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

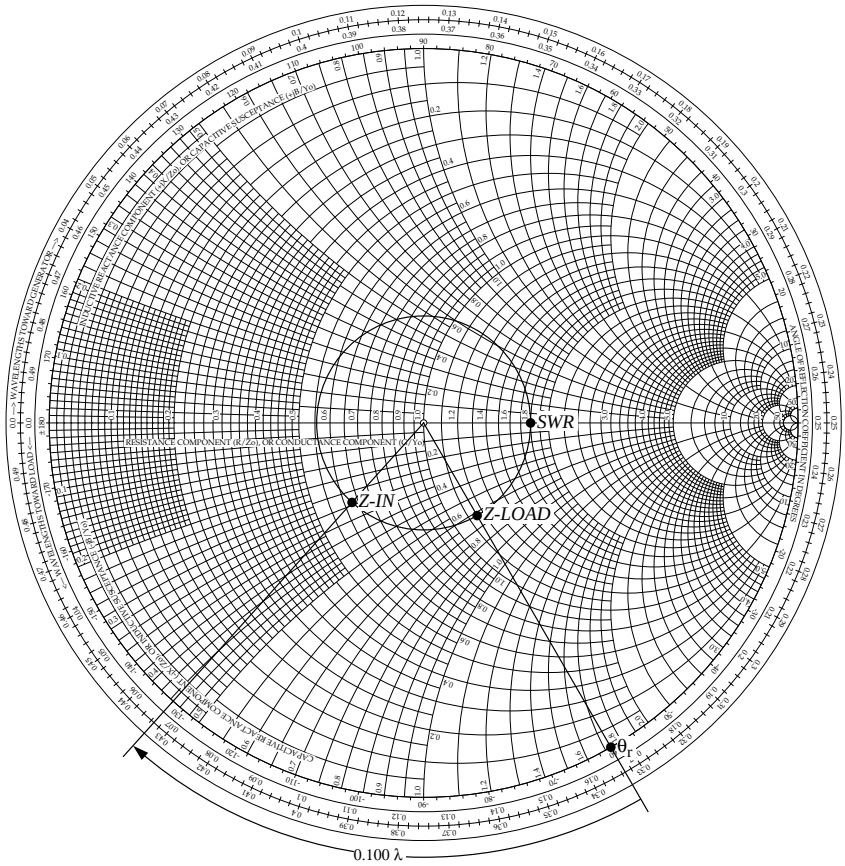

Figure P2.59: Solution of Problem 2.59.

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 θ_r. The intersection of the circle of constant $|\Gamma|$ and the line of constant θ_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 0.6λ line is equivalent to a 0.1λ line. On the WTG scale, *Z-LOAD* is at 0.333λ, 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 $Z_{in} = z_{in} Z_0 = (0.63 - j0.29) \times 75\ \Omega = (47.0 - j21.8)\ \Omega$.