess).MATLAB 14.10.0 is used to simulate the optimal tuning of PID settings for an AVR system based tuning of PID controller for AVR system has improved dynamic response and less settling time (ts).

Key Words: *Proportional-Integral-Derivative Controller (PID controller), Automatic voltage regulator (AVR), Peak Overshoot (Mp), Rise Time (Tr), Settling Time (ts), and Steady State Error (ess)*

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1. INTRODUCTION

Electricity companies have been running the energy systems at maximum capacity for the previous two decades, putting them dangerously close to their stable limits and threatening the overall system's security. An unstable and erratic pattern of generating terminal voltage damping has resulted in the stability of the electric grid has become a main priority and a major problem. Impacted. Increasing reliability and achieving nominal values can be accomplished in part by series capacitors, which are used to maintain a stable reference voltage in a power supply. Line for transporting electricity. However, a control system for the engine's exciter is necessary. As a result of its own cost, the regulator (automatic voltage) is drawing attention. Advantages In order to keep the generator voltage stable, the automatic generation system must be used. An electronic charge controller is used to regulate the flow of reactive electricity. AVR systems are designed to maintain the reference voltage of a system's terminals. An exact level of parallelism Thus, the AVR's stability. The electrical grid's safety is endangered if this system is implemented. Therefore, in both the transient and steady state, AVRs are critical components of the power system operations. Despite the power of today's control systems, Proportional plus Integral Derivative (PID)-type techniques with a different system Operators for AVR devices are popular. One of the most widely used controllers, the PID, is preferred by businesses due to its straightforward