Homework 6

Due date:
May.12th , 2021
Turn in your homework in class

Rules:

- Please 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. [12%] Determine the equivalent impedance for the terminal (a,b) :

a)

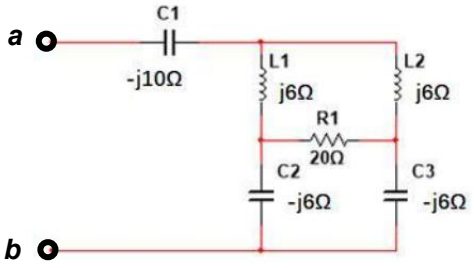

Fig.1-1

b) $\omega = 50000 rad/s$

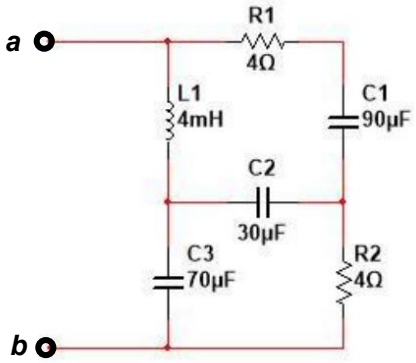

Fig.1-2

c)

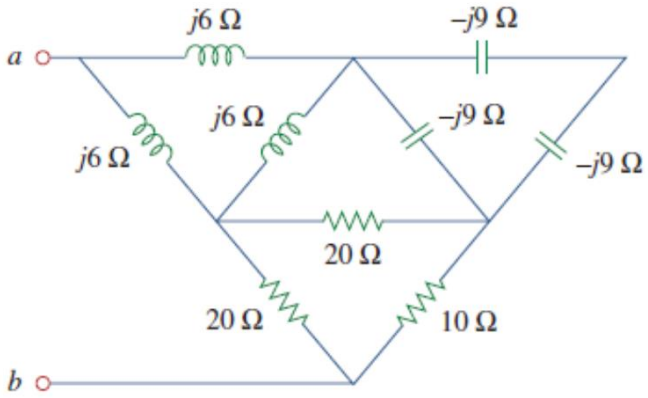

Fig.1-3

2. [10%] The three loads in the circuit seen in below are described as follows: Load 1 has the complex power $\mathbf{S} = 6 - \mathrm{j}3 \ \mathrm{kVA}$; Load 2 has the apparent power $S = 7.5 \ \mathrm{kVA}$ with a power factor of 0.8 lagging; Load 3 is a 30Ω resistor in parallel with an inductance whose reactance is 7.5Ω.

a) Calculate the average power and the reactive power delivered by each source if

$$\boldsymbol{V}_{g1} = \boldsymbol{V}_{g2} = 150\angle 0° \ V(rms)$$

b) It is known that the total power is equal from the source side view and the load side view. For the a) part, we have calculated the average power and the reactive power delivered by the source side. Try to calculate the consumed load power to prove the equality mentioned below.

$$\sum \boldsymbol{P}_{\boldsymbol{deliver}} = \sum \boldsymbol{P}_{\boldsymbol{absorb}}$$

$$\sum \boldsymbol{Q}_{\boldsymbol{deliver}} = \sum \boldsymbol{Q}_{\boldsymbol{absorb}}$$

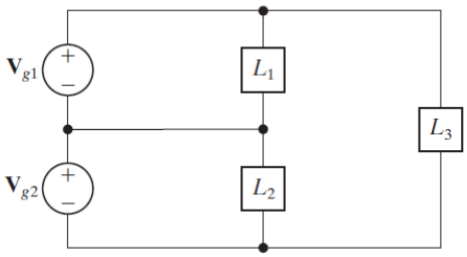

Fig. 2

3. [12%] For the op amp circuit in Fig. 3, calculate:

   (a) the complex power delivered by the voltage source.

   (b) the average power dissipated in the 12Ω resistor.

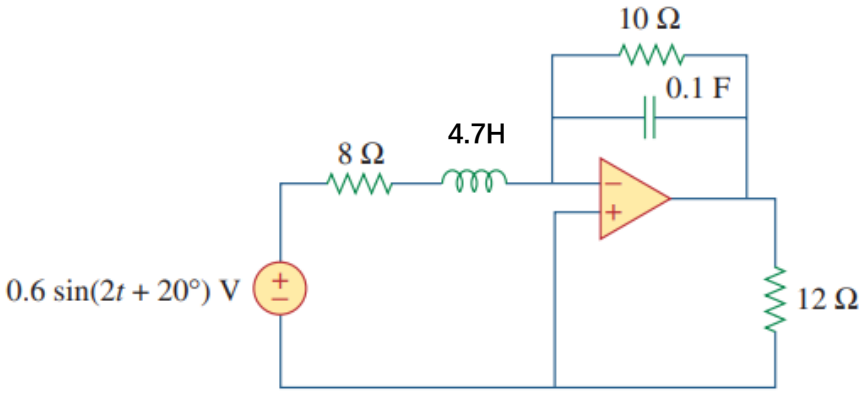

Fig. 3

4. [14%] For the given circuit in Fig.4, find the voltage $\widetilde{V}_s$ and the complex power $\mathbf{S}$ on $\widetilde{V}_s$.

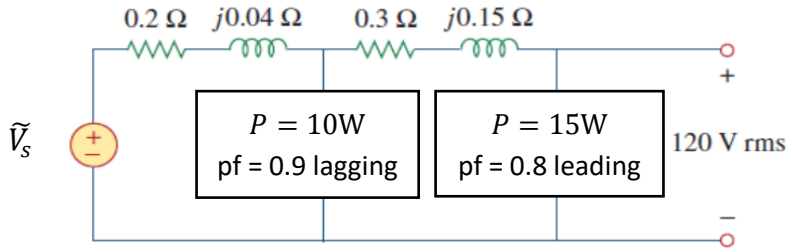

Fig. 4

5. [12%] Determine the average and rms values of the following periodic voltage or current waveform.

