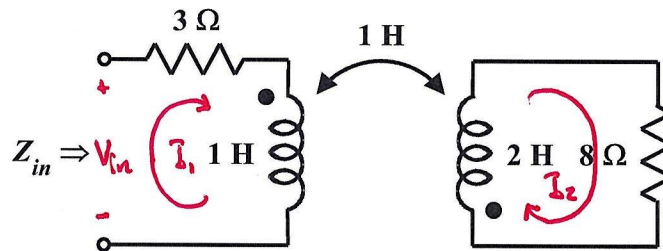


Homework Problem #031

Determine the input impedance of the circuit shown below in rectangular form at $\omega = 2$ rad/s. Show your work.



$$3I_1 + j2I_1 + j2I_2 = V_{in}$$

$$j2I_1 + j4I_2 + 8I_2 = 0$$

$$\begin{bmatrix} 3+j2 & j2 \\ j2 & 8+j4 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} V_{in} \\ 0 \end{bmatrix}$$

$$I_1 = \frac{\begin{vmatrix} V_{in} & j2 \\ 0 & 8+j4 \end{vmatrix}}{\begin{vmatrix} 3+j2 & j2 \\ j2 & 8+j4 \end{vmatrix}} = \frac{(8+j4)V_{in}}{(3+j2)(8+j4)+4} = \frac{(8+j4)V_{in}}{20+j28}$$

$$\Rightarrow Z_{in} \triangleq \frac{V_{in}}{I_1} = \frac{20+j28}{8+j4} = \frac{(5+j7)(2-j)}{(2+j)(2-j)}$$

$$= \frac{17+j9}{4+1}$$

$$= \frac{17}{5} + j\frac{9}{5} \Omega$$

$$\text{or } 3.4 + j1.8 \Omega$$