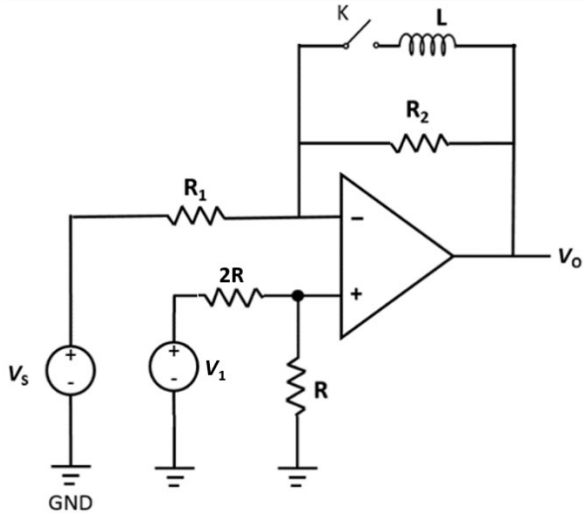
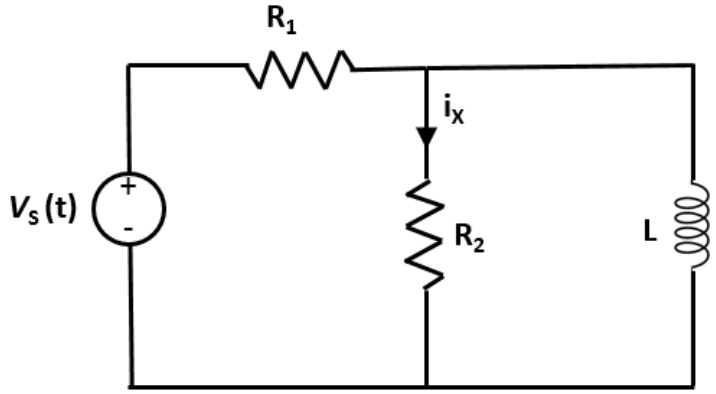
Homework 8

Problem 1 (4 pt)
Find the differential equation for v_o in the opamp circuit below for t>0 when the switch K is closed (You don't need to solve the equation). Assume the opamp is ideal with infinite gain.

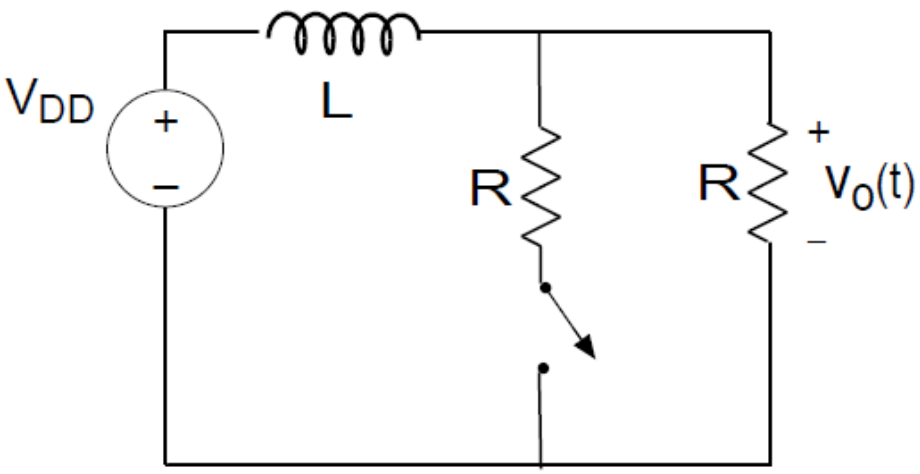


Problem 2 (4 pt)
Find the differential equation for i_x in the circuit to the right. Write it in terms of the signal source $V_S(t)$ and the component values R_1, R_2, L. (hint: write down the differential equation for certain node voltage first, and then substitute the node voltage with i_x).



Problem 3 (5+1 pt)

The circuit below is a model for power supply that provides a voltage VDD to two load resistors through a long wire that is modeled with an inductance, L. Both loads have resistance R. One of the loads is switched on and off, and as a result, more or less current is required from the supply. Because of the inductance, the changes in current cause the voltage supplied to the other load to be corrupted with voltage spikes. Suppose the switch has been closed for a long time and then opened at $t = 0$. Find $V_o(t)$ for $t > 0$ and plot $V_o(t)$. (Consider VDD, L, R are known).



Problem 4 (5+1 pt)

In the circuit below, V_1=3 V, R_1 = 2 KΩ, R_2 = 4 KΩ, R_3 = 4 KΩ, L = 2 mH. The switch has been turned to "1" for a long time and now is shifted to "2" at t = 0. Find V_L (t) for t >0 and plot V_L (t)