Abstract

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GAIN SCHEDULING CONTROL WITH MULTI-LOOP PID FOR 2-DOF ARM ROBOT TRAJECTORY CONTROL

High accuracy trajectory tracking with a suitable rate of change in velocity is a very challenging topic in direct drive robot control. This challenge is due to the nonlinearities and input couplings present in the dynamics of robotic arms. In this paper, a 2 DOF robotic arm has been controlled by a multi-loop PID gain scheduling controller for a specific trajectory input. A nonlinear dynamic model of the manipulator has been obtained. A method of linearization was used for obtaining a linearized model for each set of individual operational points along the trajectory. A new proposed approach for merging between the Linearized models is introduced based on a weighting technique. A comparison between the output behaviour of the nonlinear model and the linearized model with the developed weighting technique has been carried out. A multi-loop PID controller has been designed for each individual linearized model as a MIMO plant. Then, the proposed controller was applied on the nonlinear plant using the weighting technique approach. The results have been compared at different trajectory inputs to guarantee the robustness and performance of the controller. The proposed approach has shown a simple design and good results over the other previous researches. Keywords Nonlinear Dynamic, Linearization, Gain Scheduling Control, PID, Weighting Technique, Fuzzy Logic.