

MECH 3140 Group Project (Due ~ Last Week of Classes)

Here is an initial summary of the things I will be looking for. The final requirements are subject to change (this is to give you a feel for what you will need to do). Members of each group will turn in a “grade” for each of the other members in the group at the presentation to evaluate how much each member contributed to the project. You may split up tasks however you wish, but each member of the group must understand the project as a whole! There will be a 1-hour group presentation/interview (20-30 minute presentation). I will ask questions specific to your project and expect that any group member can adequately answer the questions. I may also ask higher-level question for which no points will be deducted. You are to bring your presentation on a thumb-drive and as well as a print out of your slides (use multiple slides/page to save paper). One slide should show your matlab code where you simulate the control system.

You may choose to design a controller to control the position of the pendulum in the lab, or choose a simulation only project. If you choose a simulation only project, the system must be 3rd or 4th order.

1. Approval of Project (Due ~ 4/15/2005). Each group must see me to get approval for the project they wish to do. Each group should have a 1-page project description which includes:
 - a. Schematic of your system
 - b. What are the inputs? Outputs? DOF? System Order?
 - c. Initial time outline including division of tasks!
2. Develop the model for your system (EOMs)
 - a. Simulate your system (step responses)
 - b. Sketch the roots of each TF (poles and zeros)
 - c. Sketch the Bode Diagram of the system
3. Select actuators and sensors to control your system. You must select REAL actuators and sensors.
 - a. Model the dynamics of your actuators (including saturation)
 - b. Do your sensors/actuators have any dynamics/constraints that must be taken into account?
 - c. Simulate your system open loop (i.e actuator->system->sensor)
4. Develop a controller for your system
 - a. What type of controller was used
 - b. Where are the closed loop roots?
 - c. What is the bandwidth of the controller? DC Gain?
 - d. What is the step response of the closed loop system?

5. Test your controller
 - a. Simulate your controller to various disturbances – How does it perform?
 - b. Test the tracking ability of your controller. Does it correlate with the bandwidth of your closed loop system

6. (BONUS) Design a compensator (lead/lag?) using Bode Techniques
 - a. TF?
 - b. Determine K such that the maximum error is 1% of the disturbance input.
 - c. What is the closed loop TF?