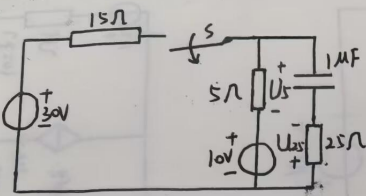


电路作业 (六)

7-3



(a)

$t < 0$ 时, 电路达到稳态, 电容看作开路, 此时

$$U_C(0-) = \left(\frac{30-10}{15+5} \times 5 + 10 \right) V = 15V$$

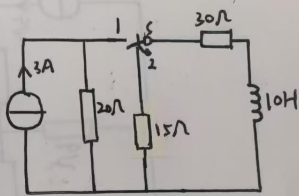
$\therefore U_C(0+) = U_C(0-) = 15V$

$t = 0+$ 时, 将电容视作 15V 的电压源.

$$i(0+) = \frac{15-10}{5+25} = \frac{1}{6} A$$

$$U_5(0+) = R_5 \cdot i(0+) = \frac{5}{6} V$$

$$U_{25}(0+) = R_{25} \cdot i(0+) = \frac{25}{6} V$$



(b)

$t < 0$ 时, 电路达到稳态时, 电感看作短路, 此时

$$i_L(0-) = \left(\frac{20}{20+30} \times 3 \right) A = 1.2A$$

$\therefore i_L(0+) = i_L(0-) = 1.2A$

$t = 0+$ 时, 可将 L 看作电流源

$$U_{30}(0+) = R_{30} \cdot i_L(0+) = 36V$$

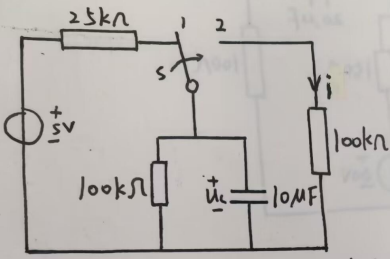
$$U_{15}(0+) = R_{15} \cdot i_L(0+) = 18V$$

$$U_{20}(0+) = i_S \cdot R_{20} = 60V$$

由 KVL: $U_{30}(0+) + U_{15}(0+) + U_L(0+) = 0$

$$U_L(0+) = -54V$$

7-5



$t < 0$ 时, 电路达到稳态, 电容看作开路, 此时

$$U_C(0-) = \left(\frac{5}{100+25} \times 100 \right) V = 4V$$

$\therefore U_C(0+) = U_C(0-) = 4V$

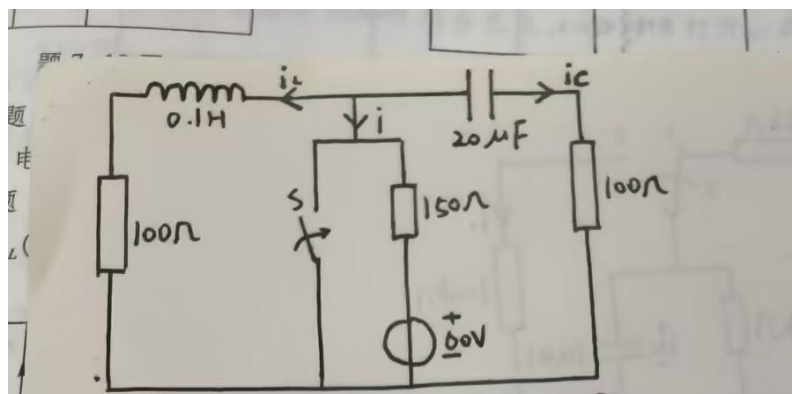
$t > 0$ 时, $R_{eq} = \frac{100 \cdot 100}{100+100} k\Omega = 50k\Omega$

$$\therefore \tau = R_{eq} \cdot C = 50 \times 10^3 \cdot 10 \times 10^{-6} s = 0.5s$$

