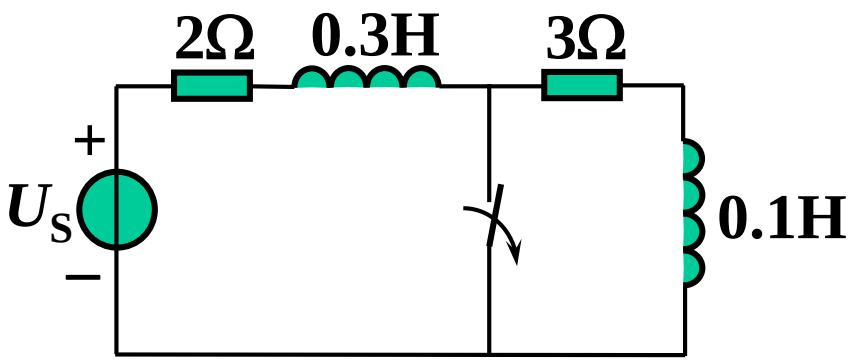
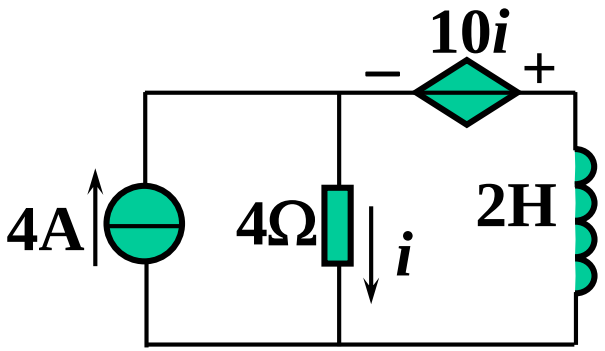
1、确定时间常数



(a)



(b)

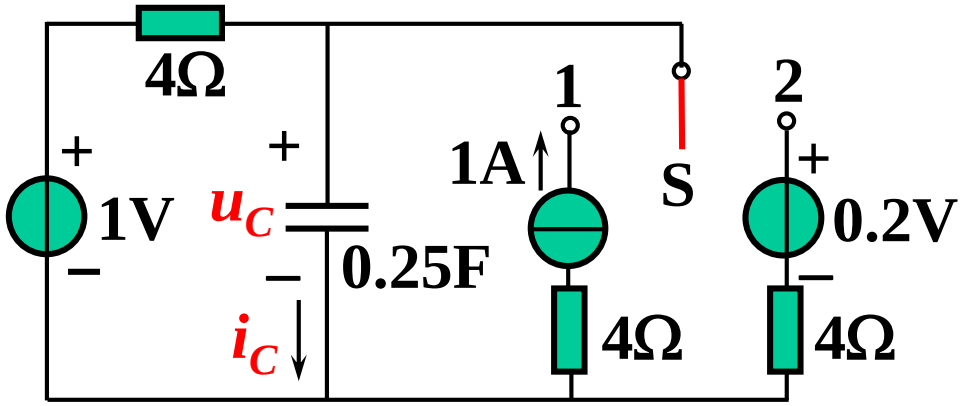
解　(a)　$\tau=(0.1+0.4)/(2+3)=0.08\text{s}$

