Chad Rathbun

Hw#10 (1)

$i = 40mA \quad t \le 0 \qquad V(t) = L\frac{di(t)}{dt}$

$i(t) = (A_1 e^{-10000t} + A_2 e^{-40000t})A \quad t \ge 0$

$V(t) = (.02H)\left(\frac{d}{dt}\left(A_1 e^{-10000t} + A_2 e^{-40000t}\right)\right)$

$V(t) = -200A_1 e^{-10000t} - 800A_2 e^{-40000t}$

$t=0 \qquad\qquad t<0$

$28 = -200A_1 - 800A_2 \quad (1) \qquad .04 = A_1 + A_2 \quad (2)$

$A_2 = .04 - A_1$

$\begin{bmatrix} -200 & -800 & 28 \\ 1 & 1 & .04 \end{bmatrix} \quad A_1 = .1, \quad A_2 = -.06$

$V(t) = \left(-200(.1)e^{-10000t} - 800(-.06)e^{-40000t}\right)$

$= \left(-20e^{-10000t} + 48e^{-40000t}\right)$ ✓

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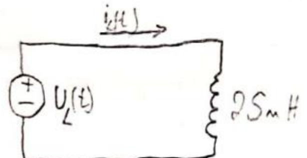
(2) $V_L(t) = 3e^{-4t}\,mV \quad 0^+ \le t \le 2s$

$V_L(t) = -3e^{-4(t-2)}\,mV \quad 2 \le t < \infty$



$i(0) = 1A$

$i_L(t) = \frac{1}{L}\int_0^t V_L(t)\,dt + i(0)$

$= \frac{1}{.0025}\left[\int_0^t .003\,e^{-4t}\right] + 1$

$= 1.2\left(\frac{1-e^{-4t}}{4}\right] + 1$

$= 1.3 - .3e^{-4t}\,A$

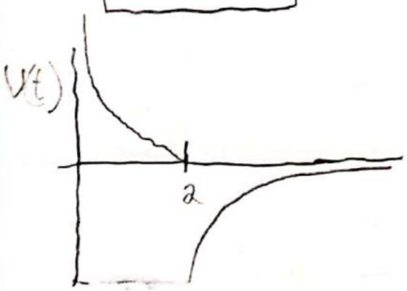
$i_L(2s) = 1.3 - .3e^{-4(2)}$

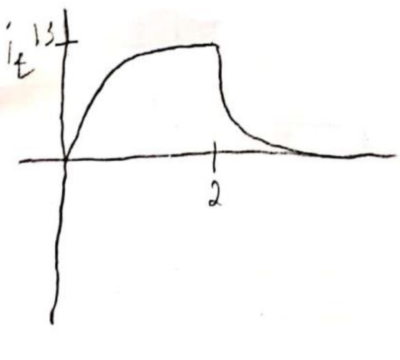
$= 1.2998\,A$

$i_L(t) = \frac{-.003}{.0025}\int_2^t e^{-4(t-2)}\,dt + 1.2998$

$= -1.2\left[\frac{e^{-4(t-2)} - 1}{-4}\right] + 1.2998$

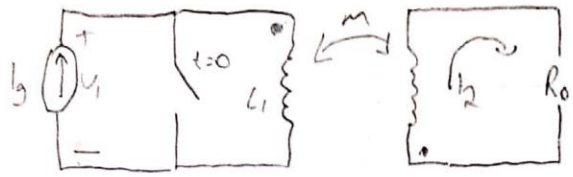
$= .3e^{-4(t-2)} + 1$





Chad Matthews

Hw# 10 (3) $L_1 = 5H$, $L_2 = .2H$, $M = .5H$, $R_0 = 10\Omega$



a) $I_2 R_0 + L_2 \frac{di_2}{dt} + M \frac{di_2}{dt} = 0$

$I_2(10) + .2\frac{di_2}{dt} + .5\frac{di_2}{dt} = 0$

$-.5\frac{di_2}{dt} = .2\frac{di_2}{dt} + 10 I_2$

$5e^{-10t} = 5e^{-10t}$ ✓

b) $I_s = e^{-10t} - 10 \quad t \geq 0$

$I_2 = 625e^{-10t} - 250e^{-50t} \quad t \geq 0$

$-.5\left(\frac{d}{dt} e^{-10t} - 10\right)$

$= 5e^{-10t}$

$= .2\left(\frac{d}{dt} 625e^{-10t} - 250e^{-50t}\right) + 10\left(625e^{-10t} - 250e^{-50t}\right)$

