LECTURE 6

Standing wave ratio

\[
\Gamma_1 = \frac{S-1}{S+1} \quad S = \frac{1 + \sqrt{1}}{1 - \sqrt{1}}
\]

The constant \( \Gamma \) circle intersects the real axis in two points. By definition, \( S \geq 1 \) = only the intersection point on the right-hand side of the chart's center gives \( S \).

Impedance to Admittance Calculations

Impedance: \( Z = R + jX \)

Admittance: \( Y = \frac{1}{Z} = \frac{1}{R + jX} = \frac{R - jX}{R^2 + X^2} = \frac{1}{Z} + j \frac{X}{Z} \)

Normalized admittance

\[
\tilde{Y} = \frac{Y}{Y_0} = \frac{G}{Y_0} + j \frac{B}{Y_0} = \tilde{G} + j \tilde{B}
\]

\( Y_0 = \frac{1}{Z_0} \) = characteristic admittance of the line

\[
\tilde{G} = \frac{G}{Y_0} = \frac{G}{Z_0}, \quad \tilde{B} = \frac{B}{Y_0} = \frac{B}{Z_0}
\]

\( \tilde{Y} = \frac{Y}{Y_0} = \frac{Z_0}{Z} = \frac{1}{\tilde{Z}} \) (normalized values)
\[ \tilde{Z}_{in} = \frac{1}{\tilde{Z}_{L}} = \frac{1-e^{-j\pi}}{1+e^{-j\pi}} \]

Rotation by \(\frac{3}{4}\) on Smith chart transforms \(\tilde{Z}_{L}\) into \(\tilde{Z}_{L}^*\).

**STEP 1** Place \(\tilde{Z}_{L}\) on Smith chart (\(P_{\tilde{Z}_{L}}\))

**STEP 2** Draw constant \(S\) circle

**STEP 3** Draw radius from center to \(\tilde{Z}_{L}\) and extend the radius to the other side

**STEP 4** New intersection gives \(\tilde{Z}_{L}^*\)

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**Single-Stub Matching**

- **Shunt** - use \(Z's\)
- **Series** - use \(Y's\)

\[ Y_{in} = Y_d + Y_s \]

\[ Y_{in} = Y_{in}' + Y_s = 1 = Y_o \rightarrow \text{matching} \]

**Double-Stub Matching**

\[ d_1 : \text{Re}(Y_d) = 1 \]
\[ l : \text{Im}(Y_s) = -\text{Im}(Y_d) \]

\[ Y_{in} = Y_{in}' + Y_s = 1 = Y_o \rightarrow \text{matching} \]

**Manual Adjustment**

\(d_1, d_2\) degrees of freedom