

Design of IMC-PID Controller Cascaded Filter for Simplified Decoupling Control System

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Abstract : In this work, the IMC-PID controller cascaded filter based on Internal Model Control (IMC) scheme is systematically proposed for the simplified decoupling control system. The simplified decoupling is firstly introduced for multivariable processes by using coefficient matching to obtain a stable, proper, and causal simplified decoupler. Accordingly, transfer functions of decoupled apparent processes can be expressed as a set of n equivalent independent processes and then derived as a ratio of the original open-loop transfer function to the diagonal element of the dynamic relative gain array. The IMC-PID controller in series with filter is then directly employed to enhance the overall performance of the decoupling control system while avoiding difficulties arising from properties inherent to simplified decoupling. Some simulation studies are considered to demonstrate the simplicity and effectiveness of the proposed method. Simulations were conducted by tuning various controllers of the multivariate processes with multiple time delays. The results indicate that the proposed method consistently performs well with fast and well-balanced closed-loop time responses.

Keywords : coefficient matching method, internal model control (IMC) scheme, PID controller cascaded filter, simplified decoupler

Conference Title : ICMCE 2016 : International Conference on Mechatronics and Control Engineering

Conference Location : Singapore, Singapore

Conference Dates : July 04-05, 2016