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A comparative simulation and experimental study for control of a ball and plate system using model-based controllers

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Abstract

A ball and plate system (BPS) is a standard system case study in the control engineering which is known as a nonlinear, a multivariable and an unstable system, has been widely used to investigate and demonstrate new control strategies that can deal with nonlinearities. In this paper, five control strategies are applied to control and stabilise a lab-made BPS prototype, particularly, linear model predictive control (LMPC), proportional-integral-derivative (PID), state feedback using pole placement, linear quadratic regulator (LQR) and linear quadratic tracker (LQT) controllers. These controllers have been simulated using MATLAB environment and then implemented using the Arduino Uno ATmega328P microcontroller. Therefore, MATLAB program is also used to evaluate the closed loop system responses and to determine the parameters and the gains for different controllers in a real-time fashion. Finally, a comparison as well as a superiority conclusions are presented for the used controllers for this BPS.

Keywords

ball and plate, linear quadratic tracker, model predictive control

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