3.5 SINGLE STUB MATCHING USING SMITH CHART:

PROBLEM 1:

A 30m long lossless transmission line with Z_0 = 50 ohm operating at 2 MHz is terminated with a load Z_L=60+j40 ohm. If v=0.6 c on the line, find Refection coefficient, the standing wave ratio and the input impedance.

STEP 1:

- To find The normalized load impedance is
- $Z_L{}' = \frac{Z_L}{Z_O}$
- $Z_L{}' = \frac{60+j40}{50}$
- $Z_L{}'$ = 1.2 +j0.8

STEP 2:

- Fig 3.5.1, draw the normalized load impedance in smith chart

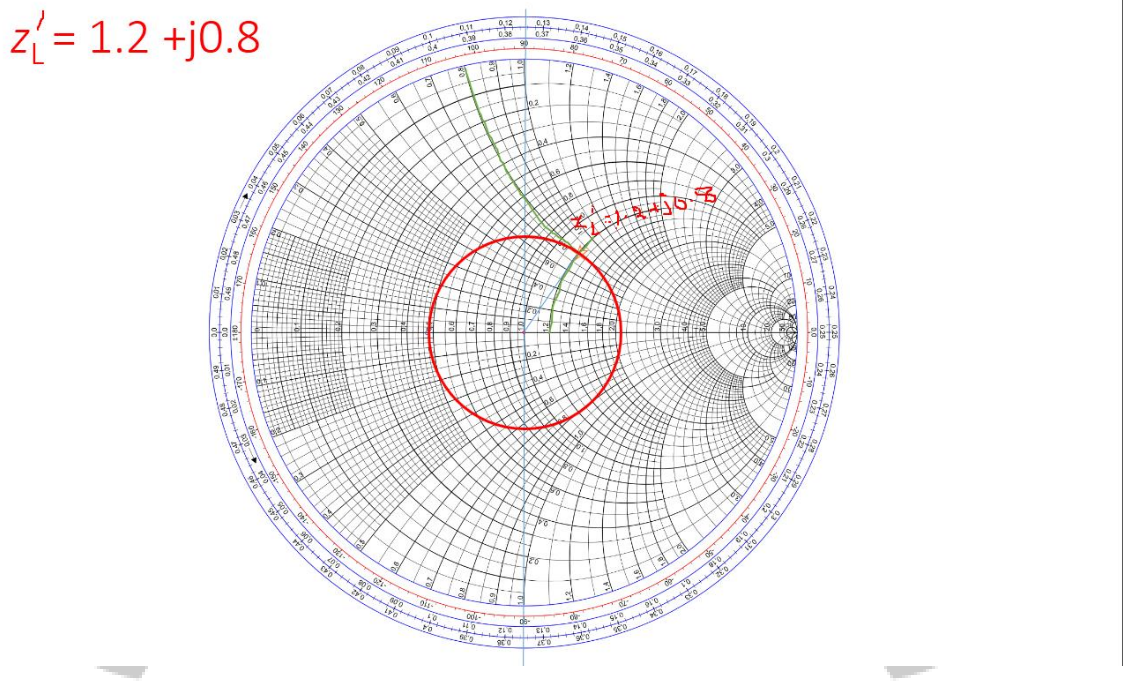

Fig: 3.5.1 Normalized load impedance

STEP 3:

- Fig 3.5.2, mark the value of Standing Wave Ratio in smith chart

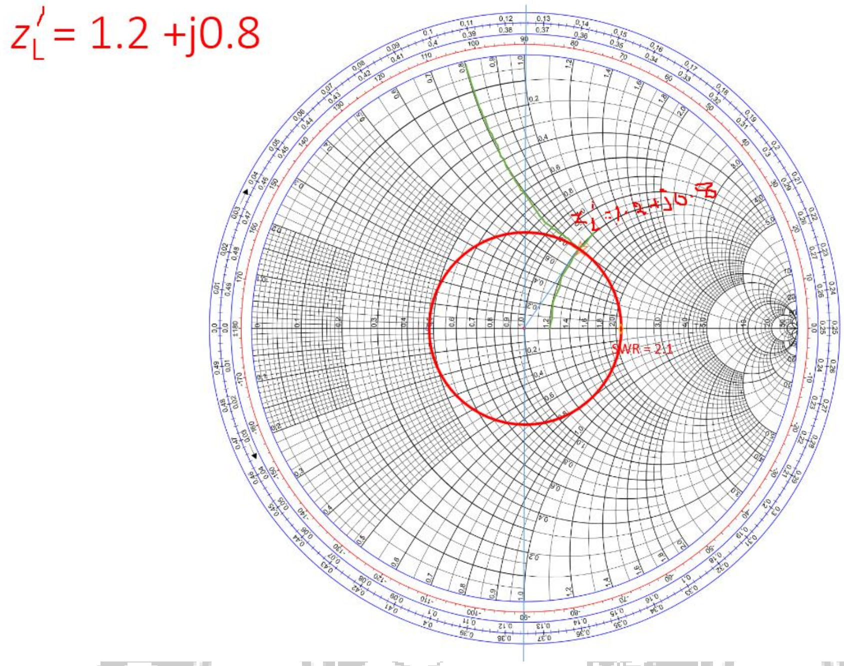

Fig 3.5.2 Standing Wave Ratio

STEP 4:

