A Novel Self-Tuning Fractional Order PID Control Based on Optimal Model Reference Adaptive System

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Abstract

This paper presents a novel self-tuning fractional order PID (FOPID) control based on optimal Model Reference Adaptive Control (MRAC). The proposed control technique has subjected to a third order system case study (power system load frequency control). The model reference describes the requirements of designer. It can be first or second order system. The parameters of MRAC have obtained using the harmony search (HS) optimization technique to achieve the optimal performance. Sometimes, the tuning of the five parameters of FOPID control online at same moment consumes more calculation time and more processing. So, this study proposes three methods for self-tuning FOPID control. The first method has been implemented to tune the two integral and derivative parameters only and the rest of parameters are fixed. The second method has been designed to adjust the proportional, integral derivative parameters while the other fractional parameters are constant. The last method has developed to adjust the five parameters of FOPID control simultaneously. The simulation results illustrate that the third method of self-tuning FOPID control can accommodate the sudden disturbance compared to other techniques. Also, it can absorb the system uncertainty better than the other control techniques.

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