(b)　$R_{eq}=14\Omega$

$\tau=2/R_{eq}=2/14=0.143\text{s}$

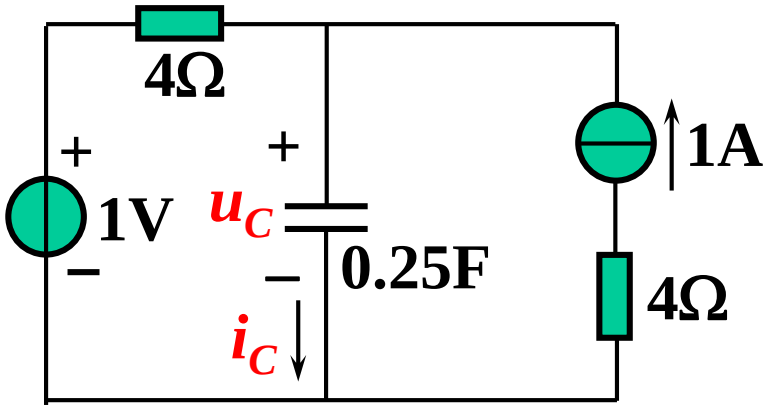
2、t=1s时开关S合向1，　t=2s时开关S合向2。

求$u_C(t)$, $i_C(t)$并画出曲线。



解　(1) $t < 1$s　　$u_C(1^-)=1$V，　$i_C(1^-)=0$

(2) 1s < $t \le$ 2s



$\tau = 1$s

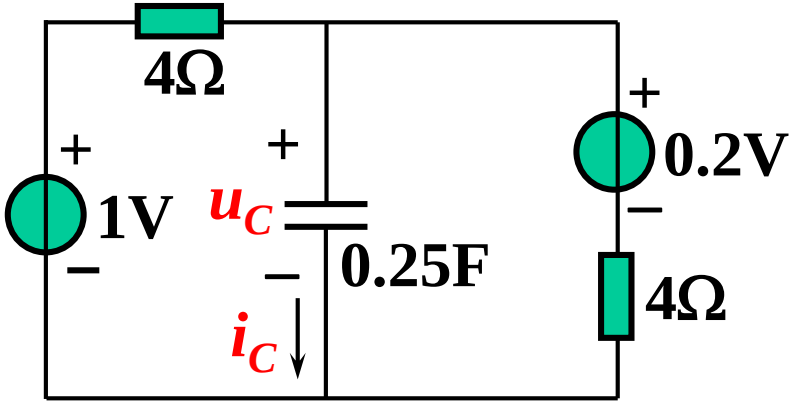
$u_C(1^+)=1$V　　$i_C(1^+)=1$A

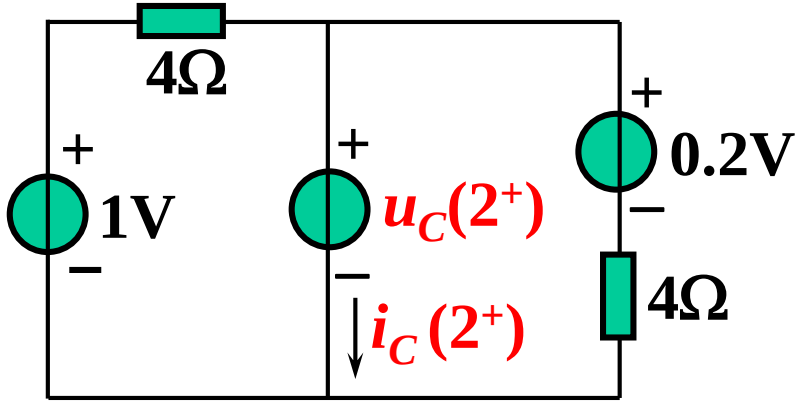
$u_C(\infty)=5$V　　$i_C(\infty)=0$

$u_C(t) = 5 - 4\mathrm{e}^{-(t-1)}$V

$i_C(t) = \mathrm{e}^{-(t-1)}$A

(3) $t>2s$





2^+电路

$u_C(t) = 5 - 4e^{-(t-1)}\text{V}$

$\tau = 0.5\text{s}$

$u_C(2^+) = u_C(2^-) = 3.53\text{V}$

$i_C(2^+) = -1.465\text{A}$

