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Performance Comparisons of MPEDE-Based Integer and Fractional-Order PID Controllers for a Cruise Control System

Mou Das Mahapatra, Shibendu Mahata, Ritu Rani De, Rajani Kanta Mudi, and Chanchal Dey

Abstract An effective technique for the optimal design of fractional-order proportional-integral-derivative (FOPID) controller in a cruise control application is presented. The minimization of step response error is formulated as an objective function. Such a proposal avoids evaluating the transient and steady-state response parameters at run-time of the optimizer. The optimization is carried out using a multi-population ensemble differential evolution (MPEDE) method. Comparisons with a classical PID controller also designed using MPEDE demonstrate the faster response time for the FOPID controlled system. The superiority of the proposed fractional controller over those of the recently reported models is demonstrated using various performance metrics.

Keywords Cruise control system · Fractional-order controller · Multi-population ensemble differential evolution · Optimization · PID controller

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