EECE 360 Homework - State Space

1) For the RC circuit example presented in class which has an IC of -2V and a unit step input which occurs at t=2,



- a. Implement the state-space model in Simulink and verify the output (total response) matches the results presented in class.
- b. Using circuit analysis techniques, compute the transfer function.
- c. Implement the transfer function in Simulink and compare the results.
- d. What do you call the output of this transfer function?
- e. Refer to your 253 notes to recall the equivalent circuit model of the initial condition of a capacitor. Compute the transfer function of this circuit.
- f. Implement the above transfer function in Simulink and compare the results.
- g. What do you call the output of this tranfer function?
- h. In your Simulink model, add the outputs of the two transfer functions that you implemented. Compare the results.
- i. What do you call this output?
- j. Your colleague implements a Simulink model of the transfer function (Y/U) of a circuit. You, on the other hand, implement a state-space representation of the circuit. What can you do with your model that your colleague cannot?

- 2) For the following system:
 - Compute the state equation.
 - You are interested in the position of all 3 nodes. Write the output equation.
 - Compute the state transition matrix.
 - Compute the characteristic equation.
 - Write the signal flow graph.
 - Convert it into the electrical domain and repeat all of the above steps.



- 3) Add a force source F to the mass and repeat Q2.
- 4) Replace B_1 with a force source F and repeat Q2.
- 5) Replace K_1 with a force source F and repeat Q2.
- 6) Replace B_2 with a force source F and repeat Q2.
- 7) Replace K_2 with a force source F and repeat Q2.
- 8) Repeat Q3-Q7, replacing the force source with a velocity source V.