$u_C(\infty) = 0.6\text{V}$

$i_C(\infty) = 0$

$u_C(t) = 0.6 + 2.93e^{-2(t-2)}\text{V}$

$i_C(t) = -1.465e^{-2(t-2)}\text{A}$

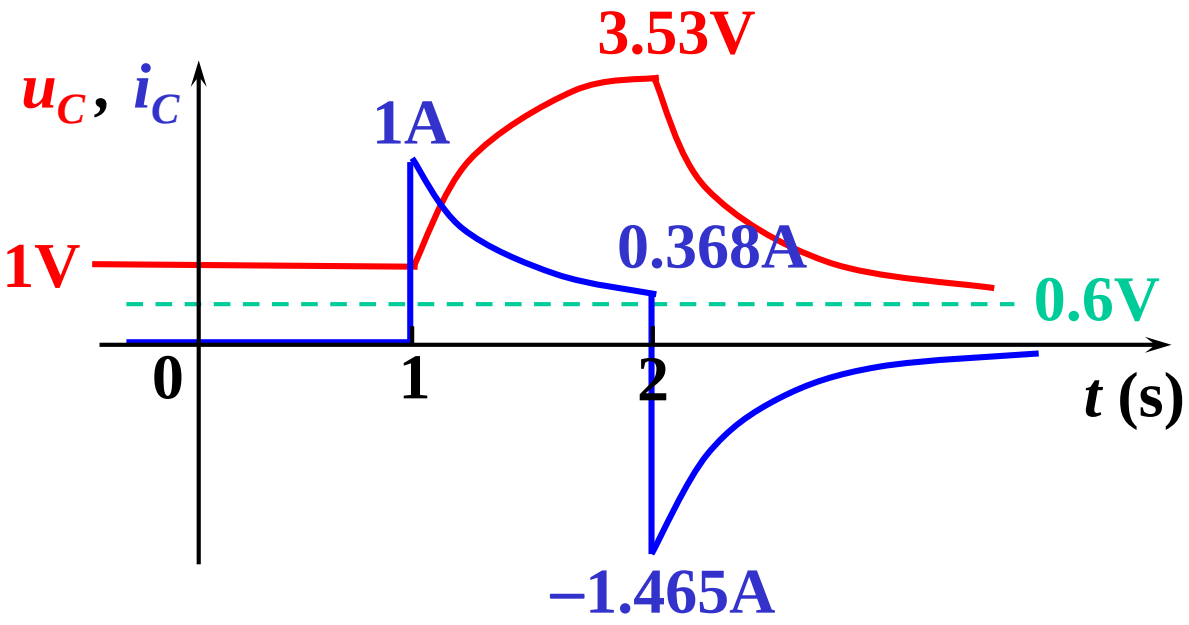
注意　延时的正确表示

$$\begin{cases} u_C(t)=1\text{V} & t \le 1\text{s} \\ u_C(t)=5-4\text{e}^{-(t-1)}\text{V} & 1\text{s} < t \le 2\text{s} \\ u_C(t)=0.6+2.93\text{e}^{-2(t-2)}\text{V} & t>2\text{s} \end{cases}$$

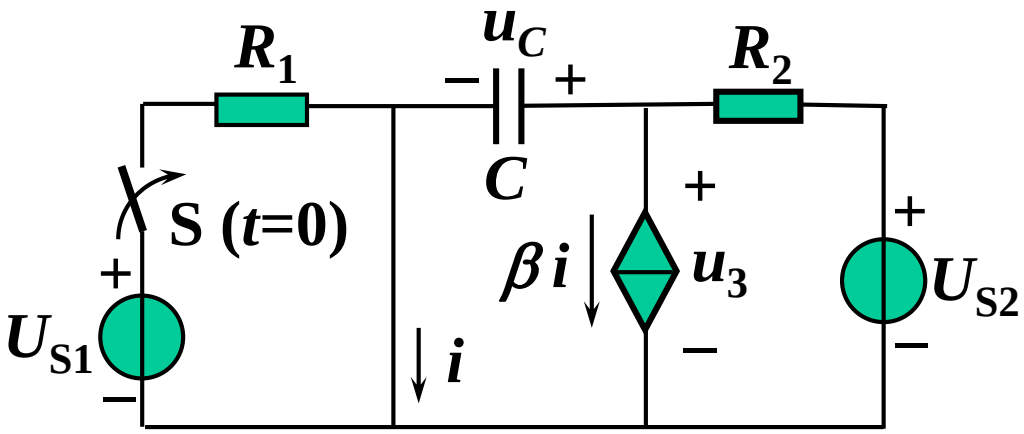
$$\begin{cases} i_C(t)=0 & t < 1\text{s} \\ i_C(t)=\text{e}^{-(t-1)}\text{A} & 1\text{s} < t < 2\text{s} \\ i_C(t)=-1.465\text{e}^{-2(t-2)}\text{A} & t>2\text{s} \end{cases}$$

