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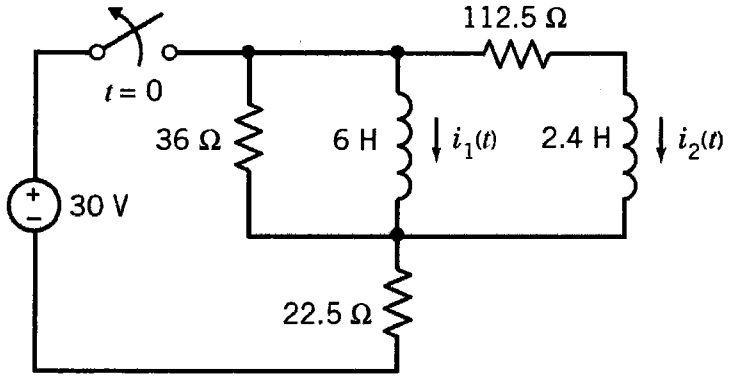
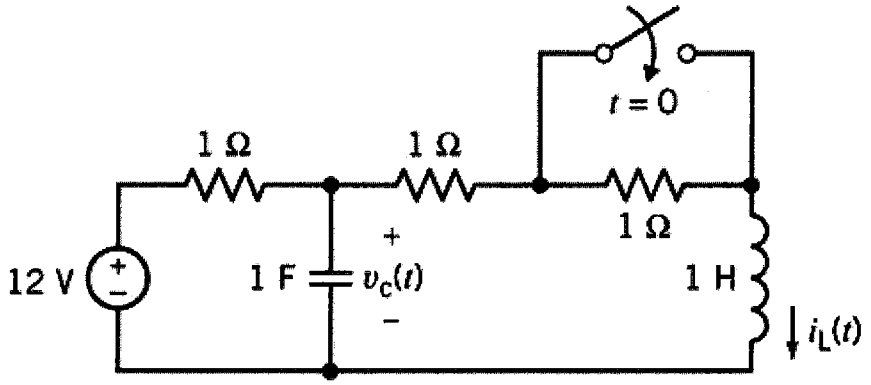
1. (15%) The circuit below is at steady state before switching. Determine the inductor current $i_2(t)$ for t > 0.

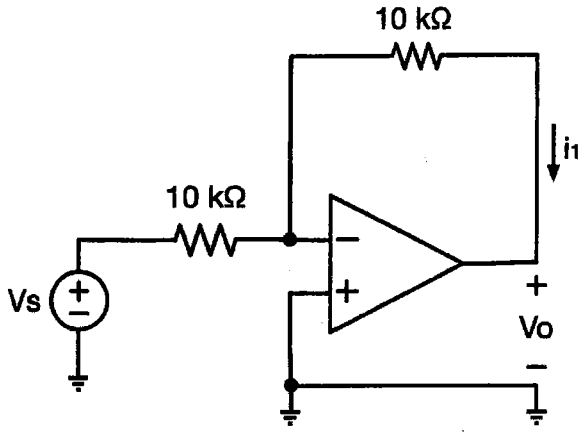


2. (15%) Determine the inductor current $i_L(t)$ for t >0, using Laplace transform:

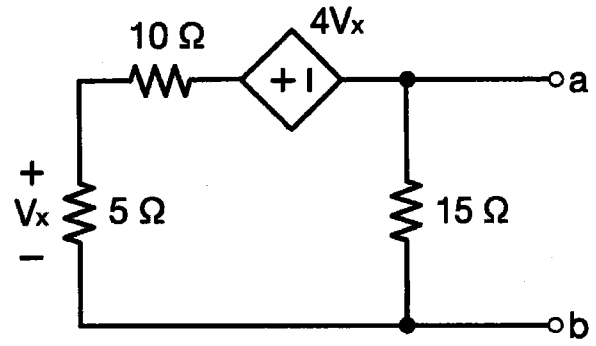


注意:背面有試題

3. (10%) Consider the given circuit. The operational amplifier has an open loop voltage gain of 10^5 V/V, input impedance of 1 MΩ, and output impedance of 10 Ω. Find the current i_1 when Vs is 1 V.



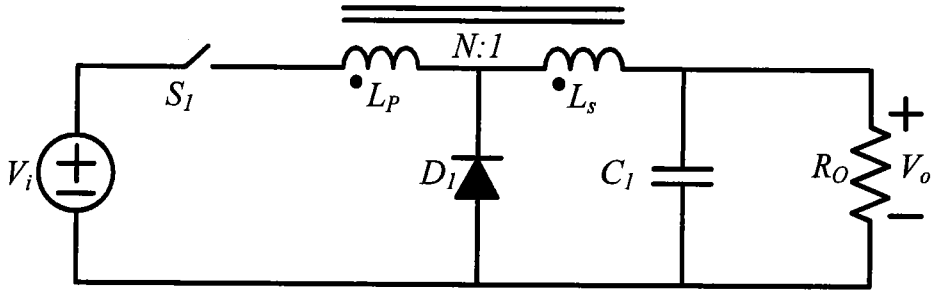
4. (10%) Find the Thevenin and Norton equivalents with respect to the terminals a and b for the given circuit.



5. (10%) A linear network has a short-circuit current of 20 A and an open-circuit voltage of 12 V. A 2-Ω resistive load is connected to this network. Determine the power dissipation on the load.

6. (3%) (a) Draw a buck-boost converter topology.
   (7%) (b) When operating with PWM control and in continuous conduction mode, determine its input to output voltage transfer ratio (V_o/V_i) in terms of the duty ratio D of the active switch.

7. (5%) (a) A buck converter with coupled inductors, with a duty ratio D and in continuous conduction mode is shown in the following figure. Determine its voltage stress imposed on switch S_1 and diode D_1.
   (5%) (b) Determine its input to output voltage transfer ratio (V_o/V_i) in terms of the duty ratio D.



8. (10%) An industrial firm has two electrical loads connected in parallel across the power source. Power is supplied to the firm at 5000 Vrms. One load is 30 kW of heating use, and the other load is a set of motors that together operate as a load at 0.6 lagging power factor and at 150 kVA.
   a. Determine the total current and the plant power factor.(5%)
   b. Please design a compensation circuit to achieve the unity power factor operation. Show your solution and show its circuit diagram. (5%)

9. (10%) Find the steady state of output voltage $v_o(t)$ in the given circuit using the superposition technique.