Homework #5: ECE 461

State Space, Canonical Forms, Heat Equation. Due Monday, October 2nd

1a) Write the differential equations which describe the following circuit

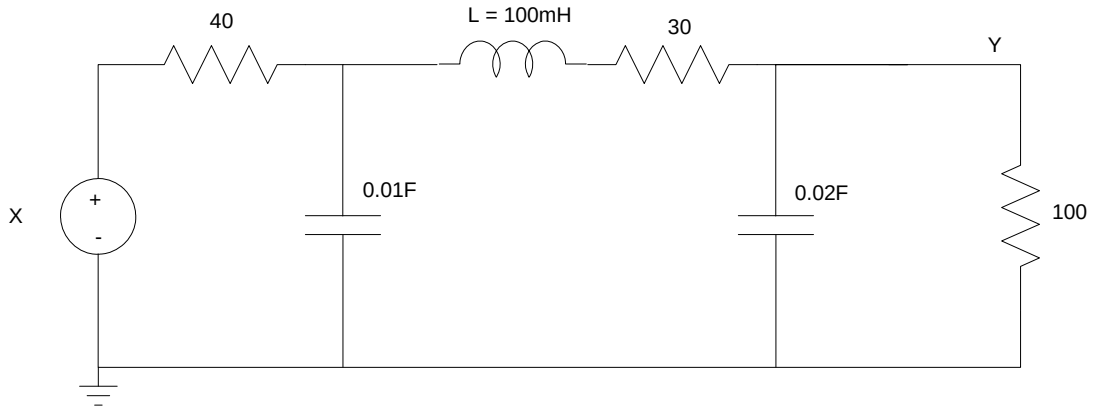
1b) Express these dynamics in state-space form

1c) Find the transfer function from X to Y

1d) From the dominant poles, predict what the step response will be like:

- DC gain
- 2% settling time
- % overshoot for a step input

1e) Find the step response for this system in Matlab and compare the actual response to what you predicted with the 1st or 2nd-order approximation.



Problem 1-5

3-Stage RC Filter

2a) Write the differential equations which describe the following circuit

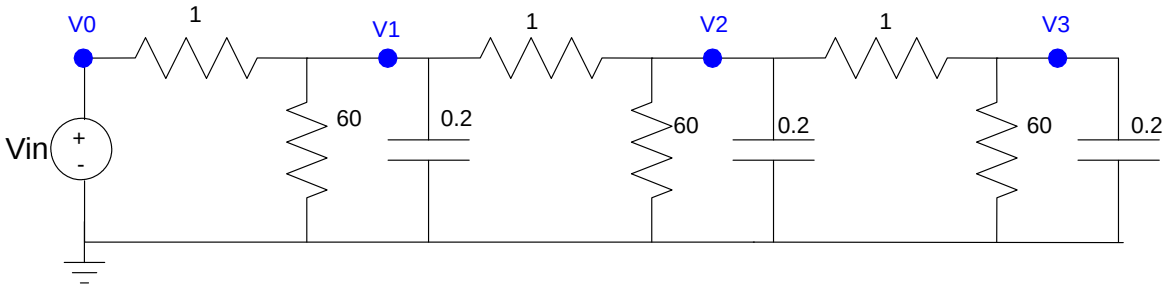
2b) Express these dynamics in state-space form

2c) Find the transfer function from Vin to V3

2d) From the dominant pole, predict what the step response will be like:

- DC gain
- 2% settling time
- % overshoot for a step input

2e) Find the step response for this system in Matlab and compare the actual response to what you predicted with the 1st-order approximation.



10-Stage RC Filter

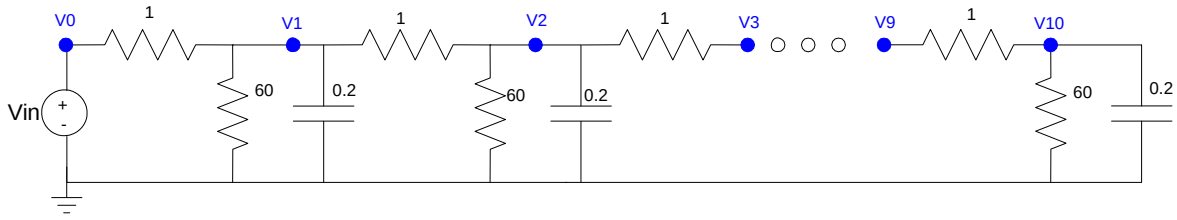
3a) Give the state-space model for the 10th-order RC filter shown below (Matlab printout of A,B,C,D preferred)

3b) Find the transfer function from Vin to V10

3c) From the dominant pole, predict what the step response will be like:

- DC gain
- 2% settling time
- % overshoot for a step input

3d) Find the step response for the 10th-order system in Matlab and compare the actual response to what you predicted with the 1st-order approximation.



4) Modify the program Heat.m to simulate the above 10th-order RC filter. Give a printout of the resulting code

note: We'll be using this simulation later on to check the controllers we design