1. (25 points)

\[ v_g \text{ is a dc voltage source} \]

After having been open for a long time, the switch is closed at \( t = 0 \).

a. Give expressions for \( i_1(0+) \) and \( i_1'(0+) \), (i.e., \( di_1/dt \) at \( t = 0^+ \)), in terms of no more than \( v_g, R_o, R, L, \) and \( C \).

b. For \( L = 10 \, \mu\text{H} \), choose \( R \) and \( C \) so that the system is underdamped and \( \alpha = 3 \times 10^6 \text{ rad/s}, \omega_d = 4 \times 10^6 \text{ rad/s} \).

2. (25 points)

\[ v_g(t) \text{ switches instantaneously from } -v_0 \text{ to } +v_0. \]

a. Write the state-variable equations in terms of the state vector

\[ x = \begin{bmatrix} i_1 \\ i_2 \\ v \end{bmatrix} \]

b. Evaluate the state vector \( x \) at \( t = 0^+ \).
3. (50 points)

I_A = 1 A
R = 2400 Ω
L = 200 μH
C = 50 pF

a. After being closed for a long time, the switch is opened at \( t = 0 \). Write a numerical time-domain expression for \( i(t) \), the current through the capacitance. This expression must not contain any complex numbers.

b. State whether \( i(t) \) is underdamped, overdamped, or critically damped.