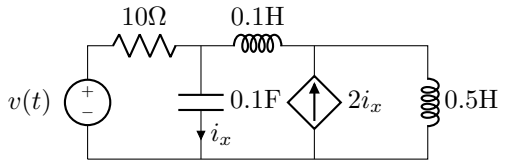
Lecture 32, Apr 1, 2022

Nodal and Mesh Analysis for AC Circuits



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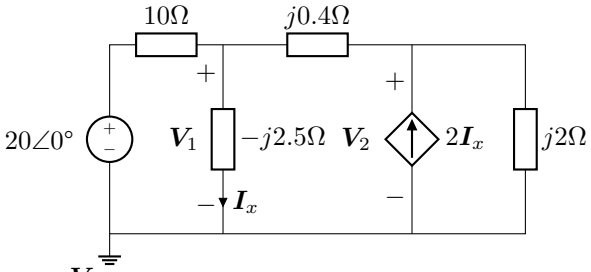
  - $v(t) = 20\cos(4t) \implies \boldsymbol{V} = 20\angle 0°$
    - Impedances:
      - $\boldsymbol{Z}_R = 10\Omega$
      - $\boldsymbol{Z}_C = -\dfrac{j}{\omega C} = -\dfrac{j}{4 \cdot 0.1\text{F}} = -j2.5\Omega$
      - $\boldsymbol{Z}_{L1} = j\omega L_1 = j4 \cdot 0.1 = j0.4\Omega$
      - $\boldsymbol{Z}_{L2} = j\omega L_2 = j2\Omega$
    - In the phasor domain:



    - $\boldsymbol{I}_x = \dfrac{\boldsymbol{V}_1}{\boldsymbol{Z}_C}$
    - $\dfrac{\boldsymbol{V}_1 - 20}{\boldsymbol{Z}_R} + \dfrac{\boldsymbol{V}_1}{\boldsymbol{Z}_C} + \dfrac{\boldsymbol{V}_1 - \boldsymbol{V}_2}{\boldsymbol{Z}_{L1}} = 0$
    - $\dfrac{\boldsymbol{V}_2 - \boldsymbol{V}_1}{\boldsymbol{Z}_{L_1}} + \dfrac{\boldsymbol{V}_2}{\boldsymbol{Z}_{L2}} - 2\dfrac{\boldsymbol{V}_1}{\boldsymbol{Z}_C}$
    - Solve the system as normal, then use nodal voltages to find phasor for $\boldsymbol{I}_x = \dfrac{\boldsymbol{V}_1}{\boldsymbol{Z}_C}$, and convert to time domain