

## Optimization of Coefficients of Fractional Order Proportional-Integrator-Derivative Controller on Permanent Magnet Synchronous Motors Using Particle Swarm Optimization

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**Abstract :** Speed control and behavior improvement of permanent magnet synchronous motors (PMSM) that have reliable performance, low loss, and high power density, especially in industrial drives, are of great importance for researchers. Because of its importance in this paper, coefficients optimization of proportional-integrator-derivative fractional order controller is presented using Particle Swarm Optimization (PSO) algorithm in order to improve the behavior of PMSM in its speed control loop. This improvement is simulated in MATLAB software for the proposed optimized proportional-integrator-derivative fractional order controller with a Genetic algorithm and compared with a full order controller with a classic optimization method. Simulation results show the performance improvement of the proposed controller with respect to two other controllers in terms of rising time, overshoot, and settling time.

**Keywords :** speed control loop of permanent magnet synchronous motor, fractional and full order proportional-integrator-derivative controller, coefficients optimization, particle swarm optimization, improvement of behavior

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