Due Friday, 6/24/16, start of class

NO LATE ASSIGNMENTS WILL BE ACCEPTED!

The goal of the project is to design a feedback controller $G_c(s)$ in the frequency domain to improve the performance of a chosen real-world single-input, single-output (SISO) linear system. Your results will be evaluated in MATLAB and/or Simulink simulation. Each individual will choose their own real-world open-loop system for controller design. For real-world project ideas, see Dr. Bob’s Atlas of Models and Transfer Functions, controls textbooks, and Internet sites. Each project topic must be different.

Specific steps to complete:

0) Find an real-world open-loop system to control and approve it with Dr. Bob (first-come, first-approved, starting immediately, but the signup deadline is Fri 5/20/16). Guidelines: SISO, linear (or linearized), real-world system with a clear actuator and sensor. It should not be too simple nor too complex. Be sure you can get the dynamic equation(s); this is required to start the project. It is entirely acceptable to find the equations and/or transfer functions from Dr. Bob’s Atlas of Models and Transfer Functions or another valid source, as long as you reference that source.

1) Perform system modeling and determine the open-loop characteristics. Plot impulse, unit step, unit ramp, and ramped-step responses. Perform the first three response plots using both MATLAB and Simulink to compare. The fourth (ramped-step) is easiest using Simulink.

   **Turn in an interim report on Friday 6/10/16, covering step 1. Max grade 70% if not submitted.**

2) Design a linear feedback controller $G_c(s)$ to achieve desired performance according to stated specifications (you determine the specifications). Depending on your system, the important considerations are transient response, steady-state error, stability, sensitivity, and disturbance-rejection. You must try at least three different forms/methods for $G_c(s)$ – report them all with one selected as the “best”. Include an output attenuation correction factor and a pre-filter if necessary in each case. Follow the steps for controller design from the ME 3012 NotesBook for each controller – organize your report according to these steps too.

3) Compare the closed-loop output performance to the original open-loop results (only for the most important input function to your real-world project, e.g. unit step). In addition to output response plots, also plot input effort vs. time, with and without the pre-filter; comment on real-world feasibility regarding required input. Also, subject your controllers to a disturbance in simulation and discuss the results. Input efforts and disturbance responses generally help in choosing the “best” controller.

4) Discussion – comment on tradeoffs, difficulties, real-world considerations, etc.

Each individual will present their results orally to the class on Friday 6/24/16 and the final report is due in class on the same day. We will treat these in-class presentations as a learning experience. Presentations are important and will form a part of your project grade. Be sure to plan ahead; use a professional PowerPoint presentation with plenty of graphical results.

**Final Written Report Format. (Include lots of images, photos, graphs, etc.)**

Memo (serves as your abstract)
1. Objectives
2. Physical System Description and Linear Model
3. Open-Loop Behavior
4. Performance Specifications for Design
5. Controller Designs
6. Open- vs. Closed-Loop Results and Discussion
7. Conclusion

Appendices (Verification of Results, MATLAB code, References, Other, if necessary)