Single Stub Matching

- It consist of 2 sections of trans. lines:

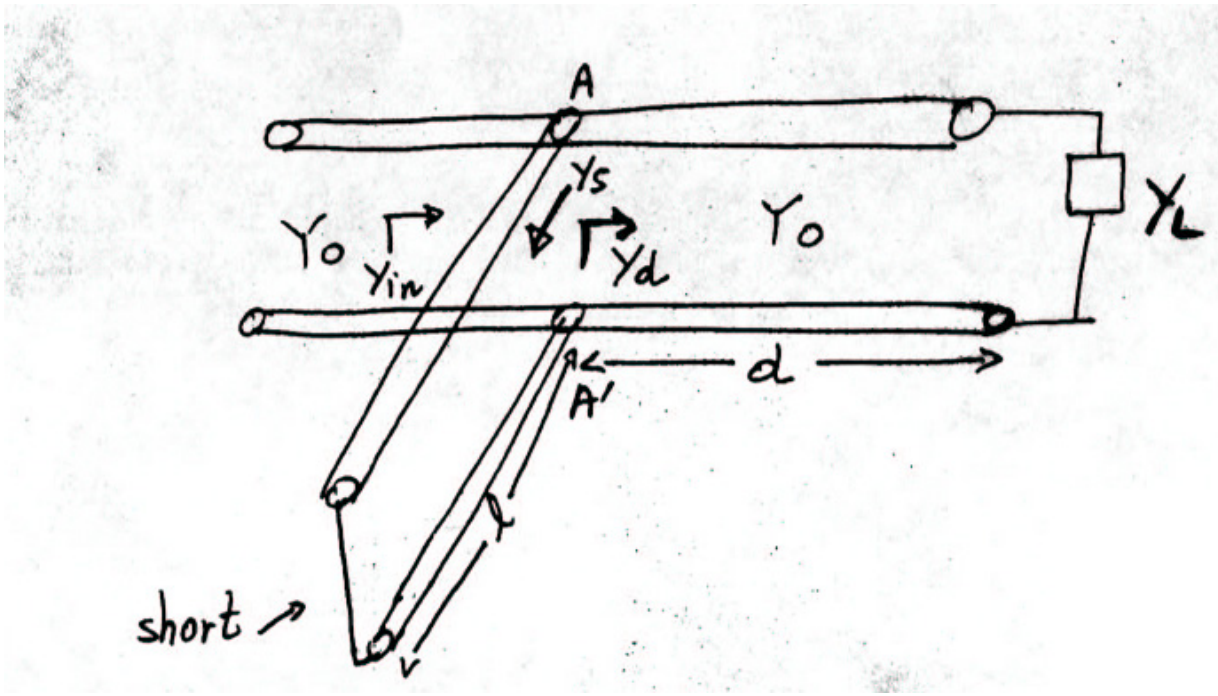
  - One of length *d* connecting the load to the feedline at AA'

  - One of length *l* connected in parallel

- This stub is shorted (could be open circuit)
- Since stub is added in parallel it is easier to work with admittances y

- Matching procedure consists of 2 steps:

  1. Transform $Y_L = 1/Z_L$ into $Y_d = Yo + jB$
  2. Select length *l* such that $Ys = -jB \rightarrow Yin = Yd + Ys = Yo$ match



Example: A 50 Ω transmission line is connected to a cellular phone antenna with load impedance ZL =25-j50 Ω. Find the position and the length of a shunt short-circuit stub required to match the 50 Ω line.

Use Smith chart

Normalize load: $\tilde{z}_L = Z_L/Z_0 = (25\text{-}j50)/50 = 0.5 - j$ → **Point A**

