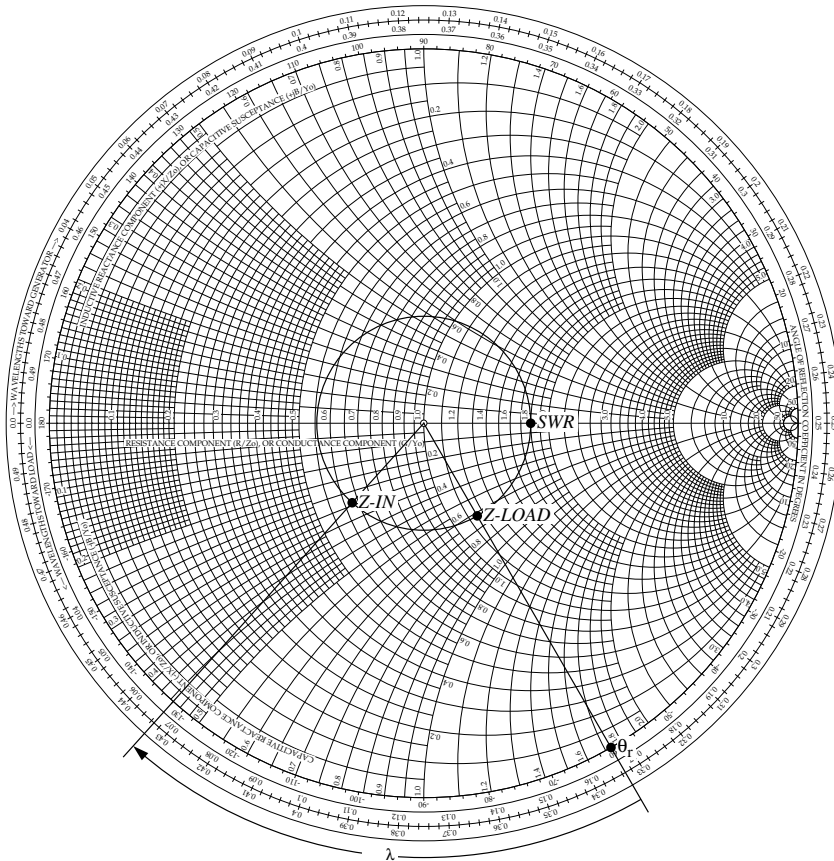


**2.59** A  $75\text{-}\Omega$  lossless line is  $0.6\lambda$  long. If  $S = 1.8$  and  $\theta_r = -60^\circ$ , use the Smith chart to find  $|\Gamma|$ ,  $Z_L$ , and  $Z_{in}$ .



**Figure P2.59:** Solution of Problem 2.59.

**Solution:** Refer to Fig. P2.59. The SWR circle must pass through  $S = 1.8$  at point SWR. A circle of this radius has

$$|\Gamma| = \frac{S-1}{S+1} = 0.29.$$

The load must have a reflection coefficient with  $\theta_r = -60^\circ$ . The angle of the reflection coefficient is read off that scale at the point  $\theta_r$ . The intersection of the circle of constant  $|\Gamma|$  and the line of constant  $\theta_r$  is at the load, point Z-LOAD, which has a

value  $z_L = 1.15 - j0.62$ . Thus,

$$Z_L = z_L Z_0 = (1.15 - j0.62) \times 75 \, \Omega = (86.5 - j46.6) \, \Omega.$$

A  $0.6\lambda$  line is equivalent to a  $0.1\lambda$  line. On the WTG scale, *Z-LOAD* is at  $0.333\lambda$ , so *Z-IN* is at  $0.333\lambda + 0.100\lambda = 0.433\lambda$  and has a value

$$z_{in} = 0.63 - j0.29.$$

Therefore  $Z_{in} = z_{in} Z_0 = (0.63 - j0.29) \times 75 \, \Omega = (47.0 - j21.8) \, \Omega$ .

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