11.52 A 50 Ω air-filled line is terminated in a mismatched load of $40 + j25$ Ω. Find the shortest distance from the load at which the voltage has the smallest magnitude.

- Use Smith chart. Also, find the load reflection coefficient, SWR, and shortest distance from the load to where the voltage has the largest magnitude. Distances are in terms of λ.

➢ Calculate the normalized load impedance $z_L = Z_L / Z_0 = (40 + j25) / 50$
$\Rightarrow$ $\mathbf{z_L = 0.8 + j0.5\ \Omega/\Omega}$. Plot z_L on Smith chart.

➢ Use compass to draw a circle through z_L, centered on Smith chart. Use a straight edge to draw radial line from center of Smith chart through z_L to outer rings of Smith chart.

➢ Move in the "WAVELENGTHS TOWARD GENERATOR" direction on the circle of constant |Γ| from z_L point at 0.1163 to r_{min} point/V_{min} point at 0.5. Shortest distance from load to V_{min} point is $d_{V\min} / \lambda = 0.5 - 0.1163$ $\Rightarrow$ $\boxed{\mathbf{d_{V\min} = 0.3837\lambda}}$.

➢ Use the "ANGLE OF REFLECTION COEFFICIENT IN DEGREES" scale to read $\angle \Gamma_L = 96.3°$.

➢ Use compass (same setting) to mark the "SWR (VSWR)" and "REFL. COEFF, V or I" scales. Read off $|\Gamma| = 0.29$ and $\Rightarrow$ $\boxed{\mathbf{SWR = 1.81}}$.

➢ Put the magnitude and angle of the load reflection coefficient together to get $\Rightarrow$ $\boxed{\mathbf{\Gamma = \Gamma_L = 0.29\angle 96.3°}}$.

➢ Last, move in the "WAVELENGTHS TOWARD GENERATOR" direction on the circle of constant |Γ| from z_L point @ 0.1163 to r_{max} point/V_{max} point @ 0.25. The shortest distance from load to V_{max} is $d_{V\max} / \lambda = 0.25 - 0.1163$ $\Rightarrow$ $\boxed{\mathbf{d_{V\max} = 0.1337\lambda}}$.

Simple Smith Chart