Homework 5

Due date: May.4^{th}

Turn in your homework online before the 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

[16 points]

(a). The circuit is shown in **Fig 1:a**. Assume steady state of the circuit. Known that $u_S(t) = 1.5\sqrt{2}cos(10^5t + 60°)$V. Express $i_R(t), i_L(t), i_C(t), i(t)$, in phasor domain.

(b). The circuit is shown in **Fig 1:b**. Assume steady state of the circuit. Known that $i(t) = 1cos(10^7t + 90°)$A. Express $u_R(t), u_L(t), u_C(t), u_S(t)$ in phasor domain..

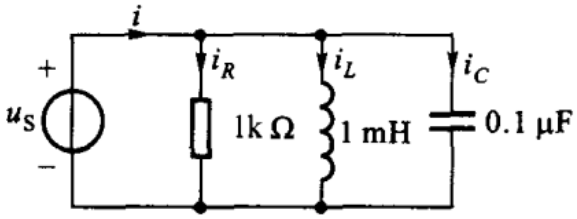

Figure 1: a

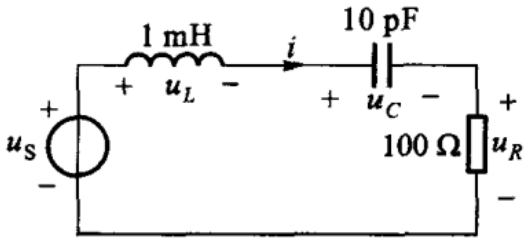

Figure 1: b

2

[12 points]The circuit is shown in **Fig 2**. Use phasor approach to calculate the currents $\dot{I}_R$, $\dot{I}_C$, $\dot{I}_L$, and draw the phasor diagram of the above three currents.

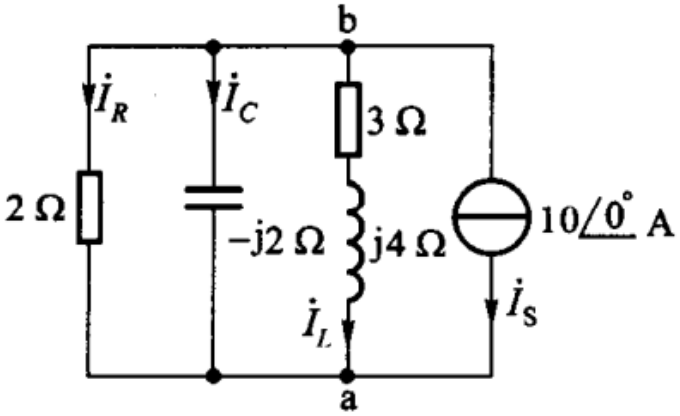

Figure 2

3

[10 points]The circuit is shown in **Fig 3**. $\dot{U}_S = 24\angle 60°$V, $\dot{I}_S = 6\angle 0°$A. Use mesh analysis to calculate $\dot{I}_1$ and $\dot{I}_2$.

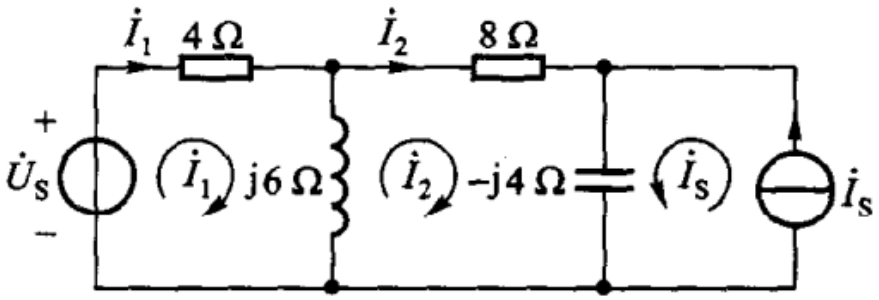

Figure 3

4

[10 points]The circuit is shown in **Fig 4**. $\dot{U}_S = 10\angle 0°\text{V}$, μ=0.5. Use nodal analysis to calculate $\dot{U}_2$.

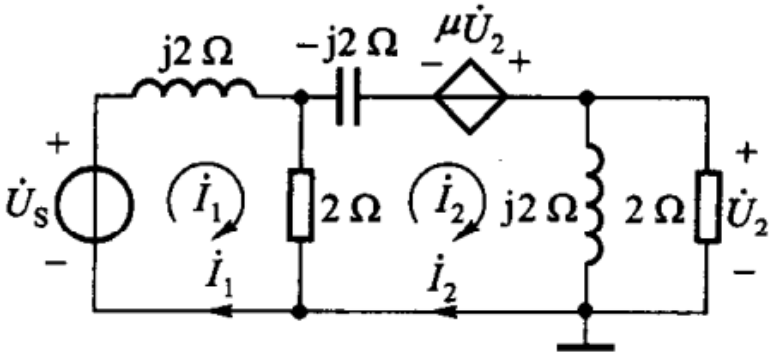

Figure 4

5

[12 points]The circuit is shown in **Fig 5**. The circuit is under sinusoidal steady state. Known that $i_S(t) = 30\sqrt{2}cos20t$ A. For the circuit excluding the 30Ω resistance, find the Thevenin equivalance(phasor domain) at the terminals a-b. Afterwards, use the Thevenin equivalence to calculate $u_k(t)$.