Draw constant SWR circle through point A

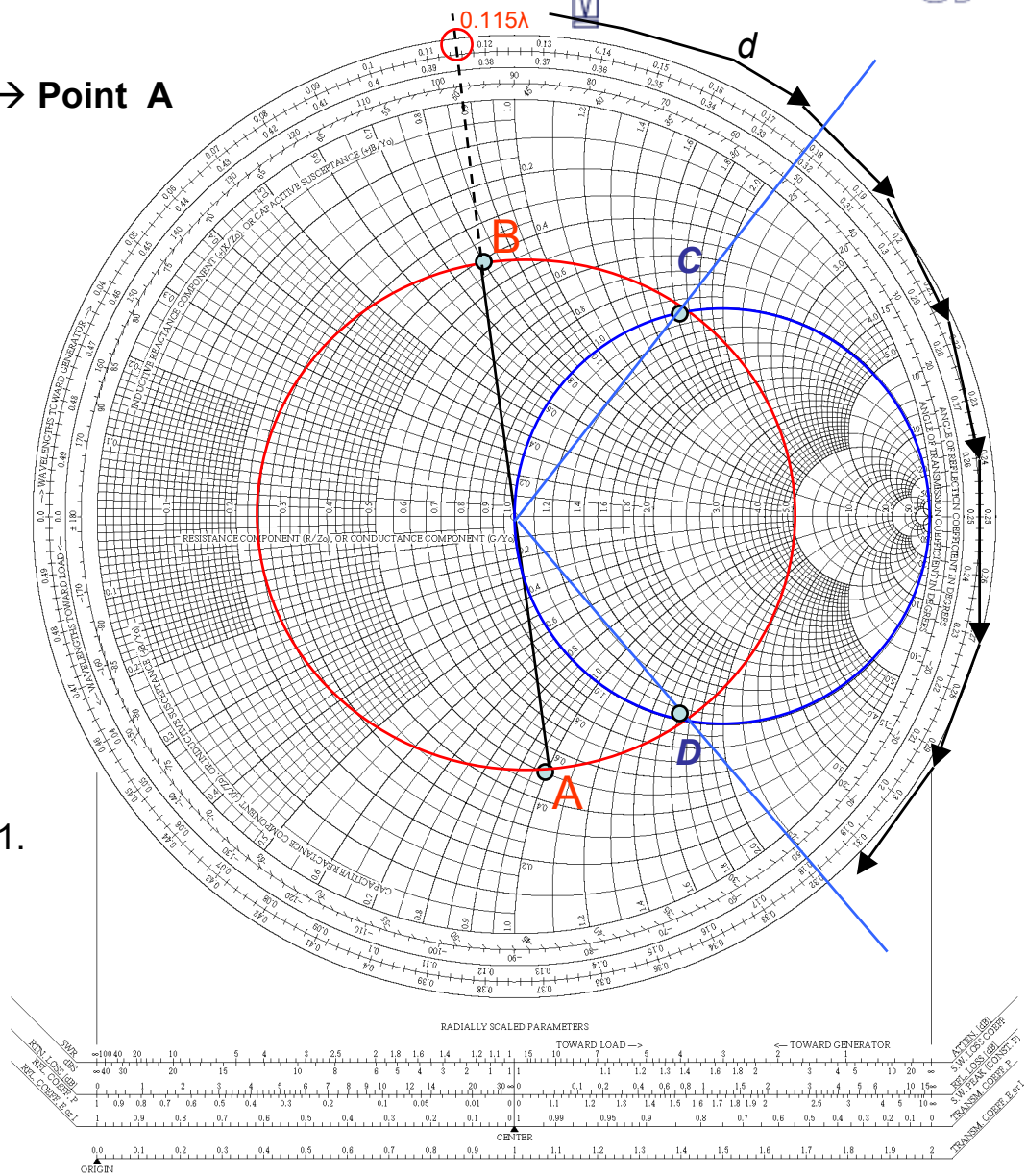
Obtain $\tilde{y}_L = 0.4 + j\,0.8$ (**point B**) at 0.115λ

In admittance domain $\tilde{r}_L$ circles → g_L circles

& x_L circles → b_L circles

For matching need to move towards generator a distance d such that y_d has a real part equal to 1.

This condition is satisfied by two **points C & D** on Smith Chart, corresponding to the intersections of the SWR circle with the $g_L = 1$ circle.



Solution for point C:

