Fractional Order PID Controller Design for Multivariable Systems using TLBO Algorithm

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Abstract

The multivariable systems have to control by using multiloop controllers and each closed loop controller has unique characteristics. The successful model structure for design of control system is extremely subject to the accurate choice of the tuning parameters (Kp, Ki, Kd, λ, μ) of the controller. The choice of optimal tuning parameters of Fractional Order PID (FOPID) controller leads to accurate controlling of desired level in multivariable system. Here, a FOPID controller design based on the advanced optimization technique called Teaching-Learning-based-optimization (TLBO) algorithm is proposed for multivariable system. The goal of paper is 1) The elimination of interaction between the control loops and 2) Reference tracking along the disturbance at each loop. These objectives are satisfied by using four cost function, namely, integral absolute error (IAE), integral square error (ISE), integral time absolute error (ITAE) and integral time square error (ITSE). Out of these cost functions, ITAE based FOPID controller design using TLBO algorithm provides better performance in terms of fast reference tracking and disturbance rejection in the loop. Moreover, the comparative analysis of convergence characteristics of each objective of the controller by using TLBO is presented. The simulation results show that the TLBO algorithm based FOPID controller for multivariable systems (2X2, 3X3) are more robust and exhibits superior response with respect to other algorithm.

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