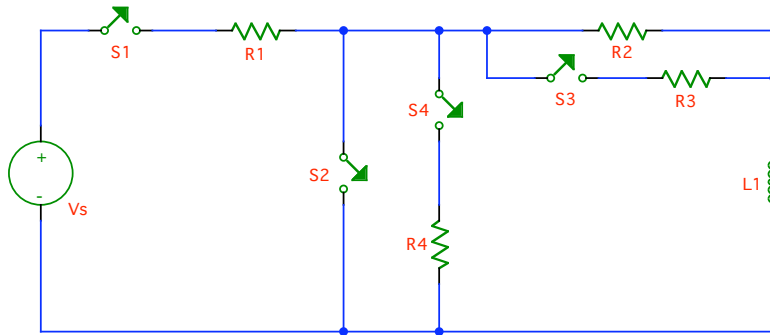


ECE 211 Fall 2003

Homework Six

(Due 10/29/03 at the beginning of discussion.)

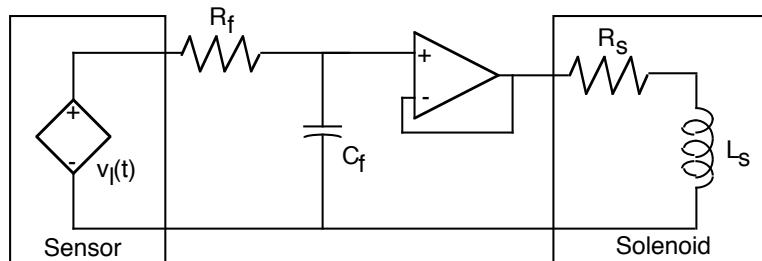
Problem One:



For the above circuit $V_s=100\text{V}$, $R_1=R_2=R_3=R_4=5R$, and $L_1=10\text{H}$.

- For time $t \leq 0$: Switch S_1 is closed. Switches S_2 , S_3 , and S_4 are open. What is the inductor current at time $t=0$?
- From time $t=0$ to time $t=2\text{s}$: Switches S_1 , S_3 and S_4 are open. Switch S_2 is closed. Write an equation for the inductor current as a function of time $0 \leq t \leq 2\text{s}$.
- From time $t=2\text{s}$ to time $t=4\text{s}$: Switches S_1 and S_4 are open. Switches S_2 and S_3 are closed. Write an equation for the inductor current as a function of time $2\text{s} \leq t \leq 4\text{s}$.
- For time $t \geq 4\text{s}$: Switches S_1 , S_2 and S_3 are open. Switch S_4 is closed. Write an equation for the inductor current as a function of time $t \geq 4\text{s}$?
- Graph the inductor current from $t=0$ to 10s .

Problem Two:



The above figure shows a fluid level sensor and shutoff valve solenoid. You are the engineer at our local chemical plant and are considering purchasing this sensor/solenoid-valve system. You have to turn off the valve within 0.2 seconds of reaching the point where the fill level sensor turns on or you will spill lots of nasty stuff and your neighbors will be very unhappy. The supplier says, "no problem", this will work. Is the supplier right? You ask for the specifications and here is what you get: the sensor voltage $V_1(t)$ changes from 0 to 12V at time $t=0$ when the tank level reaches the fill sensor, $R_f=4\text{k}\Omega$, $C_f=50\mu\text{F}$, $R_s=2\Omega$, $L_s=200\text{mH}$, and the solenoid valve turns off when the current reaches 3A.

- Graph the solenoid current vs. time from 0 to 1s.
- Calculate the time required to reach 3A.
- Would you buy this sensor (is the supplier's claim of $\leq 0.2\text{s}$ correct)?