1. (25 points)

\[ \text{v}_g \text{ is a dc voltage source} \]
After having been open for a long time, the switch is closed at \( t = 0 \).

a. Give expressions for \( i_1(0^+) \) and \( i_1'(0^+) \) in terms of \( v_g, R_o, R, L, \) and \( C \).

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

2. (25 points)

At \( t = 0 \), \( v_g(t) \) switches instantaneously from \(-v_o\) to \(+v_o\).

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)

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.

$I_A = 1\, \text{A}$
$R = 2400\, \Omega$
$L = 200\, \mu\text{H}$
$C = 50\, \text{pF}$