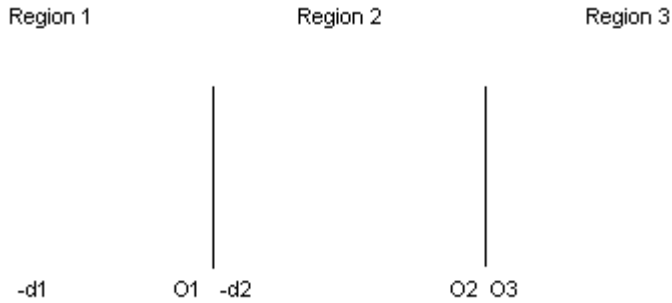


ECE 3300 Plane Wave Reflection Using a Smith Chart



Region 1: $\mu = \mu_0$, $\epsilon = 4\epsilon_0$, $\sigma = 0$, $d_1 = 0.1 \lambda_1$

Region 2: $\mu = \mu_0$, $\epsilon = \epsilon_0$, $\sigma = 0$, $d_2 = 3/8 \lambda_2$

Region 3: $\mu = \mu_0$, $\epsilon = 9\epsilon_0$, $\sigma = 0$

Step 1: (going from O_3 to O_2)

$$Z_3(O_3) = \eta_3 = 40\pi \Omega$$

At an interface, the characteristic impedance η is equal, so:

$$Z_2(O_2) = Z_3(O_3) = 40\pi \Omega = 125.67 \Omega$$

Normalize Z_2 :

$$Z_{2n}(O_2) = Z_2(O_2) / \eta_2 = 40\pi \Omega / 120\pi \Omega = 1/3 + j 0$$

Plot $Z_{2n}(O_2)$ on the Smith Chart

Step 2: (Rotating from O_2 to $-d_2$)

Rotate $3/8 \lambda_2$ towards the generator (TGW)

$$\text{Read } Z_{2n}(-d_2) = 0.6 - j 0.8$$

$$\text{Denormalize: } Z_2(-d_2) = [Z_{2n}(-d_2)] [\eta_2] = [0.6 - j 0.8][120\pi \Omega] = 226.2 - j 301.6 \Omega$$

Step 3: (going from $-d_2$ to O_1)

At an interface, the characteristic impedance η is equal, so:

$$Z_1(O_1) = Z_2(-d_2) = 226.2 - j 301.6 \Omega$$

Normalize Z_1 :

$$Z_{1n}(O_1) = Z_1(O_1) / \eta_1 = 226.2 - j 301.6 \Omega / 60\pi \Omega = 1.2 - j 1.6$$

Plot $Z_{1n}(O_1)$ on the Smith Chart

Step 4: (Rotating from O_1 to $-d_1$)

Rotate $0.1 \lambda_1$ towards the generator (TGW)

$$\text{Read } Z_{1n}(-d_1) = 0.35 - j 0.53$$

$$\text{Denormalize: } Z_1(-d_1) = [Z_{1n}(-d_1)] [\eta_1] = [0.35 - j 0.53][60\pi \Omega] = 65.97 - j 100 \Omega$$

Step 5: Read Γ , SWR, locations of E_{\min} and E_{\max} , etc.

$$\Gamma_2(O_2) = .45 \angle 180^\circ$$

$$\Gamma_2(-d_2) = .45 \angle -90^\circ$$

$$\Gamma_1(O_1) = .60 \angle -48^\circ$$

$$\Gamma_1(-d_1) = .60 \angle -118^\circ$$

Exp 1

The Complete Smith Chart

Black Magic Design

