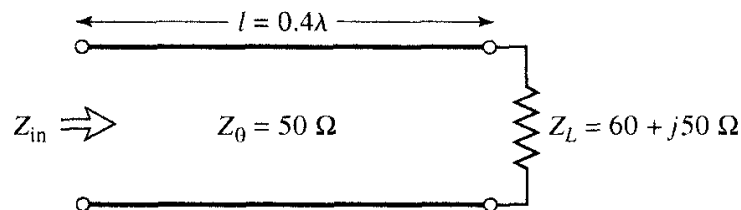


2.20 Use the Smith chart to find the following quantities for the transmission line circuit shown in the accompanying figure:

- The SWR on the line.
- The reflection coefficient at the load.
- The load admittance.
- The input impedance of the line.
- The distance from the load to the first voltage minimum.
- The distance from the load to the first voltage maximum.



$$z_L = \frac{Z_L}{Z_0} = \frac{60 + j50}{50} = 1.2 + j1 \quad \text{plot on Smith Chart}$$

a) Use compass and SWR scale (or $r_{\max}$) to get 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 $\angle \Gamma_L = 54.3^\circ$ off "ANGLE OF REFLECTION..." scale.

$$\underline{\underline{\Gamma_L = 0.422 \angle 54.3^\circ}}$$

c) Draw circle through z_L of constant $|\Gamma|$. Draw line across Smith Chart. Read $y_L = 0.49 - j0.41 \text{ S/S}$

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

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

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

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

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

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

$$l = 0.4 \lambda$$

0.074

$\phi_{in} = 126.5^\circ$

0.174

$\phi_L = 54.3^\circ$

r_{min}, v_{min}

r_{max}, v_{max}

ϕ_L

RESISTANCE COMPONENT (R/Z_0) OR CONDUCTANCE COMPONENT (G/Y_0)

INDUCTIVE REACTANCE COMPONENT ($+jX/Z_0$) OR CAPACITIVE SUSCEPTANCE COMPONENT ($+jB/Y_0$)

CAPACITIVE REACTANCE COMPONENT ($-jX/Z_0$) OR INDUCTIVE SUSCEPTANCE COMPONENT ($-jB/Y_0$)

WAVELENGTHS TOWARD GENERATOR

WAVELENGTHS TOWARD LOAD

ANGLE OF REFLECTION COEFFICIENT IN DEGREES

0.25

RADIALLY SCALED PARAMETERS

SWR (VSWR)

SWR (dB)

100 40 20 10 5 4 3 2.5 2 1.8 1.6 1.4 1.2 1.1 1.0

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

171 = 0.422

SWR = 2.47

CENTER

REFL. COEFF. V or I

REFL. COEFF. P