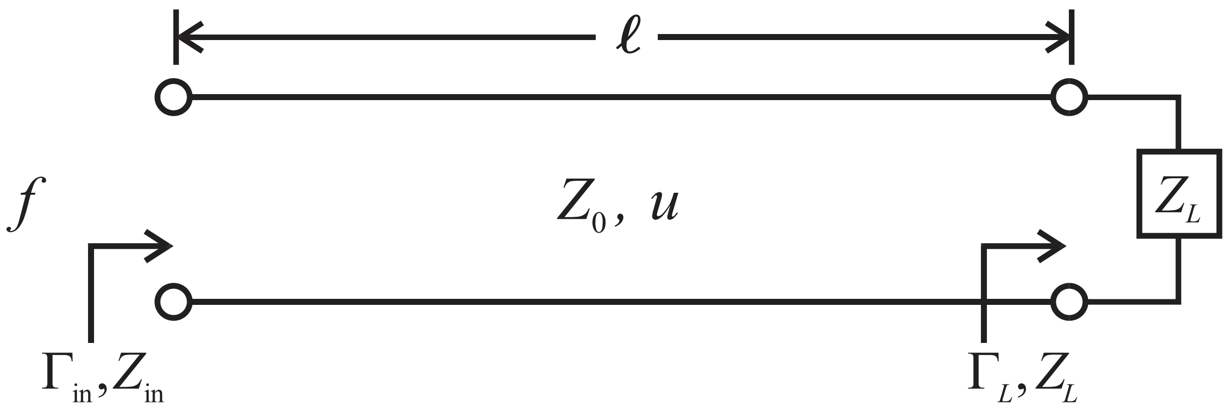


For the lossless transmission line circuit shown, $f = 100\,\text{MHz}$, $u = 3\times10^8\,\text{m/s}$, $\ell = 3.3\ \text{m}$, $Z_0 = 50\,\Omega$, and $Z_L = 75 + j\,50\,\Omega$.

1) Normalize and plot load impedance

- Normalize load impedance $z_L = Z_L / Z_0 = (75 + j\,50)/50 \Rightarrow$ **$z_L = 1.5 + j1\ \Omega/\Omega$**.
- Plot z_L on Smith chart by finding intersection of $r = 1.5$ circle with $x = 1$ arc.

