

Comparison Among Controller Designs

This exam is open book and open notes. You may consult additional references. You may even discuss the problems (with anyone), but you must prepare and turn in your own solutions, and give credit where credit is due as explained in the course information sheet on the course website. If you consult additional references, please use the notation used in our textbook when you write your solution, to show that you've understood as opposed to just reproduced the method.

Consider Example 5.13 of the textbook by Zak.

Linearize about $x = [\pi/k, 0]'$ where k is the last nonzero digit of your university ID. (Do not write your whole ID on your paper.)

1. Design a linear state feedback controller (Section 3.4) to place the poles at -4 and -5 .
2. Construct an LQ controller for the cost function

$$J = \int_0^{\infty} (x^2 + u^2) dt.$$

3. Construct a sliding controller (Sections 6.1 and 6.2).
4. Apply the method of Example 5.15.
5. Construct a linearizing feedback controller for the original nonlinear system.
6. Use matlab and/or simulink to compare the performance of the various controllers.

Please submit your m-files by email. The writeup may be submitted by email as well, so long as it is not more than 300k in size. Please submit a printout of your writeup, including derivation, plots and transcript unless you have already submitted everything by email.