MSE 312: MECHATRONICS DESIGN II

Electronics/Control Lab 2
DC MOTOR CONTROL: DESGN, ANALYSIS, AND SIMULATION

OBJECTIVES

To design and test feedback controllers in the Simulink/SimScape environment and utilize it in the PWM H-Bridge for driving a DC motor (system developed in Lab 1).

PREREQUISITES

- Matlab/Simulink 2020a or later
- Simscape Electrical
- Simulink
- Completion of LAB 1

REFERENCES

https://www.mathworks.com/help/physmod/sps/ug/example-modeling-a-dc-motor.html

LAB ACTIVITIES:

1. **Current Control:** Refer to the DC motor and H-bridge converter that you built in lab 1. Design and simulate a current controller that can control the motor current to a desired constant setpoint value. Tune your controller and improve its performance as much as you can. Change the load inertia, friction parameters, and current setpoints to test your controller. You may also connect your controller to a revolute joint single robotic arm under gravity and evaluate the performance of your controller., e.g., motor shaft rotating in a horizontal plane as shown in Figure 1.

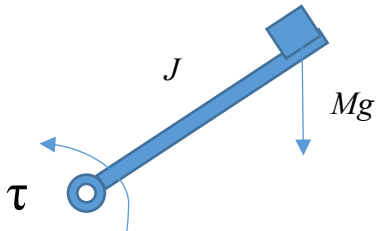

Figure 1: Single arm robot under gravity.

2. **Speed Control:** Design and build a speed controller such that it can track a desired speed profile. You may use the current controller designed in 1 above and use the cascade control method discussed in class for this purpose.

3. **Trajectory Tracking Control:** Design and build a quintic trajectory controller that can operate the motor from a given initial speed, position, and acceleration to the zero state (constant position, zero speed, and zero acceleration). Refer to the course notes for further details.

4. **Deliverables:**

   - Each group must provide a demo illustrating they have implemented the above activities during lab hours. The times for LAB 2 demo will be communicated to you in due course.
   - The design, analysis, and results for this lab should be included in your lab report for Electronics/Control part. In the report, please provide details of the design process including any assumptions and changes to the design so that the requirements for your project can be met (e.g., using a different motor, power supply, gear, H-bridge, etc).