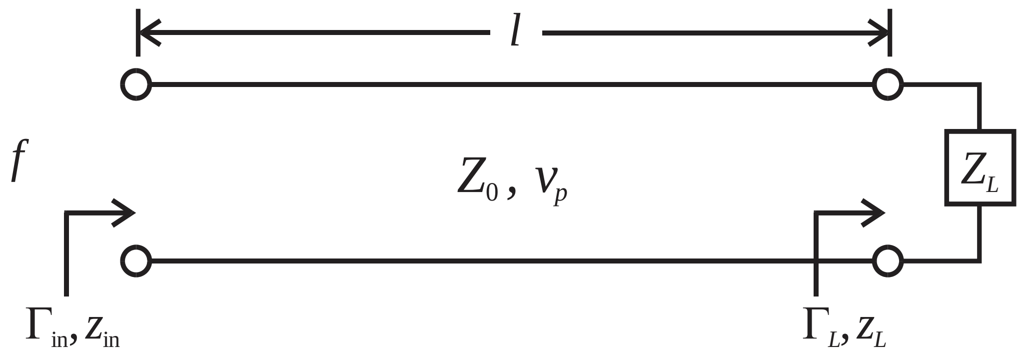


For the lossless transmission line circuit shown: $f = 100$ MHz, $v_p = 3\times10^8$ m/s, $l = 3.3$ m, $Z_0 = 50\,\Omega$, and $Z_L = 75 + j\,50\,\Omega$.

1) Normalize and plot load impedance

- Normalize $z_L = Z_L / Z_0 = (75 + j\,50)/50 \;\Rightarrow\;$ **$\underline{z_L = 1.5 + j\,1\ \Omega/\Omega}$**.
- Plot z_L on Smith chart by finding intersection of $r = 1.5$ circle with $x = 1$ arc.

2) Find load reflection coefficient and VSWR

- Set compass to distance between center of Smith chart and z_L. Use compass to mark the "REFL. COEFF. V or I" scale at bottom right of Smith chart to determine $\underline{|\Gamma_L| = 0.42}$.
- Use compass to draw $|\Gamma| = 0.42$ arc, centered on Smith chart scales, through SWR (VSWR) scale on bottom left. Read **<u>VSWR = 2.4</u>** **.**
- Use straight-edge to draw radial line from center of Smith chart through z_L and outer rings of Smith chart. Use "ANGLE OF REFLECTION COEFFCIENT IN DEGREES" scale to read $\underline{\angle\,\Gamma_L = 41.8°}$.
- Put magnitude and angle together to get **$\underline{\Gamma_L = 0.42\angle 41.8°}$**. For comparison, the analytic result is $\Gamma_L = 0.4152\angle 41.63°$.

