

Assignment 3 – Mid-Term Project Update

For Assignment 3, you should:

- 1) **Define your “team”.** You may work alone or with a partner. Groups of 3 are acceptable, if your project is appropriately challenging. (E.g., if you are working with equipment outside the usual ECE 238 scope, which will require creating building an experimental apparatus or learning to program/operate equipment, etc.)
- 2) **Pick a project.** See page two for suggestions, if you do not already have your own topic in mind.
- 3) **Do some initial analysis.** Specific examples may include:
 - a. Derive the equations of motion
 - b. Linearize the equations of motion (above), if/as appropriate
 - c. Estimate system parameters / Perform system ID
 - d. Create a (MATLAB) simulation of the dynamics
 - e. Simulate an initial version of a controller
- 4) Prepare a BRIEF (5-min) report. **Presentations will be in class, Wed. April 28.** (We will have a projector, if you wish to use one.)
- 5) Submit a BRIEF (2-page) summary of your mid-term update. To enable you to respond to any in-class feedback, **the write-up is due Fri., April 30 at midnight.** Use the homework dropbox or the electronic submission site for “Assignment 3”.

The types of issues you may choose to address in 4 and 5 may include all or some of the follow. However, use your intuition, too. (Just aim to provide an overview of your work ahead.)

- a) **What is your dynamic system?** (overview)
- b) What are your control goals?
 1. What states are being controlled?
 - 2. Can you prove they are (in fact) controllable?**
 3. Particular bandwidth or accuracy goals (if any)?
 4. Any other requirements of special note?
 - c) What are the expected, primary challenges?
 1. Sensing?
 2. Non-linearities?
 3. Control method?
 4. Bandwidth / sampling time?
 - d) What is the model of your system?
 1. Non-linear vs linearized model, as appropriate
 - 2. Simulink or m-file models encouraged**
 - 3. Initial (simulation) control experiments encouraged**
 - e) **Prove this system physically exists.**

By 5pm TODAY (April 21): Circle your top 1-3 picks. (Number your preferences, if you have more than one still in mind.) **DROP ONE COPY OF THIS FORM PER GROUP IN THE DROPBOX outside of lab for ECE 238.** This doesn't commit you to a project; I just want some idea if we need extra resources, etc...

Your name: _____

Partners' names: _____

Some possible projects include:

1. Cart and Inverted Pendulum: Stand-up and stabilization
2. Cart and "Swinging" Pendulum: E.g., Can you "kick" a ball into a basket?
3. Seesaw and single cart: Balance the seesaw
4. Seesaw and two carts, joined by a "flexible linear joint" (spring)
5. Pendubot: There are several equilibrium positions... Switch between them?
6. Rotary inverted pendulum: Similar to cart IP, but perhaps "smoother"?
7. Bouncing ball: Control a classic nonlinear dynamic system
8. Magnetic bearing system: Sys ID; Notch filters; (Lead) control design

Suggested alternate projects (already suggested by students) include:

- A. WiFi / Cell phone robotics: Determine bandwidth; motion control
- B. Rijke Tube: Control of thermo-acoustic system
- C. Helicopter apparatus: Stabilize platform with mounted rotors

Or perhaps... - Your own control project?? (Describe briefly...)
