Homework 6

Due date:
Apr. 23rd, 2018
Turn in your homework in class

Rules:

- Work on your own. Discussion is permissible, but extremely similar submissions will be judged as plagiarism.
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please submit on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.

1. A series RLC circuit exhibits the following voltage and current responses:
$$v_c(t) = (6cos4t - 3sin4t)e^{-2t}u(t) \text{ V}$$
$$i_c(t) = -(0.2cos4t + 0.18sin4t)e^{-2t}u(t) \text{ A}$$
Determine α, ω_0, R, L and C

2. Determine $v_c(t)$ in the Fig.1 for $t \geq 0$.

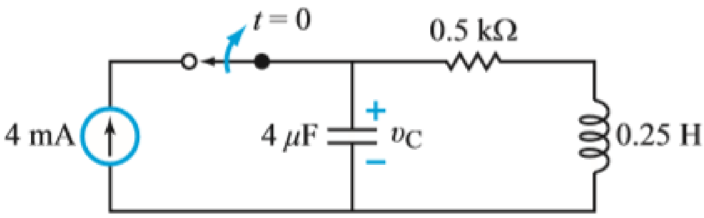


Figure 1

3. When t<0, no energy is stored in the capacitor in Fig.2. The switch moves from position A to position B at $t = 0$. Determine $i(t)$ for $t \geq 0$.

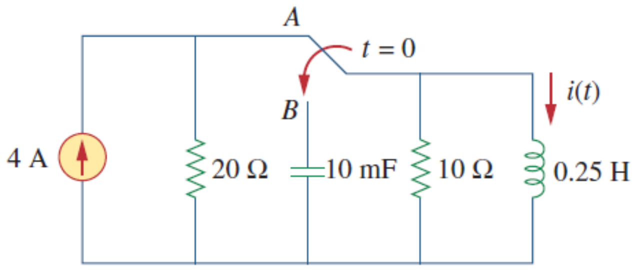


Figure 2

4. When t<0, no energy is stored in the capacitor nor the inductor in the circuit of Fig. 3. Find $i(t)$ for $t \geq 0$.

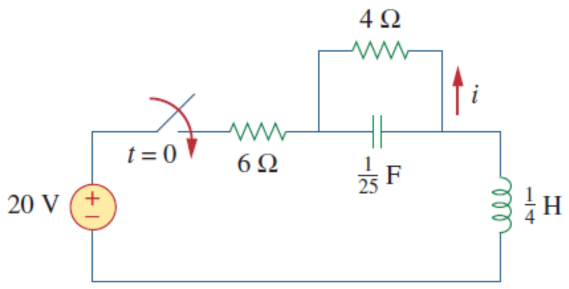


Figure 3

5. Choose the value of C in the circuit of Fig. 4 so that $v_c(t)$ has a critically damped response for $t \geq 0$.

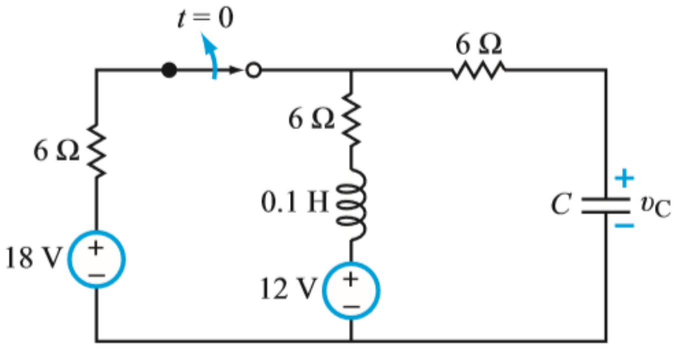


Figure 4

6. Determine $v_C(t)$ in the circuit for $t \geq 0$, given that $V_0 = 12V$, $R_1 = 0.4\,\Omega$, $R_2 = 1.2\,\Omega$, L = 0.1 H and C = 0.4 F.

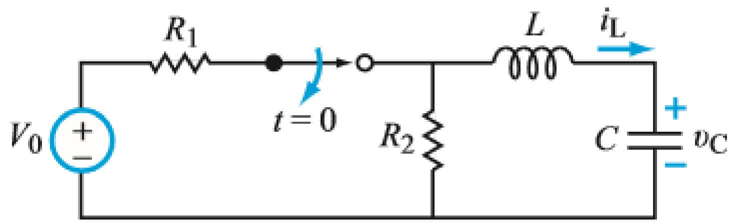


Figure 5

7. The initial value of the voltage v in the circuit shown in Fig. 6 is zero, and the initial value of the capacitor current, $i_C(0^+)$ is 45 mA. The expression for the capacitor current is known to be $i_C(t) = \mathrm{A}_1 e^{-200t} + \mathrm{A}_2 e^{-800t}$, $t \geq 0^+$,

   R=250Ω. Find:

   (a) The value of L, C, A_1 and A_2.
   (b) The express for $v(t)$ for $t \geq 0$.

