Problem # 1

The resistance, inductance, and capacitance in a parallel *RLC* circuit are 2000 Ω, 250 mH, and 10 nF, respectively.

a) Calculate the roots of the characteristic equation that describe the voltage response of the circuit.

b) Will the response be over-, under-, or critically damped?

c) What value of *R* will yield a damped frequency of 12 krad/s?

d) What are the roots of the characteristic equation for the value of *R* found in (c)?

e) What value of *R* will result in a critically damped response?

Problem #2

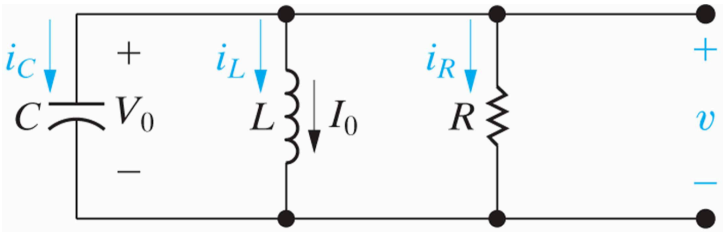
The voltage response for the circuit is known to be

$$v(t) = D_1 te^{-500t} + D_2 e^{-500t}, \quad t \geq 0.$$

The initial current in the inductor (I_0) is -10 mA, and the initial voltage on the capacitor (V_0) is 8 V. The inductor has an inductance of 4 H.

a) Find the values of *R*, *C*, D_1 and D_2.

b) Find $i_o(t)$ for $t \geq 0^+$.

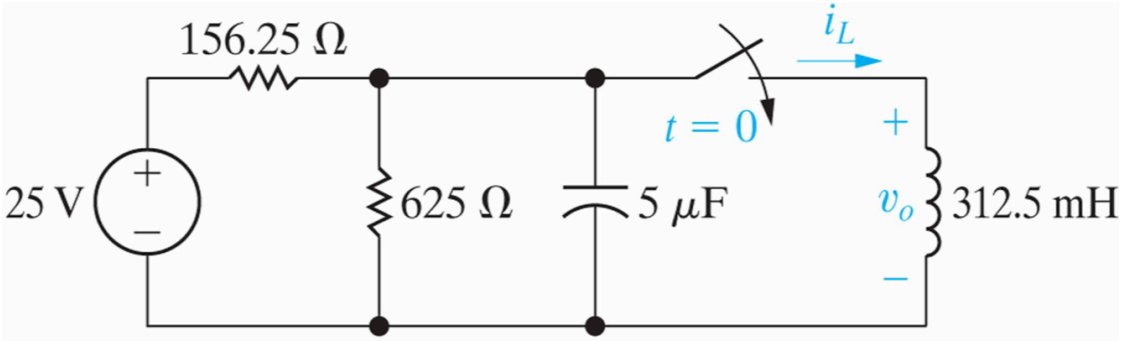


Problem #3

The switch in the circuit has been open a long time before closing at t=0. Find

a) $v_o(t)$ for $t \geq 0^+$,

b) $i_L(t)$ for $t \geq 0$.

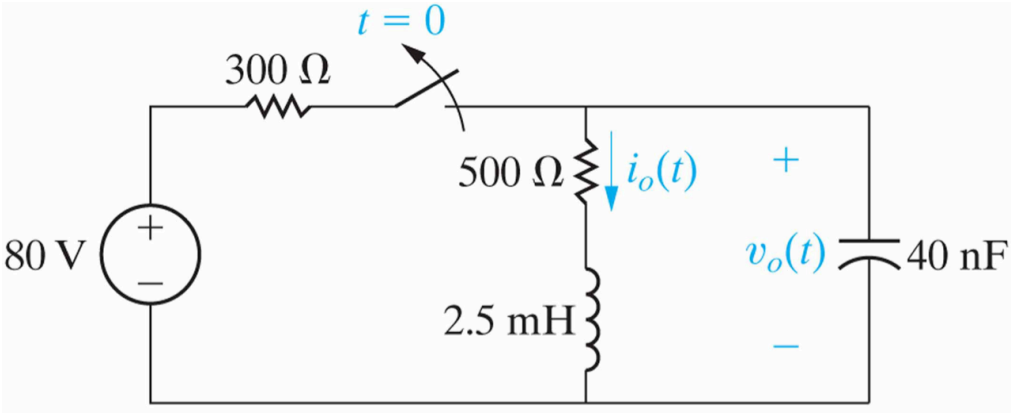


Problem #4

The switch in the circuit has been closed for a long time. The switch opens at $t = 0$. Find

a) $i_o(t)$ for $t \geq 0$,

b) $v_o(t)$ for $t \geq 0$.



Problem #5

The voltage signal is applied to the cascaded integrating amplifiers. There is no energy stored in the capacitors at the instant the signal is applied.

a) Derive the numerical expressions for $v_o(t)$ and $v_{o1}(t)$ for the time intervals $0 \le t \le 0.5$ s and $0.5 \text{ s} \le t \le t_{sat}$.

b) Compute the value of t_{sat}.