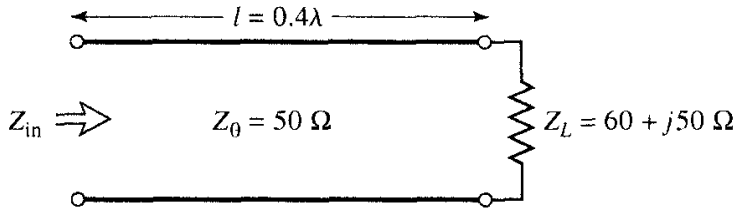
2.20 Use the Smith chart to find the following quantities for the transmission line circuit shown in the accompanying figure:

(a) The SWR on the line.
(b) The reflection coefficient at the load.
(c) The load admittance.
(d) The input impedance of the line.
(e) The distance from the load to the first voltage minimum.
(f) The distance from the load to the first voltage maximum.



$z_L = \frac{Z_L}{Z_0} = \frac{60+j50}{50} = 1.2 + j1$ Ω/Ω plot on Smith chart

a) Use compass and SWR scale (or r_{max}) to get $\underline{SWR = 2.47}$

b) Use compass and REFL. COEFF, V or I scale to get $|\Gamma| = 0.422$. Draw radial line through z_L. Read $\angle\Gamma_L = 54.3°$ off "ANGLE OF REFLECTION..." scale.

$$\underline{\Gamma_L = 0.422 \angle 54.3°}$$

c) Draw circle through z_L of constant $|\Gamma|$. Draw line across Smith chart. Read

$z_L = 0.49 - j0.41$ S/S

$Y_L = z_L Y_0 = (0.49 - j0.41)\frac{1}{50} = \underline{9.8 - j8.2\ mS}$

d) Move $\ell/\lambda = 0.4$ from z_L radial line at 0.1704 along circle of constant $|\Gamma|$ and draw radial line @ $0.4 + 0.17 = 0.574$ (or 0.074). At intersection of radial line and circle read $z_{in} = 0.49 + j0.4$ Ω/Ω

$$Z_{in} = z_{in} Z_0 = (0.49 + j0.4)50$$

$$\underline{\underline{Z_{in} = 24.5 + j20\ \Omega}}$$

e) Note radial line through z_L is at 0.174 on "WAVELENGTHS TOWARD GENERATOR" scale while r_{min}/V_{min} is @ 0.5. $0.5 - 0.174 = 0.326$

$$\Rightarrow \underline{\underline{\ell_{min} = 0.326\lambda \text{ from load}}}$$

f) Note radial line through z_L is at 0.174 on "WAVELENGTHS TOWARD GENERATOR" scale while r_{max}/V_{max} is @ 0.25

$$\underline{\underline{\ell_{max} = 0.25 - 0.174 = 0.076\lambda}}$$

2.20 cont.

$Z_0 = 50\Omega$

$\ell = 0.4\lambda$

Simple
Smith Chart