

ABSTRACT

DC motor speed control is one of the important aspects in industrial control systems. One method that is often used is a PID (Proportional-Integral-Derivative) controller which is able to provide stable and precise system performance. To improve understanding and practical skills in the application of PID, this research aims to design an analog PID training tool specifically designed for DC motor speed control. This system includes hardware in the form of a PID analog circuit as well as software to monitor and analyze system performance. The prototype developed utilizes a potentiometer as a PID parameter controller, a DC motor as an actuator, and a speed sensor to provide feedback. Test results show that this tool is able to represent the working principle of PID well and provides an effective platform for studying and experimenting with DC motor control. The Ziegler Nichols method obtained the results of tuning the PID controller with optimal parameters $K_p = 2.475$, $K_i = 0.45$, and $K_d = 1$. The response analysis obtained rise time = 1.6584 s, settling time = 14.6048 s, overshoot = 17.6901%, and steady state error = 0.0395. From these results, the PID system is able to provide a fast and stable response with a good level of accuracy.

Key words: analog PID, speed control, DC motor, training tool, control system.