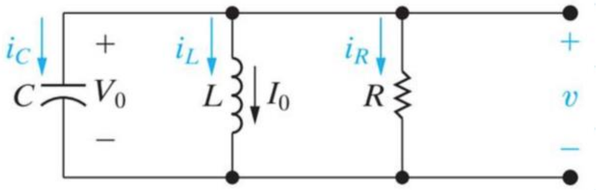


Figure 6

8. The op-amp circuit shown in Fig.7 is called a two-pole low-pass filter. If $v_{in} = Au(t)$, determine $v_{out}(t)$ for $t \geq 0$ when A = 2V, R_1 = 5kΩ, R_2 = 10kΩ, R_3 =12kΩ, R_4 = 20kΩ, C_1 = 100μF, and C_2 = 200μF. (No energy is stored in the capacitors when t<0).

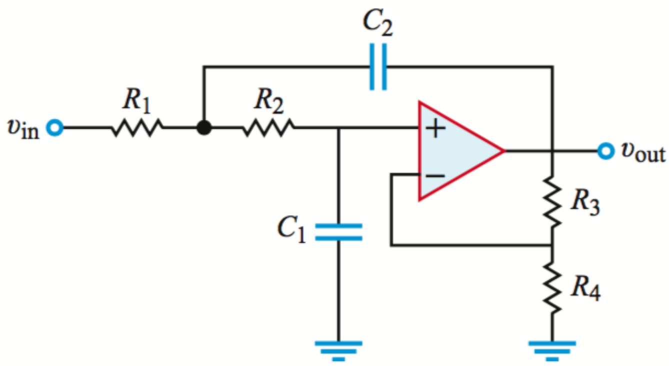
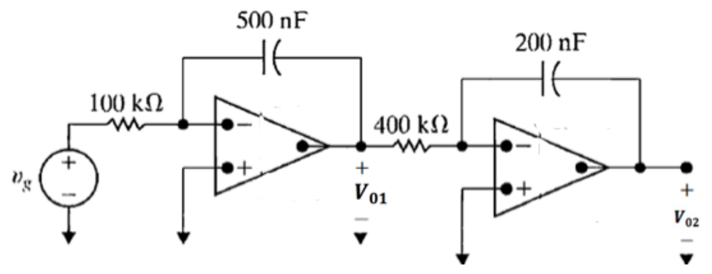
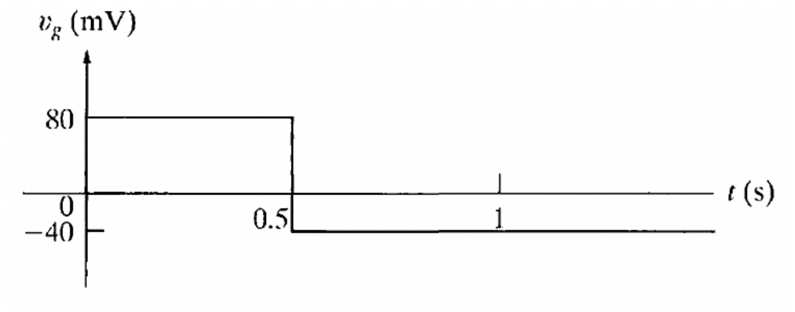


Figure 7

9. The voltage signal of Fig. 8 (b) is applied to the cascaded integrating amplifiers shown in Fig.8 (a). There is no energy stored in the capacitors at the instant the signal is applied. Derive the numerical expressions for $v_{o1}(t)$ and $v_{o2}(t)$ for the time intervals $0 < t < 1$ s. Assume the Ops are working in their linear range.



(a)



(b)

Figure 8

10. In the circuit shown in Fig.9, the switch is closed at t = 0 and re-opened at t = 0.5s. Determine the response $i_L(t)$ for $t \geq 0$. There's no energy stored in the inductor and capacitor when t<0.

    Assume that V_S = 18V, R_S =1Ω, R_1 =5Ω, R_2 =2Ω, L= 2H and C= $\frac{1}{17}$F.

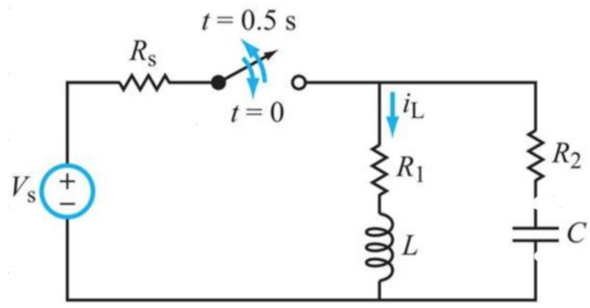


Figure 9