$i_s(t) = A_1 \cdot \cos(1000t + 90) + A_2 \cdot \cos(2000t - 90)$

Assume the system is in steady state. Find the current i_a at times

$t_1 = 4\pi$ ms: $i_a(t_1) = B_1$

$t_2 = 5\pi$ ms: $i_a(t_2) = B_2$

A1 : 6 A

A2 : 9 A

L : 1 mH

C : 250 uF

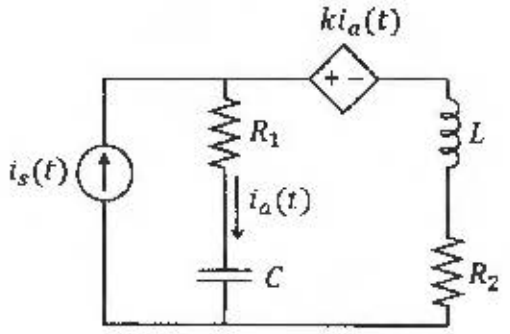
R1 : 8 ohm

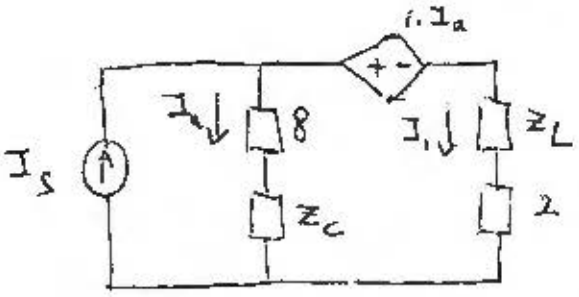
R2 : 2 ohm

k : 1 V/A

2 DIFFERENT ω !

WE NEED TO USE SUPERPOSITION





$\omega = 1000$: $Z_L = j \cdot 1000 L = j$

$Z_C = \frac{1}{j\omega C} = -4j$

$I_S = 6e^{j\frac{\pi}{2}} = 6j$

$\omega = 2000$: $Z_L = j\,2000\,L = 2j$

$Z_C = \frac{1}{j2000C} = -2j$

$I_S = 9e^{-j\frac{\pi}{2}} = -9j$

$I_1 = I_S - I_a \Rightarrow I_a(8 + Z_C) = 1 \cdot I_a + (I_S - I_a)(2 + Z_L)$

$\Rightarrow I_a = I_S \frac{2 + Z_L}{9 + Z_C + Z_L}$

① $\omega = 1000$: $I_a = 6j \frac{(2+j)}{(9-4j+j)} = \frac{6(-1+2j)}{3(3-j)}\frac{(3+j)}{(3+j)} = \frac{2}{10}(-5+5j) = -1+j$

$i_{a_1}(t) = \sqrt{2}\cos(1000t + 135^\circ)$

② $\omega = 2000$: $I_a = (-9j)\frac{2+2j}{9+3j-2j} = 2(1-j) \Rightarrow i_{a_2}(t) = 2\sqrt{2}\cos(2000t - 45^\circ)$

③ $i_a(t) = i_{a_1}(t) + i_{a_2}(t) = \sqrt{2}\cos\left(1000t + \frac{3\pi}{4}\right) + 2\sqrt{2}\cos\left(2000t - \frac{\pi}{4}\right)$

④ $t = 4\pi \cdot 10^{-3}$: $i_a = \sqrt{2}\cos\left(4\pi + \frac{3\pi}{4}\right) + 2\sqrt{2}\cos\left(8\pi - \frac{\pi}{4}\right) = \sqrt{2}\cos\left(\frac{3\pi}{4}\right) + 2\sqrt{2}\cos\left(\frac{-\pi}{4}\right)$

$= \sqrt{2}\left(\frac{-\sqrt{2}}{2}\right) + 2\sqrt{2}\left(\frac{\sqrt{2}}{2}\right) = -1 + 2 = 1$ $\quad \boxed{B_1 = 1\,A}$

$t = 5\pi \cdot 10^{-3}$: $i_a = \sqrt{2}\cos\left(5\pi + \frac{3\pi}{4}\right) + 2\sqrt{2}\cos\left(10\pi - \frac{\pi}{4}\right) = \sqrt{2}\cos\left(-\frac{\pi}{4}\right) + 2\sqrt{2}\cos\left(\frac{-\pi}{4}\right)$

$= \sqrt{2}\left(\frac{\sqrt{2}}{2}\right) + 2\sqrt{2}\left(\frac{\sqrt{2}}{2}\right) = 1 + 2 = 3$ $\quad \boxed{B_2 = 3\,A}$