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Fractional-Order PI Controller Tuning Rules for Cascade Control System

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Abstract : The fractional–order proportional integral (FOPI) controller tuning rules based on the fractional calculus for the cascade control system are systematically proposed in this paper. Accordingly, the ideal controller is obtained by using internal model control (IMC) approach for both the inner and outer loops, which gives the desired closed-loop responses. On the basis of the fractional calculus, the analytical tuning rules of FOPI controller for the inner loop can be established in the frequency domain. Besides, the outer loop is tuned by using any integer PI/PID controller tuning rules in the literature. The simulation study is considered for the stable process model and the results demonstrate the simplicity, flexibility, and effectiveness of the proposed method for the cascade control system in compared with the other methods.

Keywords : Bode’s ideal transfer function, fractional calculus, fractional–order proportional integral (FOPI) controller, cascade control system
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