FUZZY TRACKING CONTROL DESIGN WITH INPUT-OUTPUT CONSTRAINTS ON PENDULUM-CART SYSTEM

Name : Muhammad Altway
Advisor : Dr. Trihastuti Agustinah, ST., MT.

ABSTRACT

Pendulum-Cart System is an example of nonlinear system which is commonly used to examine the performance and the efficiency of various control methods. In this research, the control problem is to force the cart to track a given sine reference signal while the pendulum is in upright position. Pendulum-Cart System is represented by Takagi-Sugeno (T-S) fuzzy model for some operating points. Based on T-S fuzzy model, controller rule with the concept of Parallel Distributed Compensation (PDC) will be established. Since the control signal and the rail of the cart are limited and external disturbances may lead to the instability of the system, fuzzy tracking control scheme is designed by satisfying $H_\infty$ tracking performance and input-output constraints. The concept of Lyapunov’s stability is used to analyze the stability of designed system. Then, the design problem is formulated in terms of Linear Matrix Inequality (LMI) problem. Simulation and implementation results show that designed control system is able to force the cart to track a given sine reference signal and the constraints on signal control and cart position are satisfied. Furthermore, the system also has $H_\infty$ tracking performance in which $L_2$-Gain is less than a prescribed attenuation level.

Keywords : Takagi-Sugeno Fuzzy, Linear Matrix Inequality, $H_\infty$ Tracking Performance, Input-Output Constraints, Pendulum-Cart System
Halaman ini sengaja dikosongkan