Homework 5

Due date: Apr. 28th, 2021, Wednesday

Turn in your homework in class

Rules:

- Work on your own. Discussion is permissible, but extremely similar submissions will 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.

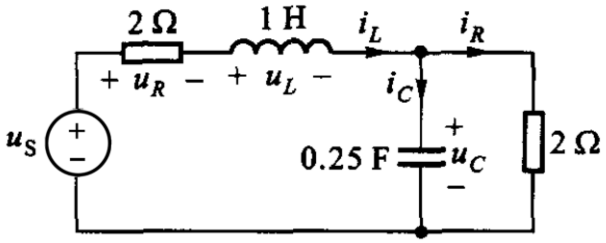
1. Find the following results (using phasors if necessary)

(1) $\frac{(50-j60)(20\angle 70°+150\angle -30°)}{(70-j120)90\angle 210°}$;

(2) Solve the equation: $\frac{dv(t)}{dt} + 4v(t) + 3\int v(t)dt = 20\sin(10t + 20°)$

2. Phasor Diagrams

Find $u_s(t)$ in the circuit below, assuming that $u_c(t) = \sqrt{2}cos2t\ \ V$. Sketch Phasors of $u_s,\ u_R,\ u_L,\ i_L,\ i_C,\ u_C,\ i_R$ in one single phasor diagram.



3. Given that the voltage and current of a two-terminal element adopt the paasive sign convention, its instantaneous value is expressed as:

(1)$\mathrm{u}(t) = 15\cos(400t + 30°)\ V,\ i(t) = 3\sin(400t + 30°)\ A$;

(2)$\mathrm{u}(t) = 8\sin(500t + 50°)\ V,\ i(t) = 2\sin(500t + 140°)\ A$;

(3)$\mathrm{u}(t) = 8\cos(250t + 60°)\ V,\ i(t) = 5\sin(250t + 150°)\ A$;

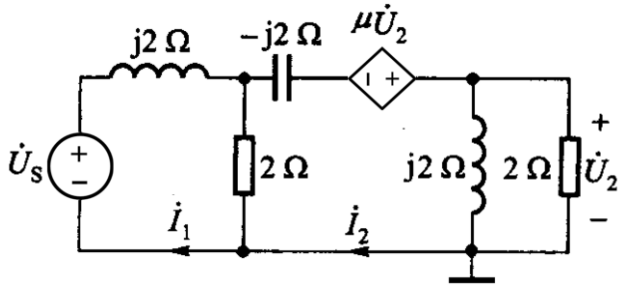
Try to determine whether the element is a resistor, inductor or capacitor, and determine its value (R=?,C=?, L=?).

4. nodal analysis & mesh analysis

Find $\dot{U}_2$ and $\dot{I}_2$ for the circuit below, assuming that $\dot{U}_s = 10\angle 0°\ V, \mu = 0.5$.

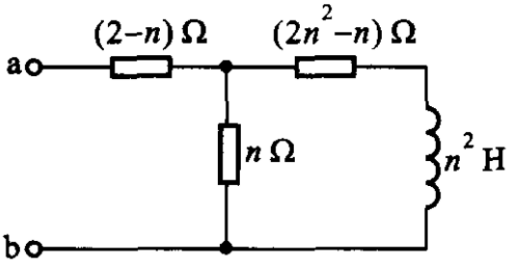
(1) Use nodal analysis;

(2) Use mesh analysis.

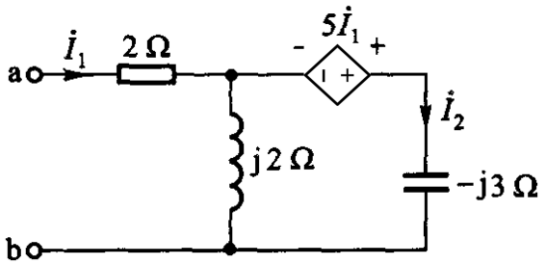


5. Find the equivalent impedance.

(1) Find $\boldsymbol{Z_{ab}}$ when the system is operating at the angular frequency ω, assuming that $n \neq 0$.

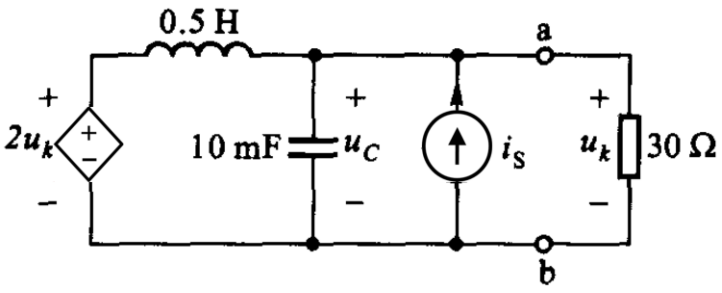


(2) Find $\boldsymbol{Z_{ab}}$.



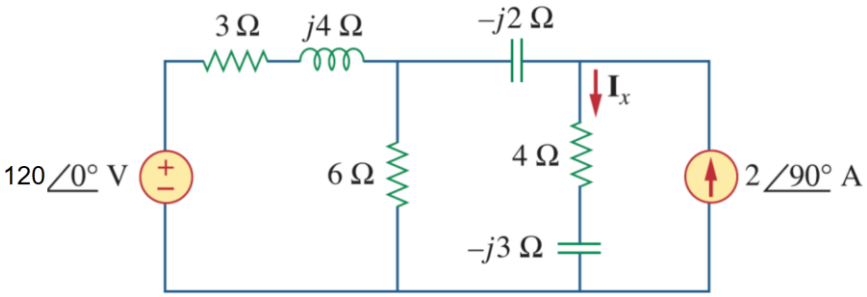
6. Thevenin equivalent.

Given that the circuit below is in steady state, use phasor method to find $\boldsymbol{u_k(t)}$ in the circuit below by using Thevenin's theorem, assuming that $i_s(t) = 30\sqrt{2}cos20t\ \ A$.(Hint: find the Thevenin equivalent circuit of the left hand side part seen from the terminals a-b)



7. Source Transformation

The two sources are with the same angular frequency. Use source transformation to find $\mathbf{I}_x$.



8. Superposition Theorem

Using superposition to find $i_L(t)$, assuming that $i_s(t) = 10\sqrt{2}cos100t\ A$, $u_s(t) = 100\sqrt{2}cos1000t\ V$.