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Analytical Design of Fractional-Order PI Controller for Decoupling Control System

Authors : Truong Nguyen Luan Vu, Le Hieu Giang, Le Linh

Abstract : The FOPI controller is proposed based on the main properties of the decoupling control scheme, as well as the fractional calculus. By using the simplified decoupling technique, the transfer function of decoupled apparent process is firstly separated into a set of n equivalent independent processes in terms of a ratio of the diagonal elements of original open-loop transfer function to those of dynamic relative gain array and the fraction – order PI controller is then developed for each control loops due to the Bode's ideal transfer function that gives the desired fractional closed-loop response in the frequency domain. The simulation studies were carried out to evaluate the proposed design approach in a fair compared with the other existing methods in accordance with the structured singular value (SSV) theory that used to measure the robust stability of control systems under multiplicative output uncertainty. The simulation results indicate that the proposed method consistently performs well with fast and well-balanced closed-loop time responses.

Keywords : ideal transfer function of bode, fractional calculus, fractional order proportional integral (FOPI) controller, decoupling control system
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