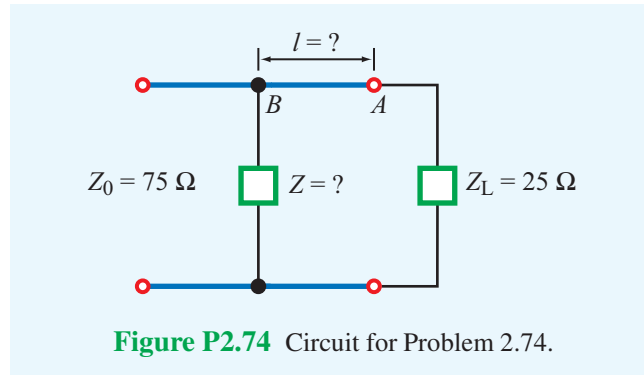
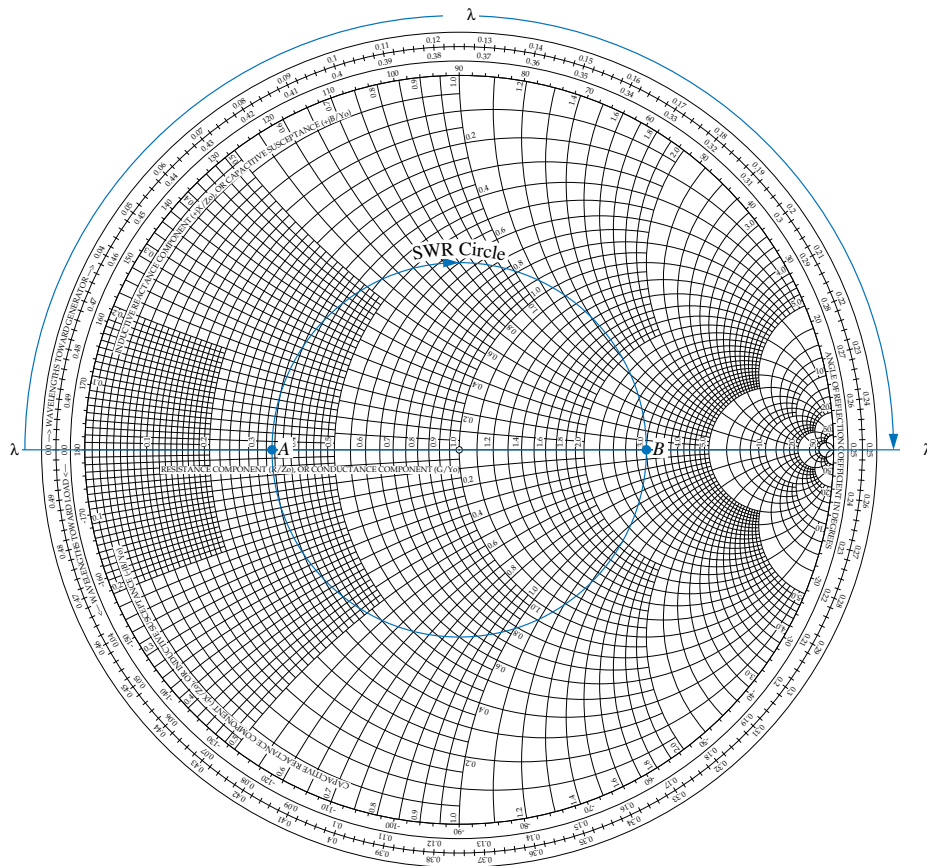


**2.74** A  $25\text{-}\Omega$  antenna is connected to a  $75\text{-}\Omega$  lossless transmission line. Reflections back toward the generator can be eliminated by placing a shunt impedance  $Z$  at a distance  $l$  from the load (Fig. P2.74). Determine the values of  $Z$  and  $l$ .



**Solution:**



The normalized load impedance is:

$$z_L = \frac{25}{75} = 0.33 \quad (\text{point } A \text{ on Smith chart})$$

The Smith chart shows  $A$  and the SWR circle. The goal is to have an equivalent impedance of  $75 \, \Omega$  to the left of  $B$ . That equivalent impedance is the parallel combination of  $Z_{in}$  at  $B$  (to the right of the shunt impedance  $Z$ ) and the shunt element  $Z$ . Since we need for this to be purely real, it's best to choose  $l$  such that  $Z_{in}$  is purely real, thereby choosing  $Z$  to be simply a resistor. Adding two resistors in parallel generates a sum smaller in magnitude than either one of them. So we need for  $Z_{in}$  to be larger than  $Z_0$ , not smaller. On the Smith chart, that point is  $B$ , at a distance  $l = \lambda/4$  from the load. At that point:

$$z_{in} = 3,$$

which corresponds to

$$y_{in} = 0.33.$$

Hence, we need  $y$ , the normalized admittance corresponding to the shunt impedance  $Z$ , to have a value that satisfies:

$$y_{in} + y = 1$$

$$y = 1 - y_{in} = 1 - 0.33 = 0.66$$

$$z = \frac{1}{y} = \frac{1}{0.66} = 1.5$$

$$Z = 75 \times 1.5 = 112.5 \, \Omega.$$

In summary,

$$l = \frac{\lambda}{4},$$

$$Z = 112.5 \, \Omega.$$

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