Experiment 1 — DC Motor / PID Control

Speed control in open- and closed-loop

Course: EEM441 **Semester:** Semester I (2025/2026)

Author: Farhan Aizuddin
Date: September 18, 2025

Contents

0.1 Introduction

This experiment covers the basics of DC motor actuation and PID control. You will measure motor speed under open-loop and compare with closed-loop P/PI/PD/PID controllers.

0.1.1 Learning Outcomes

After completing this lab, you should be able to: (i) acquire motor speed data, (ii) design a basic PID controller, and (iii) interpret step responses.

0.2 Methodology

0.2.1 Open-Loop Speed Control of a DC Motor

1. Switch on supply and measure reference voltages; calibrate variable voltages.
2. Disconnect the feedback path and drive the motor with a fixed duty cycle.
3. Record RPM vs. duty cycle and note steady-state behavior.

0.2.2 Closed-Loop Control

1. Connect the speed sensor (Hall/encoder) to the controller input.
2. Tune controllers: P, PD, PI, and PID. Record overshoot, rise time, and settling time.

0.3 Results and Discussion

Present plots of speed vs. time for each controller. Discuss stability margins and noise sensitivity.

0.4 Conclusion

Summarize key observations and recommended PID gains for the motor used.