ECE-521

Lab 5: Type One State Variable Feedback Systems

One degree of freedom system.

a) Set up the one degree of freedom system you used in lab 1.

b) Try and control the system with a controller you used in lab 1 and be sure you get similar results.

c) Simulate the system with a state feedback controller that forces the system to be a type one system. Utilize the lqr controller. Try and match a 1 cm step input and try to reach steady state in 0.5 seconds. Try and keep the magnitude of all gains (except maybe k_I) less than about 1.5. *This is just a guide, you may be able to get larger than 1.5 in magnitude.*

d) Modify your Simulink to work with the ECP system.

e) Run the ECP system with your controller.

f) Compare the simulated and actual response (compare1.m which you should have). Run the system long enough to have clearly reached steady state. The real cart position should have a position error of zero. Include this plot in your memo.

If your system seems to reach steady state (or nearly there) and starts to move violently, after resetting the system try and track a 0.5 cm input instead.

Two degree of freedom system.

a) Set up the two degree of freedom system you used in lab 2.

b) Try and control the system with a controller you used in lab 2 and be sure you get similar results.

c) Simulate the system with a state feedback controller that forces the system to be a type one system. Utilize the lqr controller. Try to have the position of the first cart follow a 1 cm step input and try to reach steady state in 0.5 seconds. Try and keep the magnitude of all gains (except maybe k_I) less than about 1.5. *This is just a guide, you may be able to get larger than 1.5 in magnitude.*

d) Modify your Simulink to work with the ECP system.

e) Run the ECP system with your controller.

f) Compare the simulated and actual response. Run the system long enough to have clearly reached steady state. The real cart position should have a position error of zero. Include this plot in your memo.

g) Redo steps (c) - (f) for the second cart.

If your system seems to reach steady state (or nearly there) and starts to move violently, after resetting the system try and track a 0.5 cm input instead.

Three degree of freedom system.

a) Set up the three degree of freedom system you used in lab 3.

b) Try and control the system with a controller you used in lab 3 and be sure you get similar results.

c) Simulate the system with a state feedback controller that forces the system to be a type one system. Utilize the lqr controller. Try to have the position of the first cart follow a 1 cm step input and try to reach steady state in 0.5 seconds. Try and keep the magnitude of all gains (except maybe k_I) less than about 1.5. *This is just a guide, you may be able to get larger than 1.5 in magnitude.*

d) Modify your Simulink to work with the ECP system.

e) Run the ECP system with your controller.

f) Compare the simulated and actual response. Run the system long enough to have clearly reached steady state. The real cart position should have a position error of zero. Include this plot in your memo.

g) Redo steps (c) - (f) for the second cart and then for the third cart.

If your system seems to reach steady state (or nearly there) and starts to move violently, after resetting the system try and track a 0.5 cm input instead.