

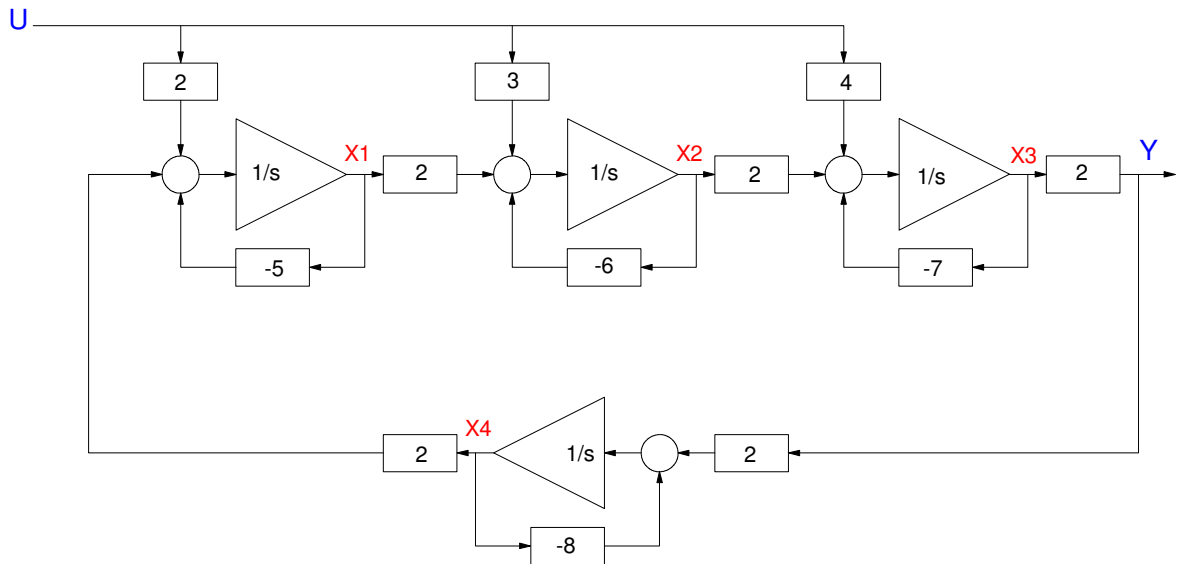
Homework #3: ECE 461 / 661

State-Space, Canonical Forms, RLC Circuits

State-Space

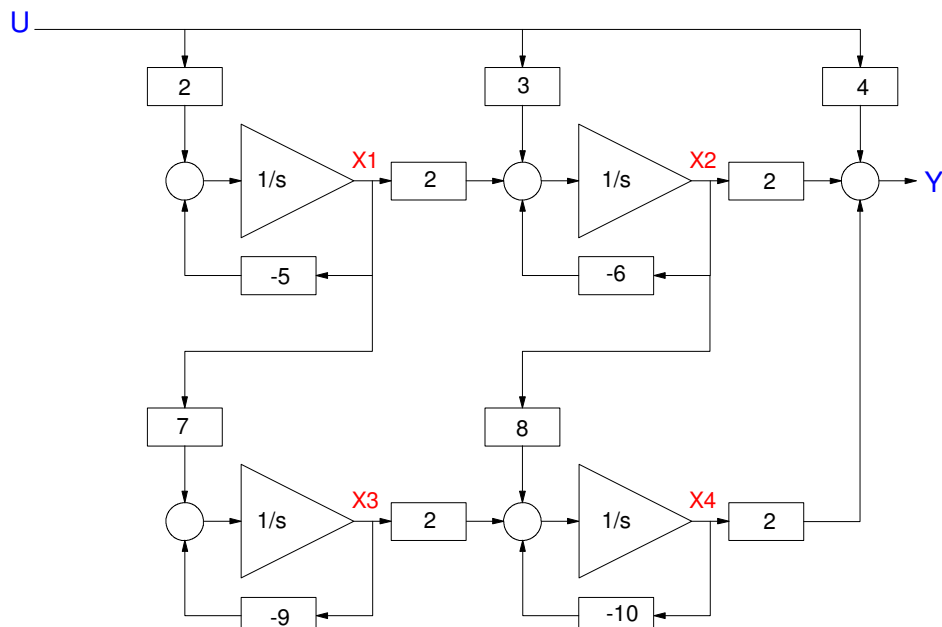
1) Express the following system in state-space form

