Trajectory Tracking Control for Robot Manipulator using Fractional Order-Fuzzy-PID Controller

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Abstract

Robotic manipulator is a Multi-Input Multi-Output (MIMO), highly nonlinear and coupled system. Therefore, designing an efficient controller for this system is a challenging task for the control engineers. In this paper, the Fractional Order-Fuzzy- Proportional Integral Derivative (FO-Fuzzy-PID) controller is investigated for the first three joints of robot arm (PUMA 560) for trajectory tracking problem. To study the effectiveness of FO-Fuzzy-PID controller, its performance is compared with other three non model controllers namely Fuzzy-PID, Fractional Order PID (FOPID) and conventional PID. Genetic algorithm (GA) optimization technique was used for tuning parameters of FOPID and conventional PID controllers. Simulation results clearly indicate the superiority of FO-Fuzzy-PID controller over the other controllers for trajectory tracking, better steady state and RMS errors. All controllers were tested by simulation under the same conditions using SIMULINK under MATLAB2013a.

References


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**Index Terms**

Computer Science  
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**Keywords**

PUMA560, Quantico polynomial trajectories planning, Proportional Integral Derivative (PID) controller, Fuzzy-PID, Fractional Order PID (FOPID), Fractional Order-Fuzzy-PID
(FO-Fuzzy-PID).