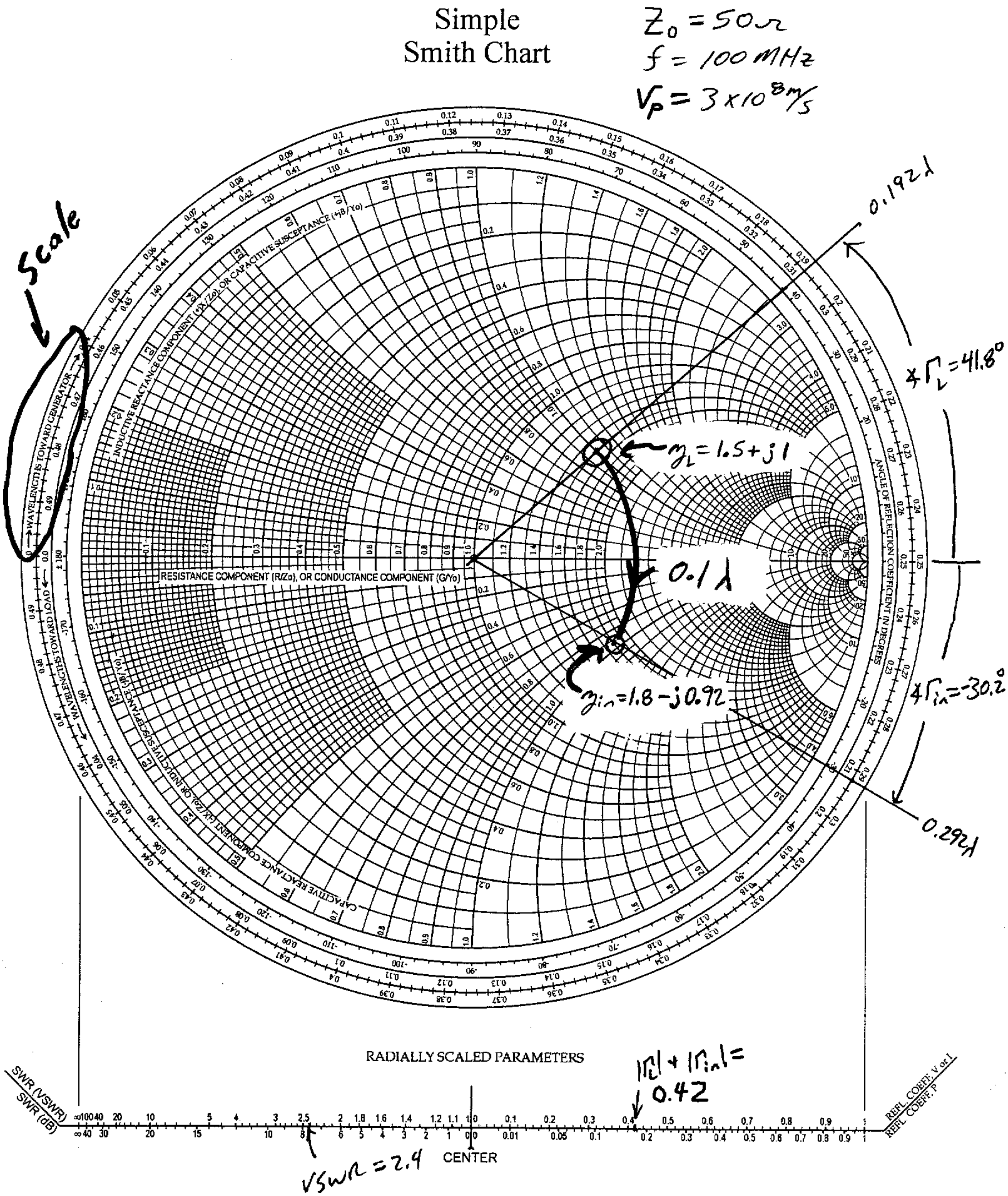
3) Find input reflection coefficient

- Calculate $l/\lambda = l\,f / v_p = 3.3\,(100\times10^6)/3\times10^8 = 1.1$. Subtract $2(0.5) = 1$ (i.e., remove integer multiples of $n\lambda/2$) to get $\Rightarrow \underline{l/\lambda = 0.1}$.
- On the Smith chart, the radial line through z_L reads 0.192 on the "WAVELENGTHS TOWARD GENERATOR" scale. Add $0.192 + l/\lambda$ to get 0.292 and draw a radial line from the center of the Smith chart through this point on the scale.

- Draw an arc, centered on Smith chart, from z_L through radial line at 0.292. The intersection of the arc and radial line is the Γ_{in} / z_{in} point. Use the "ANGLE OF REFLECTION COEFFCIENT IN DEGREES" scale to read $\angle \Gamma_{in} = -30.2°$ and note $|\Gamma_{\text{in}}| = |\Gamma_L| = 0.42$.
- Put magnitude and angle together to get $\mathbf{\Gamma_{in} = 0.42\angle{-30.2°}}$.

4) Find input impedance

- At $\Gamma_{\text{in}} = 0.42\angle{-30.2°}$ point, locate and read/interpolate value of appropriate "*r*" circle as $r_{\text{in}} = 1.8$.
- At $\Gamma_{\text{in}} = 0.42\angle{-30.2°}$ point, locate and read/interpolate value of appropriate "*x*" arc as $x_{\text{in}} = -0.92$.
- Put together to get normalized input impedance $\mathbf{z_{in} = 1.8 - j0.92\ \Omega/\Omega}$.
- Find input impedance by multiplying z_{in} w/ characteristic impedance to get $Z_{\text{in}} = Z_0 z_{\text{in}} = 50(1.8 - j0.92) \Rightarrow \mathbf{Z_{in} = 90 - j46\ \Omega}$.


Simple
Smith Chart
Z0 = 50Ω
f = 100 MHz
Vp = 3x10^8 m/s
Scale
0.192λ
∡ΓL=41.8°
yL=1.5+j1
0.1λ
yin=1.8-j0.92
∡Γin=-30.2°
0.292λ
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
RADIALLY SCALED PARAMETERS
SWR (VSWR)
SWR (dB)
REFL. COEFF. V or I
REFL. COEFF. P
|ΓL| = |Γin| = 0.42
VSWR = 2.4
CENTER