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Robust Fractional Order Controllers for Minimum and Non-Minimum Phase Systems – Studies on Design and Development

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Abstract : The modern dynamic systems used in industries are complex in nature and hence the fractional order controllers have been contemplated as a fresh approach to control system design that takes the complexity into account. Traditional integer order controllers use integer derivatives and integrals to control systems, whereas fractional order controllers use fractional derivatives and integrals to regulate memory and non-local behavior. This study provides a method based on the maximumsensitivity (Ms) methodology to discover all resilient fractional filter Internal Model Control - proportional integral derivative (IMC-PID) controllers that stabilize the closed-loop system and deliver the highest performance for a time delay system with a Smith predictor configuration. Additionally, it helps to enhance the range of PID controllers that are used to stabilize the system. This study also evaluates the effectiveness of the suggested controller approach for minimum phase system in comparison to those currently in use which are based on Integral of Absolute Error (IAE) and Total Variation (TV).

Keywords : modern dynamic systems, fractional order controllers, maximum-sensitivity, IMC-PID controllers, Smith predictor, IAE and TV
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