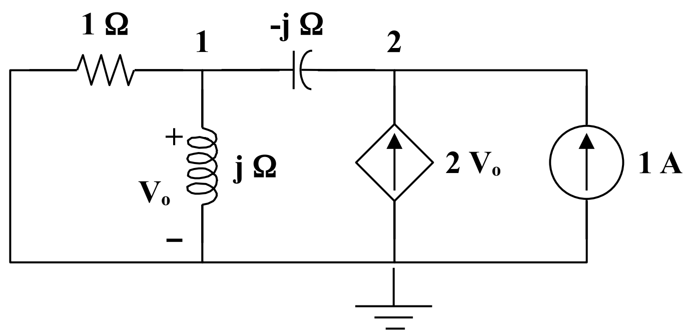
Chapter 11, Solution 15.

To find $\mathbf{Z}_{eq}$, insert a 1-A current source at the load terminals as shown in Fig. (a).



(a)

At node 1,

$$\frac{\mathbf{V}_o}{1} + \frac{\mathbf{V}_o}{j} = \frac{\mathbf{V}_2 - \mathbf{V}_o}{-j} \longrightarrow \mathbf{V}_o = j\mathbf{V}_2 \qquad (1)$$

At node 2,

$$1 + 2\mathbf{V}_o = \frac{\mathbf{V}_2 - \mathbf{V}_o}{-j} \longrightarrow 1 = j\mathbf{V}_2 - (2+j)\mathbf{V}_o \qquad (2)$$

Substituting (1) into (2),

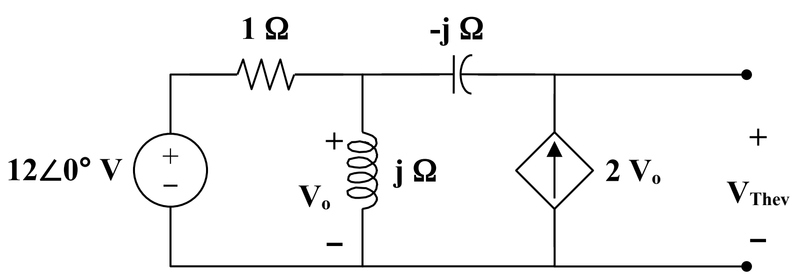
$$1 = j\mathbf{V}_2 - (2+j)(j)\mathbf{V}_2 = (1-j)\mathbf{V}_2$$

$$\mathbf{V}_2 = \frac{1}{1-j}$$

$$\mathbf{Z}_{eq} = \frac{\mathbf{V}_2}{1} = \frac{1+j}{2} = 0.5 + j0.5$$

$$\mathbf{Z}_L = \mathbf{Z}_{eq}^* = \mathbf{[0.5 - \mathit{j}0.5]\ \Omega}$$

We now obtain $\mathbf{V}_{Thev}$ from Fig. (b).



(b)

$$-2\mathbf{V}_o + \frac{\mathbf{V}_o - 12}{1} + \frac{\mathbf{V}_o}{j} = 0$$

$$\mathbf{V}_o = \frac{-12}{1+j}$$

$$-\mathbf{V}_o - (-j \times 2\,\mathbf{V}_o) + \mathbf{V}_{Th} = 0$$

$$\mathbf{V}_{Thev} = (1 - j2)\mathbf{V}_o = \frac{(-12)(1-j2)}{1+j}$$

$$P_{\max} = \frac{\left|\left[\frac{V_{Thev}}{0.5 + j0.5 + 0.5 - j0.5}\right]\right|^2}{2} 0.5 = \frac{\left(\frac{12\sqrt{5}}{\sqrt{2}}\right)^2}{2(2x0.5)^2} 0.5$$

$$= \mathbf{90\ W}$$