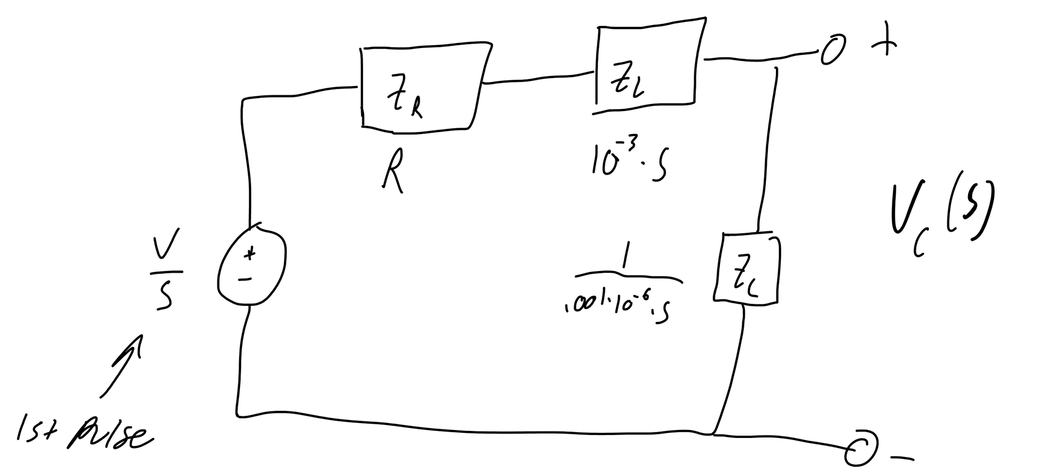
Lab 9.1.2

Tuesday, November 26, 2024 6:37 PM

1.2



$$V_C(s) = \frac{\frac{1}{.001\cdot 10^{-6} s}}{\frac{1}{.001\cdot 10^{-6} s} + 10^{-3}s + R} \cdot V_{in}(s)$$

$$V_{in}(s) = \frac{V}{s}$$

$$V_C(s) = \frac{V\cdot 10^{9}}{s^2\left(\frac{10^9}{s} + s\cdot 10^{-3} + R\right)}$$

$$\mathcal{L}^{-1}\{V_C(s)\} = V_C(t) = -\frac{Rve^{-500Rt}\sin\left(500t\sqrt{4\times10^6-R^2}\right)}{\sqrt{4\times10^6-R^2}} + v\left(1-e^{-500Rt}\cos\left(500t\sqrt{4\times10^6-R^2}\right)\right)$$

Given: $$v_C(t) = 3.5e^{-1.558\times10^6 t} - 8.5e^{-642\times10^3 t} + 4$$ ← from instructions

V must = 4 to have +4 in solution

roots of the characteristic equation

$$v_C(t) = 3.5e^{-1.558\times10^6 t} - 8.5e^{-642\times10^3 t} + 4$$

$$s_1, s_2 = -\frac{R}{2L} \pm \frac{1}{2}\sqrt{\left(\frac{R}{L}\right)^2 - \frac{4}{LC}} \quad \text{(Series)} \quad (9.10)$$ ← from Lab manual

$s_1 = -1.558\cdot10^6$, $s_2 = -642\cdot10^3$

Given: $L = 1mH$, $C = .001\ \mu F$

$$s_1 + s_2 = -\frac{R}{L} = -1.558\cdot10^6 - 642\cdot10^3$$

$$\frac{R}{1\cdot10^{-3}} = 1.558\cdot10^6 + 642\cdot10^3$$

$$R = 1\cdot10^{-3}(1.558\cdot10^6 + 642\cdot10^3)$$

$$R = 2200$$

$$\boxed{V = 4V \quad R = 2.2k\Omega}$$