$\tilde{y}_d$ = 1 + j 1.6 point C located at 0.178λ

$d_{(B,C)}$=(0.178 - 0.115)λ= 0.063λ

In order to match: $\tilde{y}_{in}$ = 1

But $\tilde{y}_{in} = \tilde{y}_d + \tilde{y}_s$ = 1 + j1.6 + $\tilde{y}_s$ = 1

=> $\tilde{y}_s$ = - j 1.6

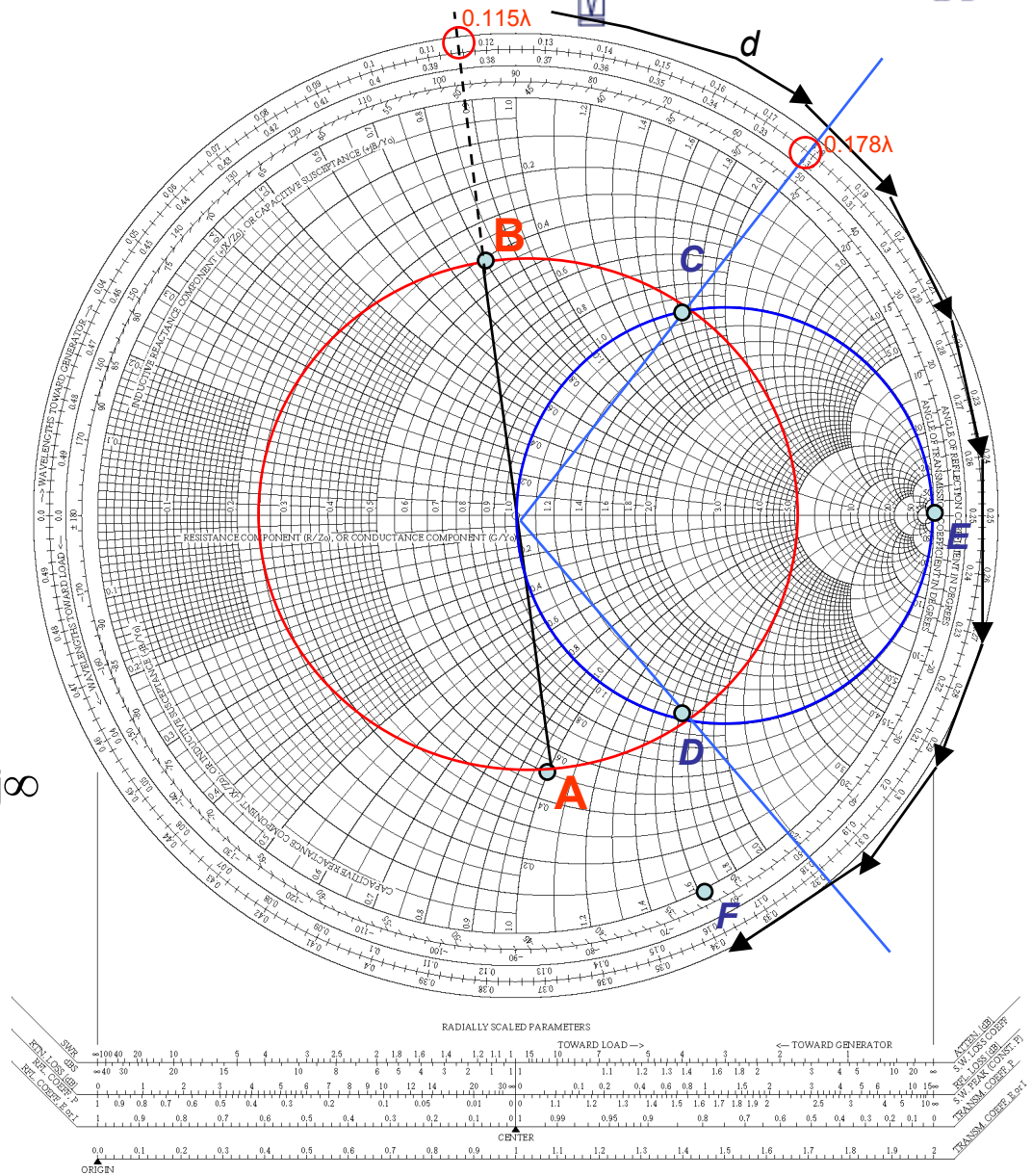
So we need a stub with admittance –j1.6.

The normalized admittance of a short is -j∞ located at **point E**

Starting from **E**, we move twd's generator until $\tilde{y}$ = -j1.6 → **point F** (0.34λ).

Distance E-F gives stub length:

ℓ = 0.34λ - 0.25 λ =0.09 λ



Solution for point D:

$\tilde{y}_d$ = 1 - j 1.6 point D located at 0.321λ

$d_{(B,D)}$=(0.321 - 0.115)λ= 0.206λ

In order to match: $\tilde{y}_{in}$ = 1

The needed normalized input admittance

of the stub is $\tilde{y}_s$ = + j 1.6,

located at **point G** (0.16λ on WTG scale)

The normalized admittance of a short is -j∞

located at **point E**

Starting from **E**, we move twd's generator

until $\tilde{y}$ = +j1.6 → **point G** (0.25+0.16 = 0.41λ)

Distance E-G gives stub length:

ℓ = 0.25λ + 0.16 λ =0.41λ