

FUZZY SELF-ADAPTIVE SLIDING MODE CONTROLLER FOR PNEUMATIC CYLINDER ROD-PISTON MOTION PRECISION CONTROL.

Mohd Iskandar Putra*, Addie Irawan, Raja Mohd Taufika

Robotics and Unmanned Systems (RUS) Research Group,
Faculty of Electrical & Electronics Engineering,
Universiti Malaysia Pahang, 26600, Pekan, Pahang, Malaysia
skandarputra1995@gmail.com

Abstract:

This paper presents the Fuzzy Self-Adaptive Sliding Mode Controller (FSASMC) designed to control a pneumatic cylinder rod-piston motion and precision. The pneumatic system is widely used in the industry due to its advantages such as high weight to power ratio, high traveling speed, clean fluid medium and cost-effective in term of price and maintenance. However, due to the high nonlinearity behavior of pneumatic system the position control of the pneumatic system is still a challenging task. The most critical part in controlling the pneumatic system with various motion is in giving a stable pressure in chambers while the rod-piston is precisely controllable with any shape of control inputs and minimum friction as well. Therefore, FSASMC is proposed to cater both fast responses through Sliding Mode Control (SMC) and dynamic stability in pressures through Fuzzy Self-adaptive tuning using Fuzzy Logic Control (FLC) in which mainly focus on steady-state error. The proposed control system is verified and analysis was emphasized on crucial parameters for pneumatic rod-piston motion; steady-state error, velocity, pressure in pneumatic cylinder chambers and frictional force. Simulation results show that the proposed controller approach performing fast and accurate response for position control of the pneumatic rod-piston with better steady-state error, no oscillation, fast response and stable in air pressures.

Keywords : Pneumatic System; Sliding Mode Control; Fuzzy Logic; Adaptive Control; Motion Control

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