$t \rightarrow \infty$ 时, $U_C = 0$

$$\therefore U_C(t) = 4e^{-2t} V$$

$$i(t) = \frac{U_C(t)}{R} = 40e^{-2t} \mu A$$



$t < 0$ 时, 电路稳态, 电容看作开路

电感视为短路

$$\text{此时, } i_L(0_-) = \frac{60}{150 + 100} \text{ A} = 0.24 \text{ A}$$

$$U_C(0_-) = R_{100} \cdot i_L(0_-) = 24 \text{ V}$$

$$\therefore U_C(0_+) = U_C(0_-) = 24 \text{ V}$$

$$i_L(0_+) = i_L(0_-) = 0.24 \text{ A}$$

$t > 0$ 时, 短路将整个电路

分为 3 个独立回路

电感回路: $t \rightarrow \infty$ 时, $i_L = 0$

$$\tau_L = \frac{L}{R} = 1 \times 10^{-3} \text{ s}$$

$$\therefore i_L(t) = 0.24 e^{-\frac{t}{\tau_L}} \text{ A} = 0.24 e^{-1000t} \text{ A}$$

电容回路: $t \rightarrow \infty$, $U_C = 0$

$$\tau_C = RC = 2 \times 10^{-3} \text{ s}$$

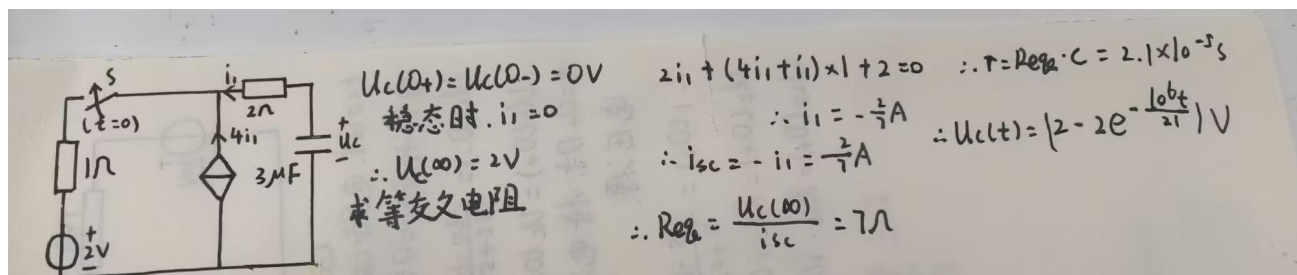
$$U_C(t) = 24 e^{-\frac{t}{\tau_C}} \text{ V} = 24 e^{-500t} \text{ V}$$

$$\therefore i_C(t) = -\frac{U_C(t)}{R} = -0.24 e^{-500t} \text{ A}$$

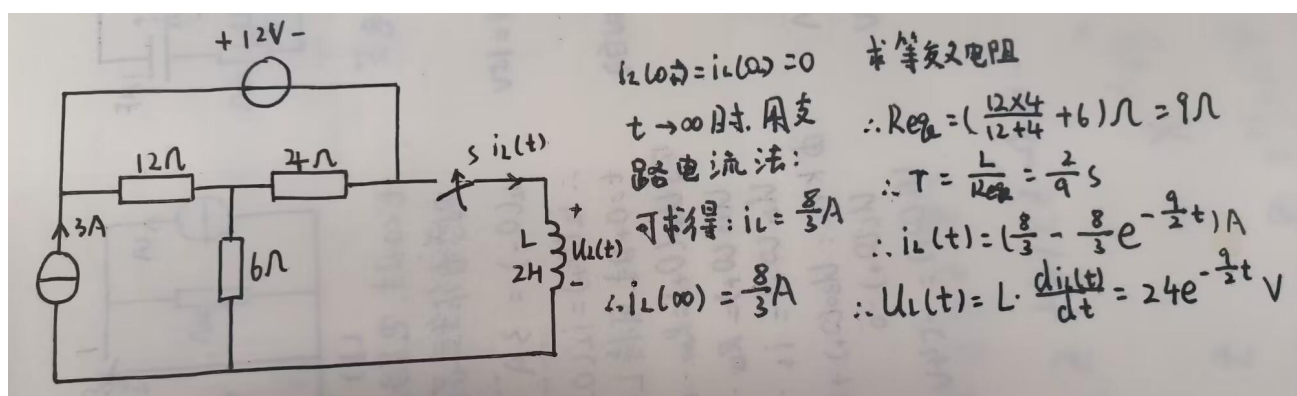
$$\text{由 KCL: } i = -(i_C + i_L)$$

$$\therefore i = (0.24 e^{-500t} - 0.24 e^{-1000t}) \text{ A}$$

7-12



7-13



7-15

