Design and Simulation of Control Systems for Field Survey Mobile Robot Platform.

Abstract

The aim of this study was to design automatic and accurate control systems for wheel speed and steering of an agricultural mobile robot. Three controllers, including lead-lag compensator, Proportional-Integral-Derivative (PID) and fuzzy logic controller were designed and simulated in this study to control the angular rate of the shaft of a DC motor actuator for a field survey mobile robot that moves between plants rows to perform image acquisition task through a digital camera mounted on a two link arm attached on the robot base. The response of the actuator model for each controller were determined and compared for a sinusoidal and a step input that simulated robot speed and positioning references respectively. Performance analysis showed the effectiveness of the PID and lead-lag compensator response for the wheel steering task, while the fuzzy logic controller design had a better performance in wheel speed control. The output of this analysis was a proved satisfaction of the proposed design criteria which results enhanced mobility of the robot in terms of fast response, speed control accuracy and smooth steering at row-end turnings.