- Find the transfer function from U to Y



2) Express the following system in state-space form

- Find the transfer function from U to Y



Canonical Forms

3) Express the following system in controller canonical form

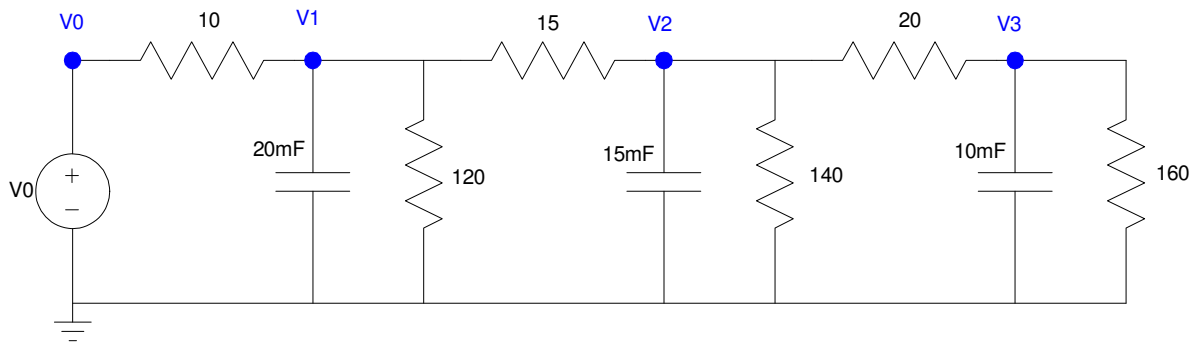
$$Y = \left(\frac{5(s+2)}{(s+3)(s+4)(s+5)} \right) X$$

4) Express the following system in Jordan (diagonal) canonical form

$$Y = \left(\frac{5(s+2)}{(s+3)(s+4)(s+5)} \right) X$$

RC Circuits

For the following RC circuit



5) Find the differential equations that describe this circuit

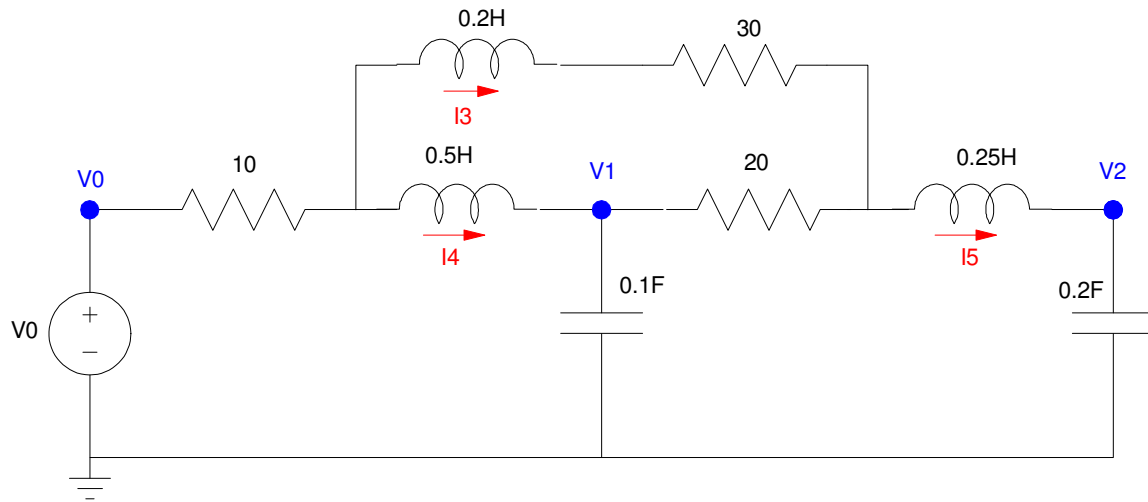
6) Find the transfer function from V_0 to V_3

7) Assume $V_0 = 0\text{V}$ and $V_3(0) = 1\text{V}$. What initial condition on V_1 and V_2 makes the energy in the system

- Decay as fast as possible?
- Decay as slow as possible?

RLC Circuits

For the following RLC circuit



8) Find the differential equations that describe this circuit

9) Find the transfer function from V_0 to V_2

10) Assume $V_0(t) = 0$ and $V_2(0) = 1V$. What initial condition on $V_1(0)$, $I_3(0)$, and $I_4(0)$ results in the energy in the system

- Decaying as fast as possible?
- Decaying as slow as possible?
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