

## Tuning Fractional Order Proportional-Integral-Derivative Controller Using Hybrid Genetic Algorithm Particle Swarm and Differential Evolution Optimization Methods for Automatic Voltage Regulator System

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**Abstract :** The fractional order proportional-integral-derivative (FOPID) controller or fractional order ( $PI\lambda D\mu$ ) is a proportional-integral-derivative (PID) controller where integral order ( $\lambda$ ) and derivative order ( $\mu$ ) are fractional, one of the important application of classical PID is the Automatic Voltage Regulator (AVR).The FOPID controller needs five parameters optimization while the design of conventional PID controller needs only three parameters to be optimized. In our paper we have proposed a comparison between algorithms Differential Evolution (DE) and Hybrid Genetic Algorithm Particle Swarm Optimization (HGAPSO) ,we have studied their characteristics and performance analysis to find an optimum parameters of the FOPID controller, a new objective function is also proposed to take into account the relation between the performance criteria's.

**Keywords :** FOPID controller, fractional order, AVR system, objective function, optimization, GA, PSO, HGAPSO

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