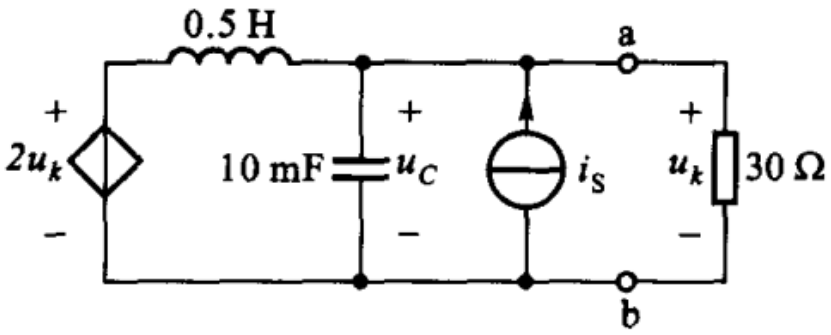

Figure 5

6

[14 points]The circuit is shown in **Fig 6**. The circuit is under sinusoidal steady state. Known that $i_S(t) = 10\sqrt{2}cos100t$ A, $u_S(t) = 100\sqrt{2}cos1000t$ V. Find $i_L(t)$. (Note: you should be careful about the operating frequency of the system when applying phasor domain equivalence)

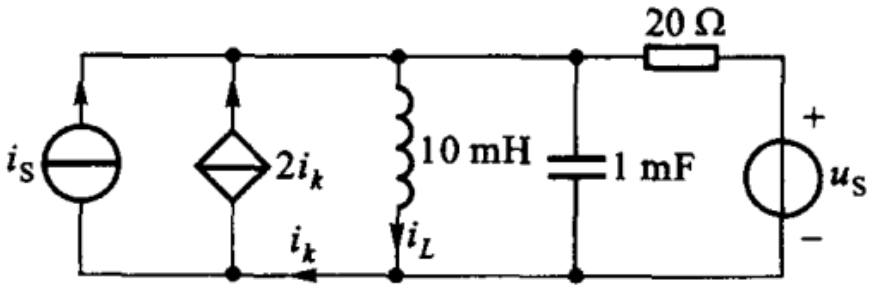

Figure 6

7

[12 points]

(a). The circuit is shown in **Fig 7:a**. All of the elements are working in Sinusoidal Steady-state. Find out the the relationship that the values of the elements satisfy to make the equivalent impedance(between a and b) pure resistive at any frequency. (Please make sure that you write down all of the conditions).

(b). The circuit is shown in **Fig 7:b**. All of the elements are working in Sinusoidal Steady-state. Try to figure out what conditions the values of the elements and ω have to meet to make sure that $\frac{\dot{U}_1}{\dot{U}_2}$ has nothing to do with Z (Z is the value of the impedence of the element), and write down the ratio.

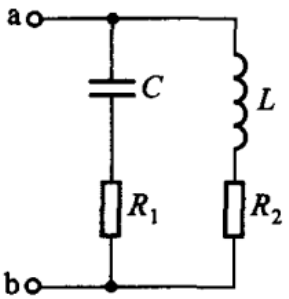

Figure 7: a

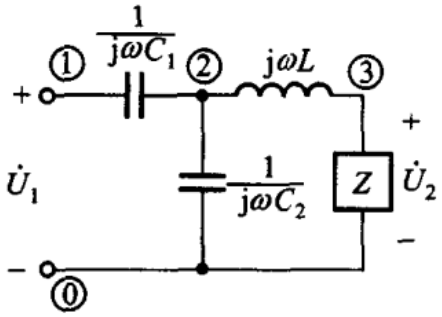

Figure 7: b

8

[14 points]

(a). Known that the sinusoidal voltage has an amplitude of 100V. The instantaneous value of the voltage at t=0 is 10V, and the period is 1ms. Please write down the expression of the voltage as a cosine function.

(b). $i_1(t) = 4cos(\omega t - 80°)A$, $i_2(t) = 10cos(\omega t + 20°)A$, $i_3(t) = 8sin(\omega t - 20°)A$. Please express these currents in phasor domain.