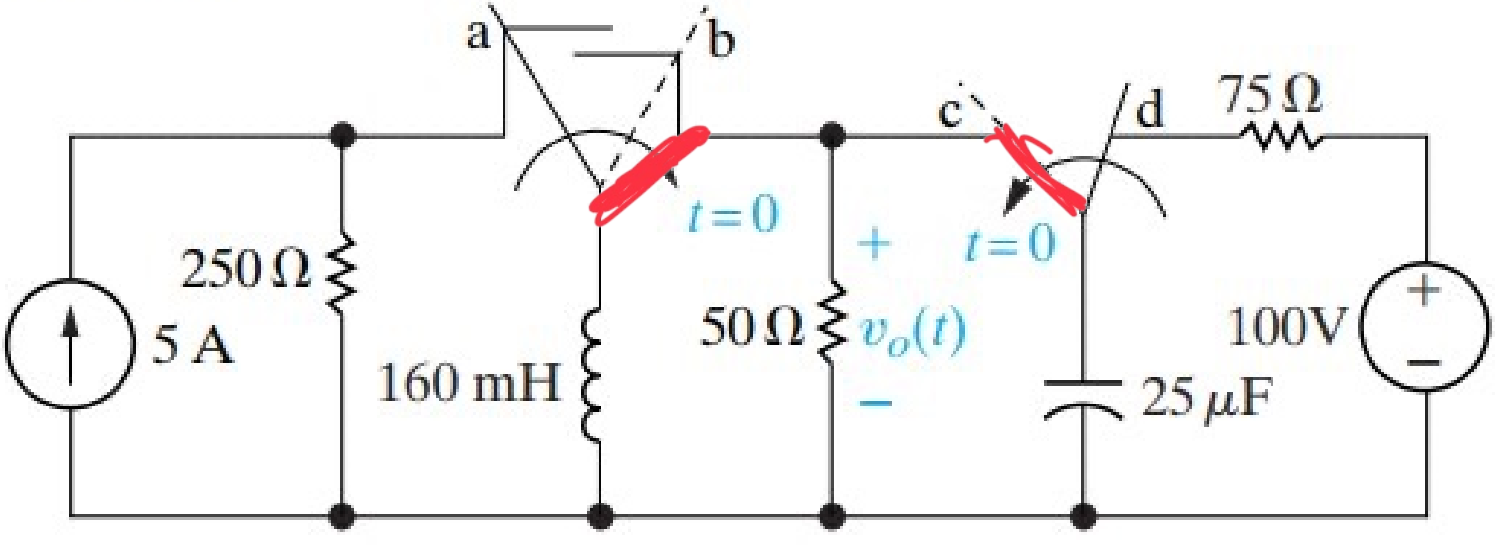
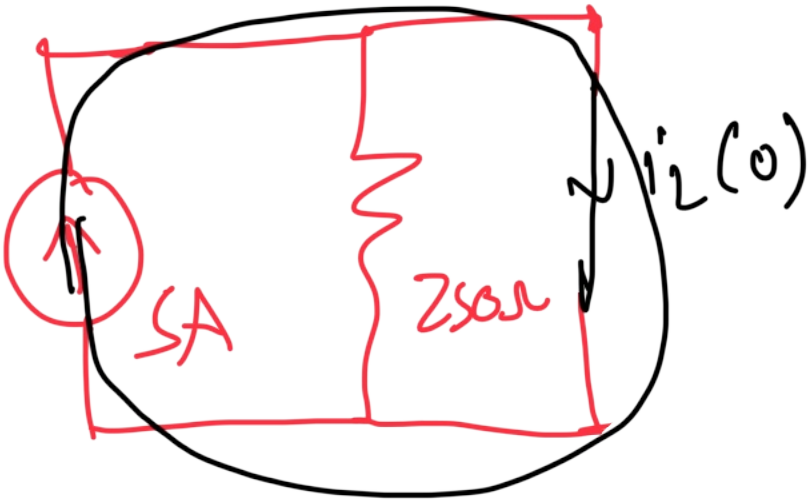
8.11 The two switches in the circuit seen in Fig. P8.11 operate synchronously. When switch 1 is in position a, switch 2 is in position d. When switch 1 moves to position b, switch 2 moves to position c. Switch 1 has been in position a for a long time. At $t = 0$, the switches move to their alternate positions. Find $v_o(t)$ for $t \geq 0$.

