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PID CONTROLLER TUNING USING FRACTIONAL CALCULUS CONCEPTS

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Abstract

In this paper, we present a new approach for tuning PID controllers. The proposed method is based on the application of basic fractional calculus concepts. In fact, the controller specifications include the desired gain crossover frequency and the slope at that frequency (which is equivalent to prescribing a specific phase margin) of a fractional-order integrator inserted in the forward path of a unit feedback control system. The PID parameters are obtained by minimizing the integral of square error (ISE) between the step responses of the ideal closed-loop system (with the fractional-order integrator) and that of the actual closed-loop system with the PID controller. The obtained closed-loop system is robust to gain variations with step responses exhibiting an iso-damping property. Simulation examples are given to illustrate the effectiveness and applicability of the proposed scheme.

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