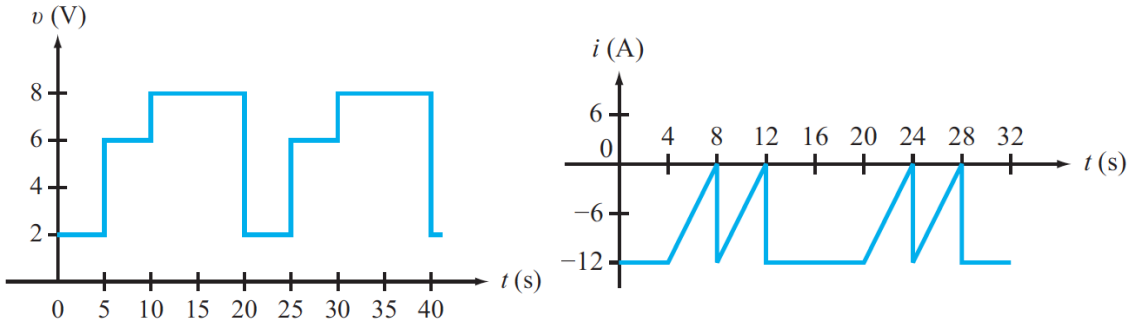

Fig. 5

6. [12%] In the op-amp circuit below, $\mathrm{V_{in}}(t) = V_0 \cos(\omega t)\, V$, with $\mathrm{V_0} = 8V$, $\omega \mathrm{RC} = 2$, and $\mathrm{R_L} = 15k\Omega$. Determine the average power delivered to $\mathrm{R_L}$.

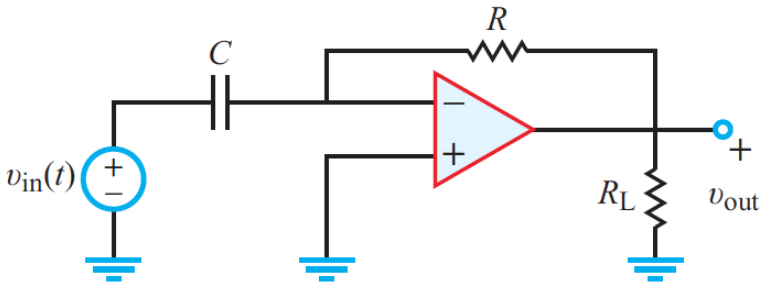

Fig. 6

7. [16%] Giving the source $V_s = 12\cos(1000t + \frac{\pi}{6})V$, $L_1 = 15mH$, $L_2 = 25mH$, $L_3 = 40mH$, $C_1 = 400\mu F$, $C_2 = 0.7mF$, $C_3 = 900\mu F$, $R_1 = R_2 = 10\Omega$, and $R_L = 20\Omega$. Derive the complex power on the load resistor R_L.

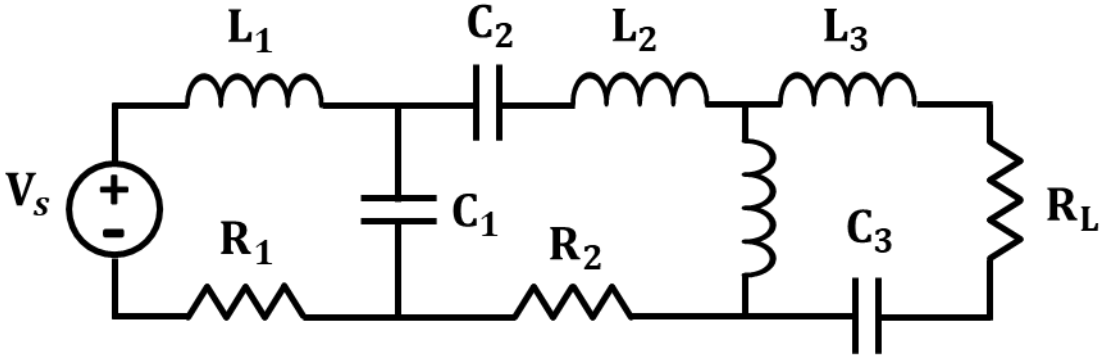

Fig. 7

8. [12%] Given the circuit of Fig. 8, voltage source $\tilde{V}_s = V_m \angle\theta$ V, $V_m = 8$ and $\theta = 20°$. Find out the average power absorbed by the 10Ω resistor and the reactive power on the inductor $j5\Omega$.

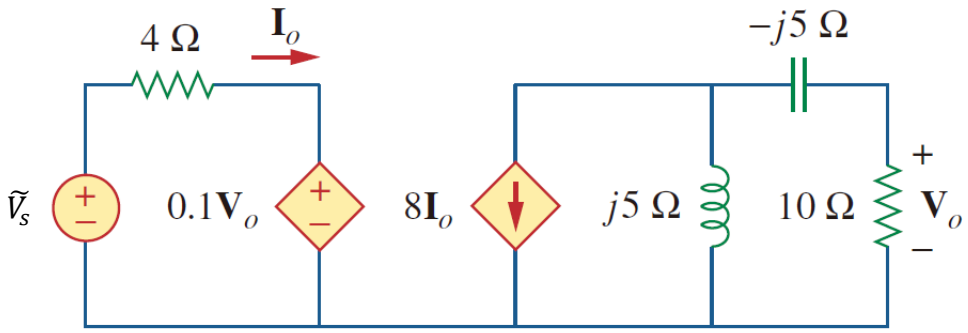

Fig. 8