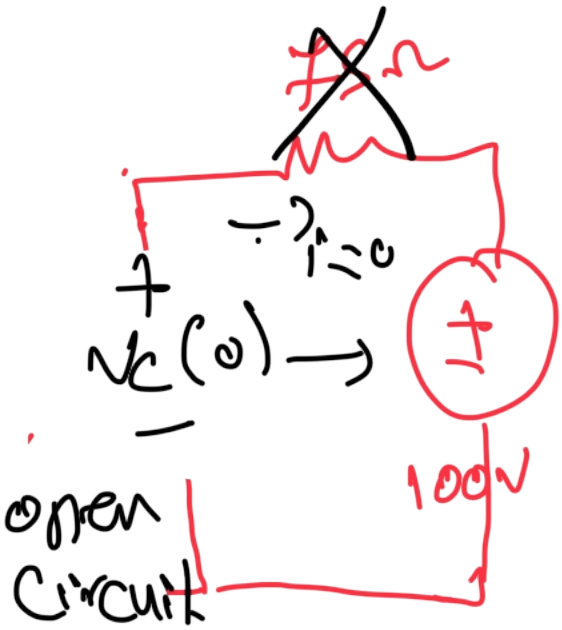
PSPICE
MULTISIM

Figure P8.11



$t < 0$

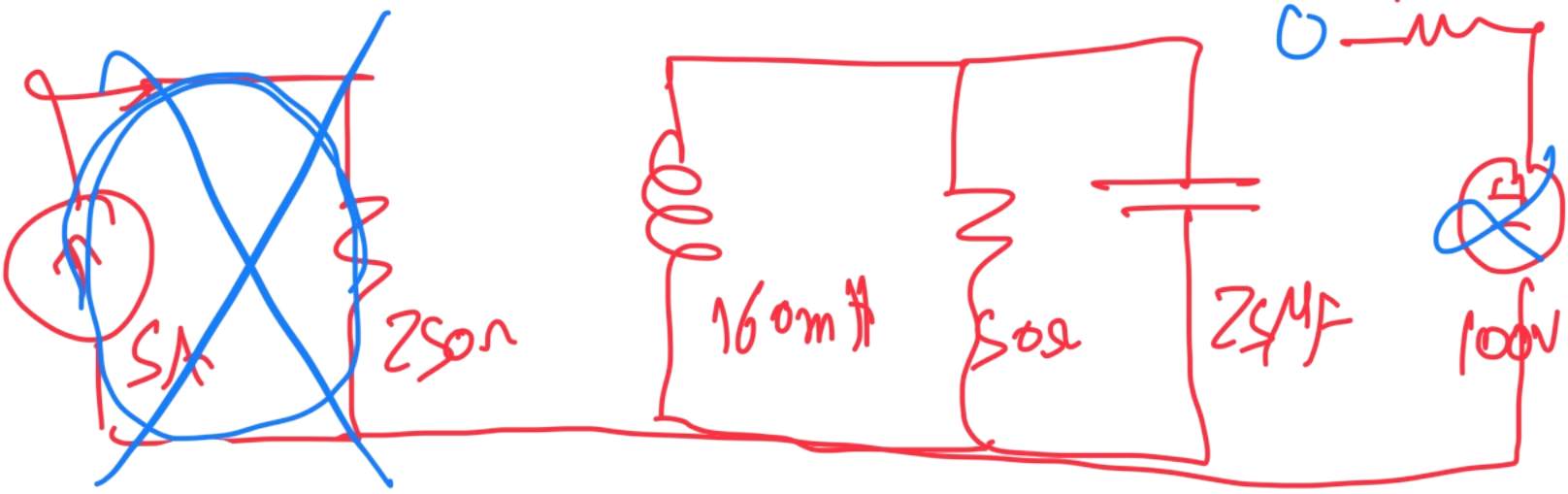


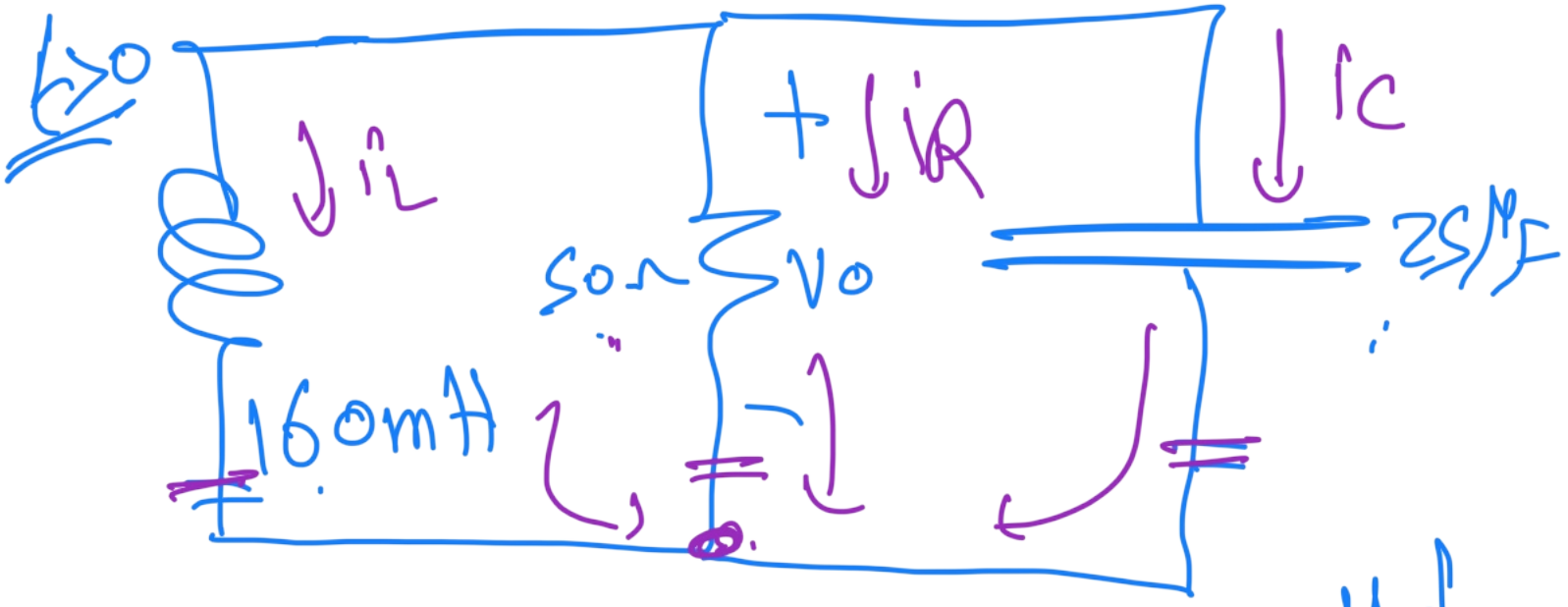


$$i_L(0) = 5A$$

$$v_c(0) = 100V$$

$t > 0$





Second order parallel

Natural Response

free source

$$\alpha = \frac{1}{2RC} = \frac{1}{2 \times 50 \times 25 \times 10^{-6}}$$

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{160 \times 10^{-3} \times 25 \times 10^{-6}}}$$

$\alpha = 400$ rad/s

$\omega_0 = 500$ rad/s

$\alpha < \omega_0$

$\Longrightarrow$ Under damped

$$v_d(t) = e^{-\alpha t}\left(B_1 \cos \omega_d t + B_2 \sin \omega_d t\right)$$

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} = \sqrt{500^2 - 400^2}$$

$\Longrightarrow \omega_d = 300$ rad/s

$$v(0) = B_1$$

$$v'(0) = -\alpha B_1 + \omega_d B_2$$

$$v(0) = v_c(0) = \boxed{B_1 = 100\,V}$$

$$\frac{dv_c}{dt} = \frac{i_c}{C}$$

$$i_C + i_R + i_L = 0$$

$$i_R = \frac{v}{R}$$

$$i_C = -(i_R + i_L)$$

$$i_C(0) = -\left[i_R(0) + i_L(0)\right]$$

$$i_C(0) = -\left[\frac{100}{50} + 5\right] = -7\,A$$

$$\frac{-7}{25 \times 10^{-6}} = -400 \times 100 + 300\,B_2$$

$$B_2 = \frac{-280000 + 40000}{300}$$

$$\boxed{B_2 = -800 \text{ V}}$$

$$v_o(t) = e^{-400t}\left[100\cos 300t - 800\sin 300t\right] \text{ V}$$

$$t \geq 0$$