注意

必须标出各转折点的数值



3、求$u_3(t)$的零状态响应、零输入响应和全响应。

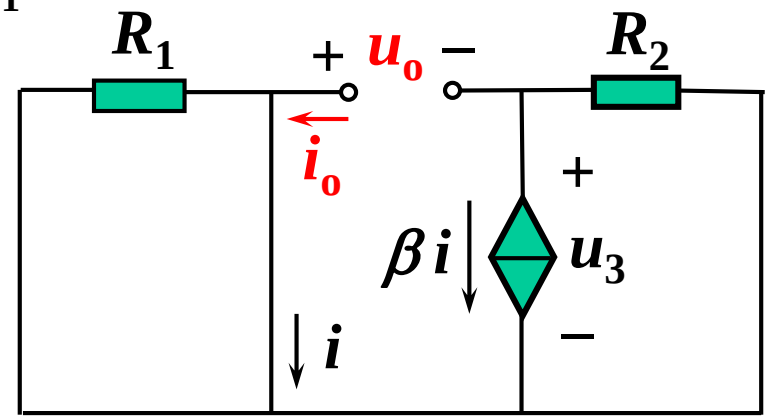


解：(1) 零状态响应

$$u_3(0^+) = u_C(0^+) = 0$$

$$u_3(\infty) = U_{S2} - \beta\, iR_2 = U_B - \beta \frac{U_{S1}}{R_1} R_2$$

求τ： 需求R_i (加压求流)



$$u_o = (1+\beta) i_o R_2$$

$$R_i = \frac{u_o}{i_o} = (1+\beta) R_2$$

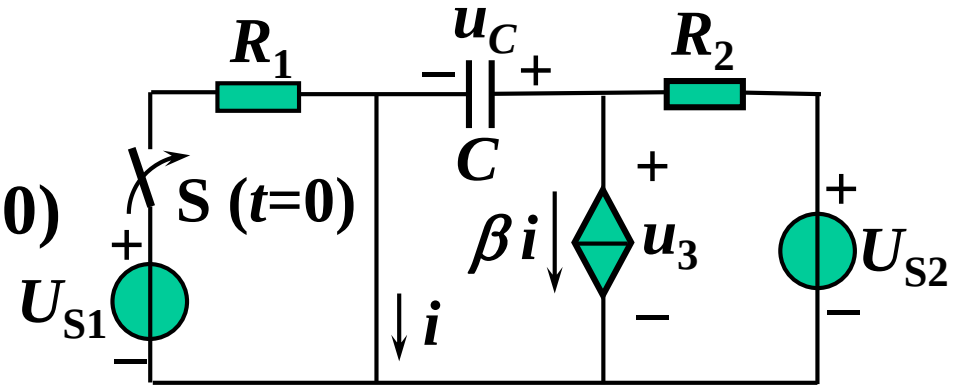
$$\tau = R_i C$$

$$u_3(t) = (U_{S2} - \beta \frac{U_{S1}}{R_1} R_2)(1 - e^{-\frac{t}{\tau}})$$

(2) 零输入响应

$$u_3(0^+)=u_C(0^+)=U_{S2}\quad(\because i=0)$$

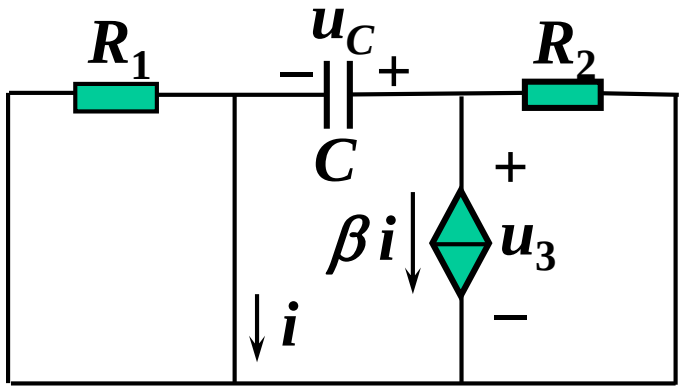
$$u_{3(t)}=U_{S2}e^{-\frac{t}{\tau}}$$



(3) 全响应

$$u_3(t)=(U_{S2}-\beta\frac{U_{S1}}{R_1}R_2)(1-e^{-\frac{t}{\tau}})+U_{S2}e^{-\frac{t}{\tau}}$$

$$=U_{S2}-\beta\frac{R_2}{R_1}U_{S1}(1-e^{-\frac{t}{\tau}})\qquad(t\geq 0)$$



求零输入响应的电路

*全响应可用三要素直接求得：

$$\tau=R_iC\quad u_3(0^+)=U_{S2}\quad u_3(\infty)=U_{S2}-\beta\, iR_2=U_{S2}-\beta\frac{U_{S1}}{R_1}R_2$$

$$u_3(t)=U_{S2}-\beta\frac{R_2}{R_1}U_{S1}(1-e^{-\frac{t}{\tau}})\qquad(t\geq 0)$$