CONTROL OF A TWO-WHEELED LEGO EV3 ROBOT USING INTERVAL TYPE-2 FUZZY LOGIC WITH PARTICLE SWARM OPTIMIZATION

W.S.KIN, N.M.A GHANI, M.F.MASROM, N.F. JAMIN and N.A.A RAZALI

Faculty of Electrical & Electronic Engineering, Universiti Malaysia Pahang, 26600 Pekan Pahang
E-mail: normaniha@ump.edu.my
www.ump.edu.my

Abstract:
Two-wheeled robot self-balancing has gained much interest of researchers due to its nonlinear dynamics. This project is aimed to design an Interval Type-2 Fuzzy Logic Controller to control a two-wheeled LEGO EV3 robot self-balancing to keep it in the upright position. In this project, two-wheeled LEGO EV3 robot is modelled using SimWise 4D software and integrated with Simulink. The robot stability performance and output response are observed at the same time when the Simulink is executed. System identification is used to get the mathematical model of the system in state space based on input and output from SimWise 4D motion to compare both results. The state space is used during optimization of IT2FLS using Particle Swarm Optimization (PSO). The performances of Interval Type 2 Fuzzy Logic Controller (IT2FLC) and optimized IT2FLS are compared. The robustness of IT2FLS is observed during disturbance rejection by injecting different direction of 0.8N and 1.0N torque to the robot in first 15 seconds.

Keywords: Fuzzy Logic Controller; Mathematical Model; IT2FLS; IT2FLC

Acknowledgement

The work presented in this paper is supported by Research grant (RDU170502) from Faculty of Electrical and Electronics Engineering, Universiti Malaysia Pahang and Ministry of Energy, Science, Technology, Environment and Climate Change, MESTECC.