AE 513 - Multivariable Control - Autumn 2021

Final Project

Due Date: Friday, Dec 17^{th}, 2019 @ 5PM

- **Brief:**. Choose a system to model (could be from work or a real-world application you're interested in), derive the dynamics, apply control techniques from class to control the system around an equilibrium point or trajectory. Simulate (or measure if it's a real system) the performance of the system in a variety of configurations/situations. Write a discussion of your results.
- **Comments:**. Please ask if you would like help selecting a system to model and deriving the dynamics. More interesting/complicated systems and more advanced control techniques will result in a higher grade. You can still get a good grade with simpler model, but your system should be more complicated than examples we've done in lectures or homeworks. If possible, you should apply at least two methods from class and compare them. If you have another technique you would like to experiment with that is outside the scope of the class, please talk to us. We will almost definitely approve it.

  The final project should be typed, use proper grammar, and contain all of the information below.

- **Content**

  1. **Introduction**

     The introduction should discuss the system you have chosen. What is the importance of the system, how is it used, where does it occur, and what is to be control or estimated (dynamic states or static parameters or both)?

  2. **Model**

     Give the mathematical equations that will be used to model your system. For dynamic systems, these equations should be for the state and for the measurement. Discuss why the particular formulation (continuous/discrete/mixed, linear/nonlinear) was chosen.

  3. **Methods**

     Discuss what control/estimation method(s) you will be using, and why you have chosen them. Discuss what you expect to see in terms of results. If at all possible, please compare at least two methods of for your system.

  4. **Results**

     The work in the paper should be of sufficient detail that a reader could take the given information and methods and be able to regenerate the results. This goal means that the document should be reasonably self-contained

  5. **Discussion and Conclusion**

     Discuss the results you obtained. Be clear about why they are or are not reasonable. Discuss how the results could be improved or extended.

6. **Reference**

   Citation for all the references that were used for completing the project.

7. **Appendix**

   Additional formulation, figures and Matlab code.

- **Grading Matrix**

Topic	**Description**	**Weight**
Introduction	Summary of system chosen and importance. What is to be controlled/ estimated?	10%
Model	Mathematical equations for system (state and observation). Justification for selection and comparison with other options.	25%
Methods	Describe control/ estimation method(s) to be used and why. Discussion of what are the expectations of simulation results. Comparison of two methods of controls.	25%
Results	Outcome of implementation. Sufficient details for simulation repeatability. Discussion of whether results are reasonable or not.	20%
Discussion and Conclusions	Summary of project methods and results. Discussion of how results could be improved or extended.	15%
Reference	Citation for all the references that were used for completing the project including text or any material taken from a published source. References should appear in numerical order.	5%
Appendix	Additional formulation, derivation, figures and Matlab code.	(included in prev.)