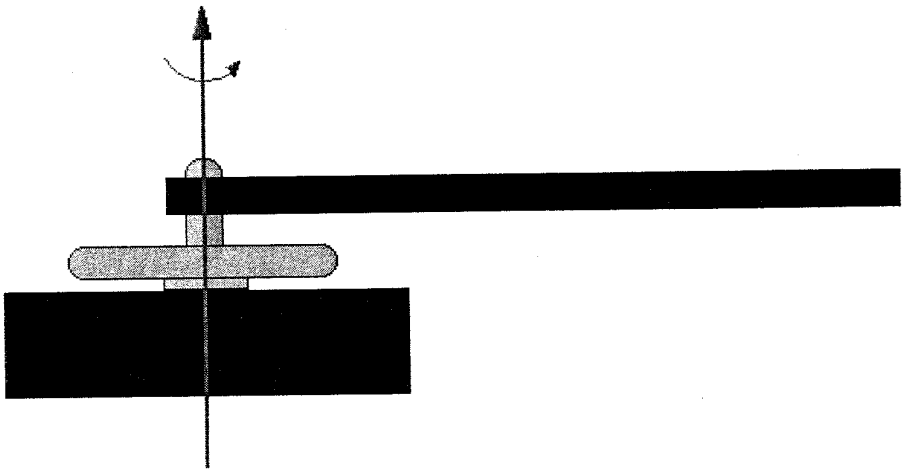
Washington University in St. Louis
ESE447
Robotics Laboratory

Instructor: Dennis Mell
Email: dmell@wustl.edu

LAB ASSIGNMENT – Single Link Position Control
TESTBED: Quanser Power Plant with single axis link



TASK OBJECTIVE: Use Simulink in conjunction with the Quanser interface modules and the above testbed to gain insight into closed-loop position control, expand experience with Simulink, and gain familiarity with simulation control.

TASK-1: Use Simulink with Quanser interface blocks and create a system which oscillates the link between -45° and 45°.

- Solve this problem as a position control closed-loop feedback system with a parallel PID controller.
- Construct the PID controller for individual blocks (do not use PID block).
- Explore the effects of each component of the controller "P", "I", and "D".
- This should be completed in two consecutive class periods (4 hours).

TASK-2: Oscillate the system with various input waveforms.

TASK-3: Move the link to any given θ and hold the position.

TASK-4: Create a control screen with three selectable modes with controls as listed below:

1. Move to zero position.
2. Move to position "X^{o}".
3. Oscillate between "$\pm X^{o}$".

QUESTIONS:

- Could you use this system as a position control device?
- What is the shape of the motion when looking at the position using the scope?
- Can you control the shape of the motion while oscillating?
- What can you say about the speed of the link throughout the entire oscillating region? (Think about this in terms of the amount of energy being delivered to the motor.)
- Can you predict the shape of the motion if the SRV-02 unit would be tipped on its side?
- Does this controller have any predictive nature?
- What is the primary affect of “P” in the transient region when the system is subjected to a step input?
- What is the primary affect of “P” in the steady state region when the system is subjected to a step input?
- What is the primary affect of “I” in the transient region when the system is subjected to a step input?
- What is the primary affect of “I” in the steady state region when the system is subjected to a step input?
- What is the primary affect of “D” in the transient region when the system is subjected to a step input?
- What is the primary affect of “D” in the steady state region when the system is subjected to a step input?