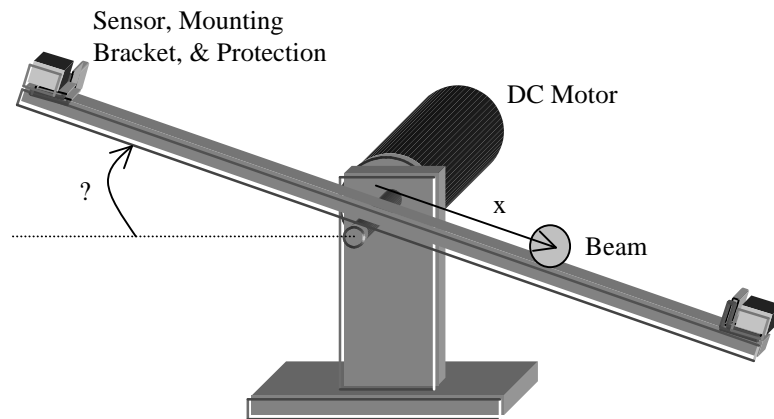


EE443L Lab 7: System Modeling, Simulation, and Control

Introduction System modeling and simulation provide useful and safe mechanisms for initial controller design. The ball and beam system shown below will be investigated through modeling, simulation, and controller design in this lab.

Procedure

1. For the ball and beam system shown determine the relationship between ball position x and motor torque t . Assume the ball is a ping pong ball with mass m much smaller than the $M = 0.22\text{kg}$ mass of the beam, that the beam will stay close to level when in operation, and that the friction of the ball on the beam is negligible.



2. Add the ball and beam dynamics to your simulink motor simulation where it is noted that the motor is directly connected to the beam. Ensure that x , θ are available for plotting and visualization.
3. Add a PID controller to the ball and beam to place the ball at any desired position.
4. Download the matlab function ballbeam.m which is a m-file for watching the ball and beam in action. You will need to store x , θ in the workspace as matrices from simulink so that they can be passed to this function in matlab. Use matlab's help to get more information on the ballbeam function.
5. By whatever means you'd like (root locus, etc.) adjust the PID controller until the ball accurately moves to the position you specify. Plot both x , θ versus time noting your desired ball position and gains. Also print out your simulink simulation.