State of Libya

Ministry of Education

Al Asmarya Islamic University Faculty of Engineering

DESIGN AND IMPLEMENTATION OF BALL AND BEAM CONTROL SYSTEM USING PID & FUZZY LOGIC CONTROLLERS

This graduation project is submitted to Al Asmarya Islamic University in partial fulfilment of the requirements of the award of bachelor's degree in Electrical and Computer Engineering

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ABSTRACT

The ball and beam system is the most popular laboratory model used in the control system due to its simplicity and easiness in construction and control theoretically. However, this system is an open-loop system and nonlinearity in its dynamic. Due to these problems, the controller needs to be designed to stabilize the system. The system consists of the beam supported at both sides by lever arms and attached with a motor. The beam can be tilted about its horizontal axis and the ball will roll on the top of the beam with an acceleration that is proportional to the angle of the beam. The important objective of the system is to regulate the position of the ball along the beam to its reference position. This project is implemented in hardware using Arduino Uno board programmed by MATLAB/Simulink, and two different control approaches are designed and implemented in MATLAB: a classical controller, which is Proportional-Integral-Derivative (PID) controller, and an intelligent controller, which is Fuzzy Logic Controller (FLC) to improve the system response and compare the performance for each of them.

The results indicated that the performance of the FLC is not affected by the change of the system, whereas the PID controller is affected by the setpoint and initial position of the ball.