HW#3

9.23 (15 points)

a) Show that, at a given frequency ω, the circuits in Fig. P9.23(a) and (b) will have the same impedance between the terminals a,b if

\[
R_1 = \frac{\omega^2 L_1^2 R_2}{R_2^2 + \omega^2 L_2^2}, \quad L_1 = \frac{R_2^2 L_2}{R_2^2 + \omega^2 L_2^2}
\]

b) Find the values of resistance and inductance that when connected in series will have the same impedance at 4 krad/s as that of a 5 kΩ resistor connected in parallel with a 1.25 H inductor.

Answer: [b] \( R_1 = 2500 \text{ohm}, L_1 = 625 \text{mH} \)

9.37 (10 points)

Use the concept of current division to find the steady state expression for \( i_o \) in the circuit in Fig. P9.37

\[
i_o = 400 \cos 20,000t \text{ mA}
\]

Answer: \( i_o = 474.34 \cos(20000t + 18.43^\circ) \text{ mA} \)
9.44 (15 points)

Find the Norton equivalent with respect to terminals a,b in the circuit of Fig. P9.44.

\[ I_N = 10 \angle -45^\circ \text{ A}, \quad Z_{Th} = 1.6 + 3.2j \Omega \]

9.48 (20 points)

9.48 Find the Thévenin equivalent circuit with respect to the terminals a,b of the circuit shown in Fig. P9.48.

\[ V_{Th} = 500 \angle -53.13^\circ \text{ A}, \quad Z_{Th} = 100 - j100 \Omega \]
**9.52 (20 points)**

Use the node-voltage method to find the steady-state expression for \( v_n(t) \) in the circuit in Fig. P9.52 if

\[
\begin{align*}
v_{n1} &= 20 \cos(2000t - 36.87) \text{ V}, \\
v_{n2} &= 50 \sin(2000t - 16.26) \text{ V}.
\end{align*}
\]

**Figure P9.52**

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**Answer:** \( 36 \cos(2000t) \)

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**9.62 (20 points)**

Use the mesh-current method to find the branch currents \( I_a, I_b, I_c, \) and \( I_d \) in the circuit shown in Fig. P9.62.

**Figure P9.62**

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**Answer:** \( I_a = 5 \angle 0^\circ \text{A}, \ I_b = 11.18 \angle 63.43^\circ \text{A}, \ I_c = 7.07 \angle 45^\circ \text{A}, \ I_d = 5 \angle 90^\circ \text{A} \)