$= (-1250e^{-10t} + 2500e^{-50t} + 6250e^{-10t} - 2500e^{-50t}) \times 10^{-3}$

$= 5e^{-10t}$

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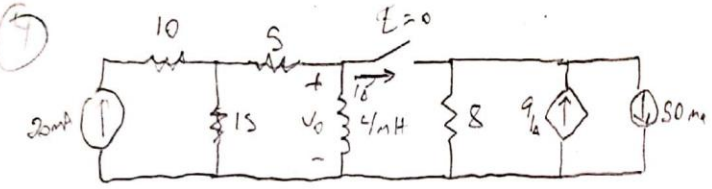
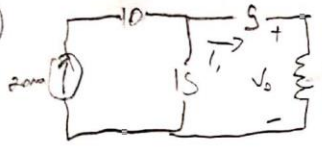
(1)

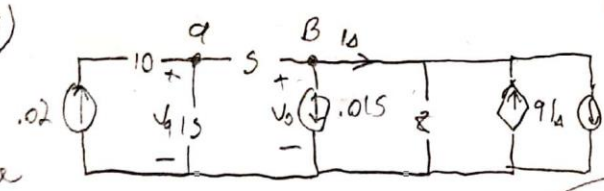


(a)



$I_1 = \frac{15}{15+5}(.02) = .015A$

ii)



node a: $\frac{V_a}{15} + \frac{V_a - V_0}{5} - .02 = 0$

$V_a + 3V_a - 3V_0 = .3$

$4V_a = .3 + 3V_0$

$V_a = .075 + .75V_0$

iii) $I_\Delta = \frac{V_0}{8} - 9I_\Delta + .05$

$10 I_\Delta = \frac{V_0}{8} + .05$

$I_\Delta = \frac{V_0}{80} + .005$

node B: $.015 + \frac{V_0 - V_a}{5} + \frac{V_0}{8} - 9I_\Delta + .05 = 0$

$13V_0 - 8V_a - 360I_\Delta = -2.6$

$15V_0 - 8(.075 + .75V_0) - 360\left(\frac{V_0}{80} + .005\right) = -2.6$

$V_0\left(13 - (8 \times .75) - \frac{360}{80}\right) = -2.6 + (8 \times .075) + (360 \times .005)$

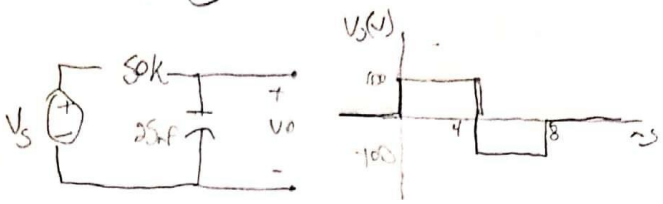
$2.5V_0 = -.2$

$V_0 = \frac{-.2}{2.5}$

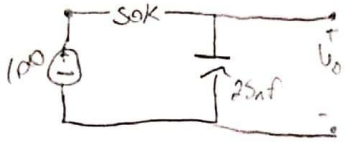
$V_0 = -0.08$

Chad Pathban

Hw #10 (5)



$0<t<4$ ms: $V_s = 100V$ | $t<0$: $V_s = 0$ | $4<t<8$ ms: $V_s = -100$ | $8<t<\infty$: $V_s = 0$



$$V_o = 100 - 100e^{-(800 \times 4\times10^{-3})}$$
$$t=4ms = 95.92$$

A) $\tau = RC = (50\times10^3)(25\times10^{-9})$
$= 1.25\times10^{-3}$ s

$t=4ms$ $V_o = V_o(\infty) + (V_o(0) - V_o(\infty))e^{-t/\tau}$
$= 100 - 100e^{-t/1.25\times10^{-3}}$ V
$= 100 - 100e^{-800t}$ V

$$V_o = -100 + 195.92e^{-800(.008 - .004)}$$
$$t=8ms = -100 + 195.92e^{-3.2}$$
$$= -92.01V$$

$t=8ms$ $V_o = -100 + (95.92 + 100)e^{\frac{-(t-.004)}{1.25\times10^{-3}}}$
$= -100 + 195.92e^{-800(t-.004)}$.

$V(t) = 0V$ $t<0$
$= 100 - 100e^{-800t}$ $0<t<4ms$
$= -100 + 195.92e^{-800(t-.004)}$ $4ms<t<8ms$
$= -92.01e^{-800(t-.008)}$ $8ms<t<\infty$

$$V_{ot} = 0(-92.01 - 0)e^{-\frac{t-.008}{1.25\times10^{-3}}}$$
$$= -92.01e^{-800(t-.008)}$$

B)