

ECE306S



MEMORANDUM

G.1

Date:

LECTURE 6

To:  
From:  
Subject:

Standing wave Ratio

$$|\Gamma| = \frac{S-1}{S+1} \quad S = \frac{1+|\Gamma|}{1-|\Gamma|}$$

The constant  $\Gamma$  circle intersects the real axis in two points. By definition  $S \geq 1 \Rightarrow$  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  $Y = \frac{1}{Z} = \frac{1}{R + jX} = \frac{R - jX}{R^2 + X^2} = \underbrace{G}_{\text{conductance}} + j \underbrace{B}_{\text{susceptance}}$

Normalized admittance

$$\tilde{Y} = \frac{Y}{Y_0} = \frac{G}{Y_0} + j \frac{B}{Y_0} = g + jb$$

$Y_0 = \frac{1}{Z_0}$  → characteristic admittance of the line

$$g = \frac{G}{Y_0} = G Z_0, \quad b = \frac{B}{Y_0} = B Z_0$$

$$\tilde{Y} = \frac{Y}{Y_0} = \frac{Z_0}{Z} = \frac{1}{\tilde{Z}}$$

↳ normalized values

$$\tilde{\Gamma}_L = \frac{1}{\tilde{Z}_L} = \frac{1-\Gamma}{1+\Gamma}$$

6.2

$$\tilde{Z}_{in}(l=2/\lambda) = \frac{1+\Gamma e^{-j\pi}}{1-\Gamma e^{-j\pi}} = \frac{1-\Gamma}{1+\Gamma} = \tilde{\Gamma}_L$$

Rotation by  $\frac{\lambda}{4}$  on Smith chart transforms  $\tilde{Z}_L$  into  $\tilde{\Gamma}_L$ .

STEP 1 Place  $\tilde{Z}_L$  on Smith chart ( $P_{Z_L}$ )

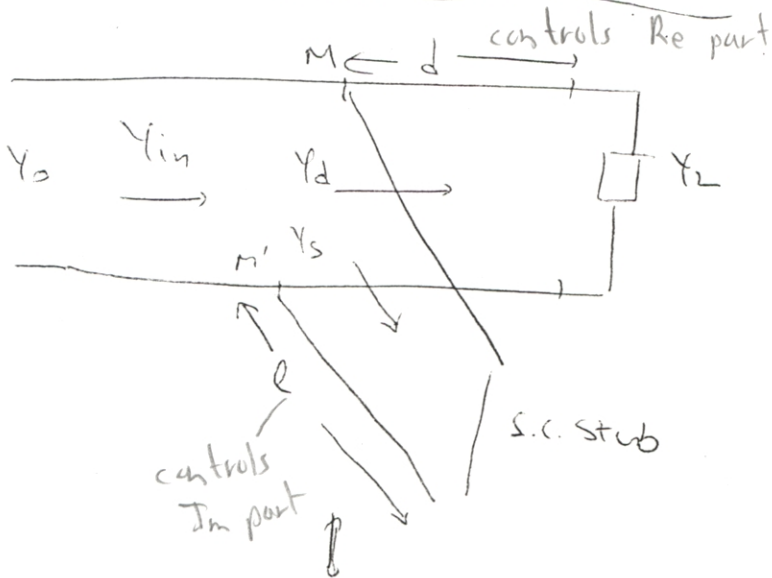
STEP 2 Draw constant  $\Gamma$  circle

STEP 3 Draw radius from center to  $P_{Z_L}$  and extend the radius to the other side

STEP 4 new intersection gives  $\tilde{\Gamma}_L$ .

### Single-stub Matching

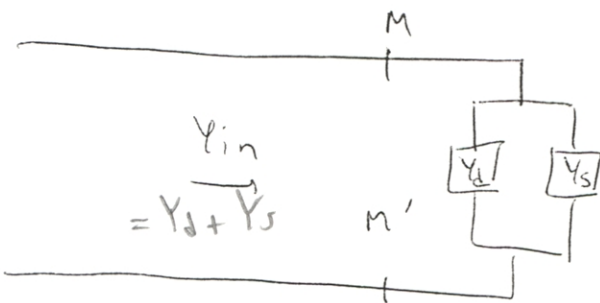
series - use Z's  
shunt - use Y's



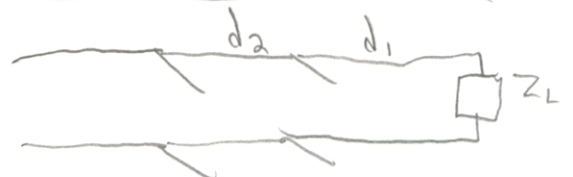
$$d: \text{Re}(Y_d) = 1$$

$$l: \text{Im}(Y_s) = -\text{Im}(Y_d)$$

$$Y_{in} = Y_{in}' + Y_s = 1 = Y_0 \rightarrow \text{matching}$$



### Double-stub matching



Manual adjustment  
 $d_1, d_2$  degrees of freedom