2) Find load reflection coefficient and SWR

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

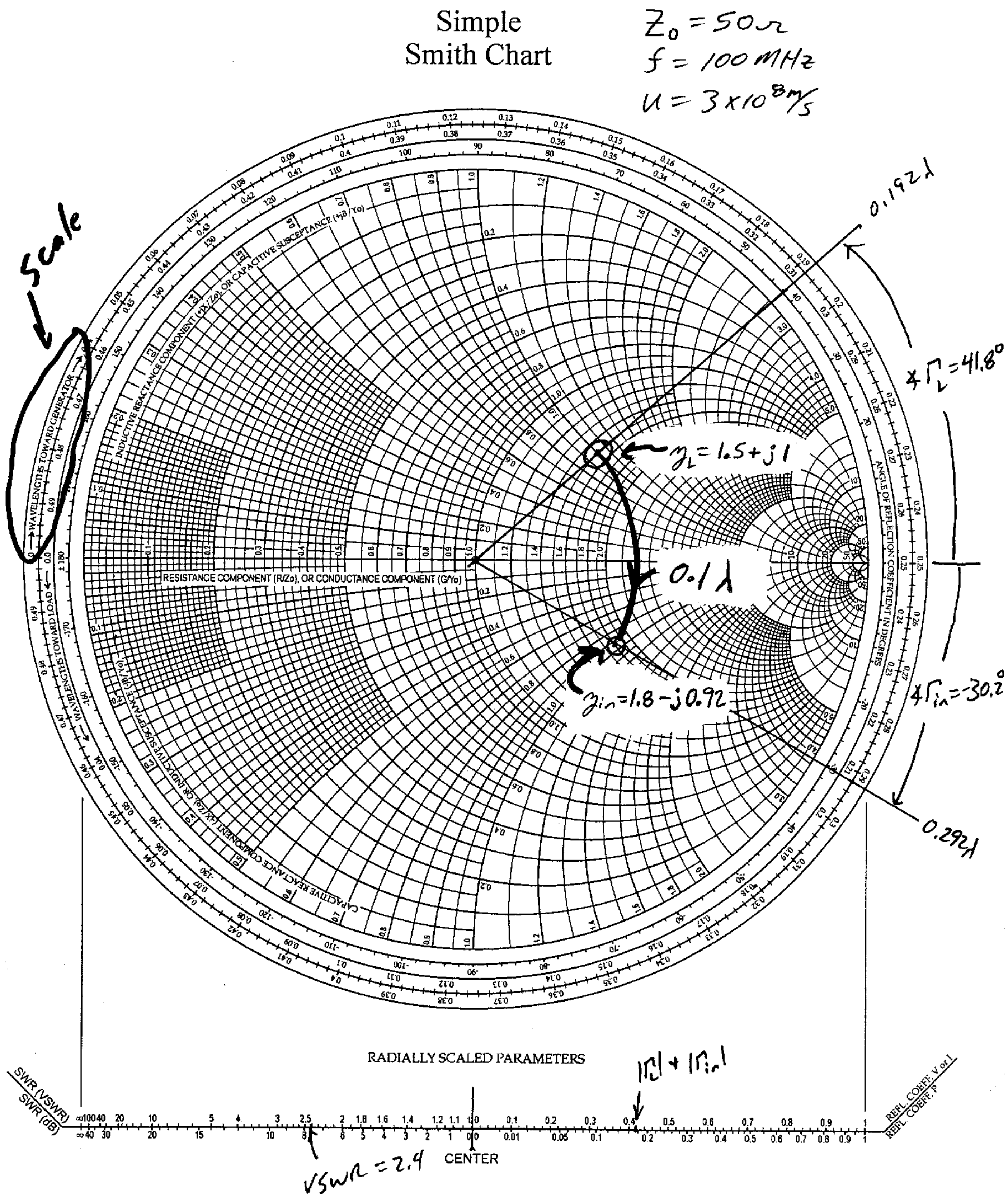
3) Find input reflection coefficient

- Calculate $\ell/\lambda = \ell f / u = 3.3\,(100\times10^6)/3\times10^8 = 1.1$. Subtract $2(0.5) = 1$ (i.e., remove integer multiples of $n\lambda/2$) to get $\Rightarrow \ell/\lambda = 0.1$.

- On the Smith chart, the radial line through z_L reads 0.192 on the "WAVELENGTHS TOWARD GENERATOR" scale. Add $0.192 + \ell/\lambda = 0.192 + 0.1$ to get 0.292 and draw a radial line from the center of the Smith chart through this point on the "WAVELENGTHS TOWARD GENERATOR" scale.
- Draw an arc, centered on Smith chart, from the z_L point through the radial line at 0.292. The intersection of the arc and radial line is the Γ_{in} and z_{in} point. Use the "ANGLE OF REFLECTION COEFFCIENT IN DEGREES" scale to read $\angle\,\Gamma_{in} = -30.2°$ and note $|\Gamma_{in}| = |\Gamma_L| = 0.42$.
- Put magnitude and angle together to get **$\Gamma_{in} = 0.42\angle{-30.2°}$**.

4) Find normalized input impedance and input impedance

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


Simple
Smith Chart
Z0 = 50Ω
f = 100 MHz
u = 3×10^8 m/s
Scale
0.192λ
∡Γ_L = 41.8°
y_L = 1.5 + j1
0.1λ
y_in = 1.8 − j0.92
∡Γ_in = −30.2°
0.292λ
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
RADIALLY SCALED PARAMETERS
SWR (VSWR)
SWR (dB)
REFL. COEFF. V or I
REFL. COEFF. P
CENTER
|Γ_L| + |Γ_in|
VSWR = 2.4