- Fig 3.5.3, mark the wavelength in smith chart

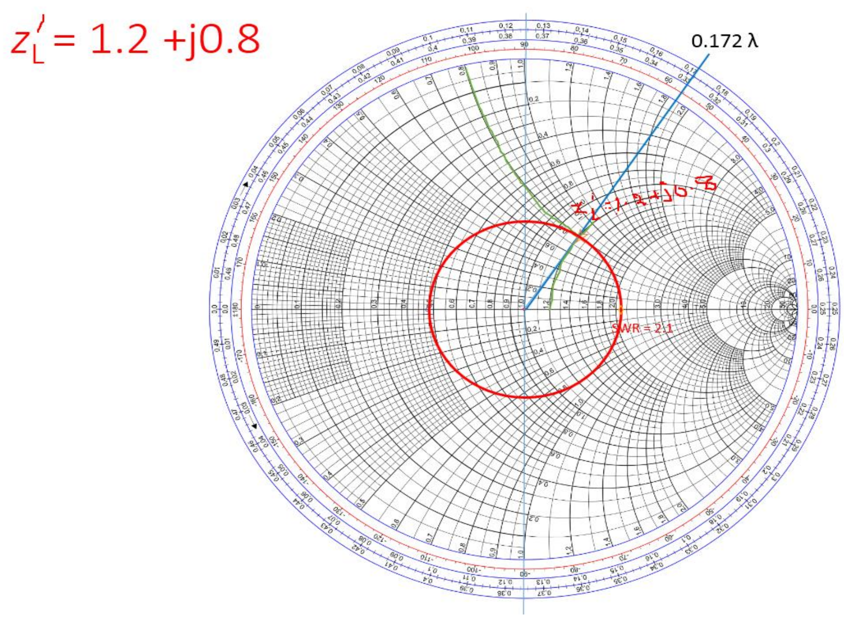

Fig: 3.5.3 wavelength

STEP 5:

- Calculate the velocity and wavelength using 30m long transmission line v = 0.6c

= 0.6 X 3X10^8

= 1.8X10^8

$\lambda = \frac{v}{f}$

$\lambda = \frac{1.8X10^8}{2\,X\,10^6}$

λ = 90m

L = 30m

$1\text{ m} = 30\text{ X}\frac{\lambda}{90}$

$L = \frac{\lambda}{3}$

L = 0.333 λ

STEP 6:

- Fig 3.5.4, draw the new wavelength in smith chart

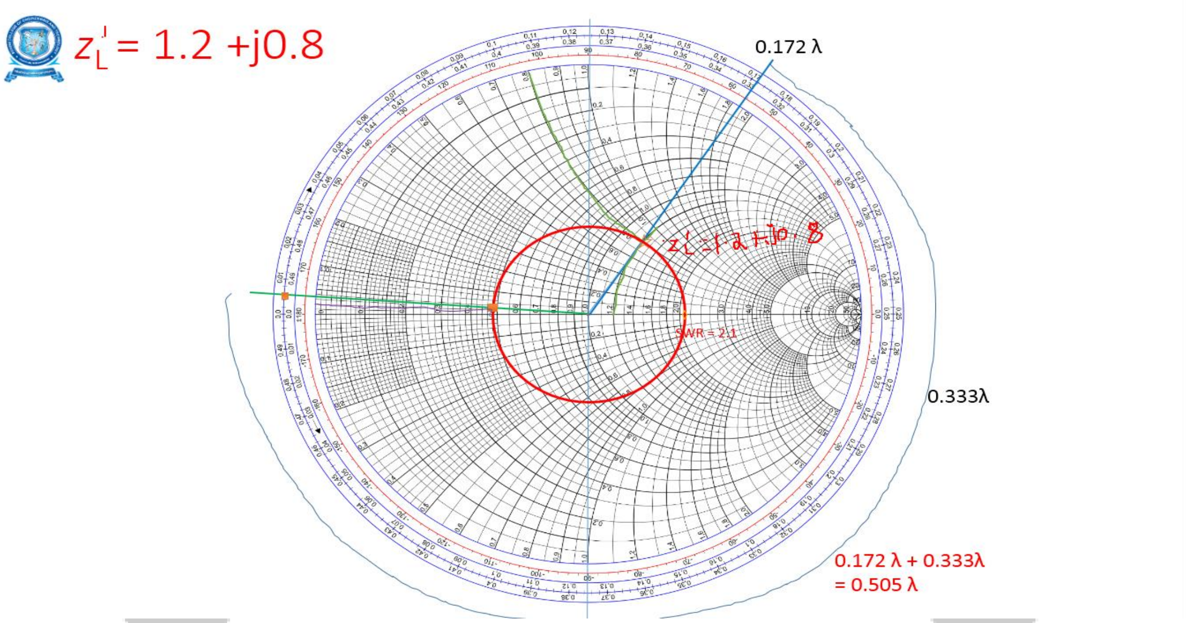

Fig: 3.5.4 new wavelength

STEP 7:

Fig 3.5.5, calculate the normalized input impedance and mark the Z_{in} in smith chart

$Z_{in} = Z_{in}'\, Z_O$

$Z_{in}' = 0.48 – 0.03$

Z_{in} = (0.48 – j0.03) 50

Z_{in} = 24 + j1.5 ohm

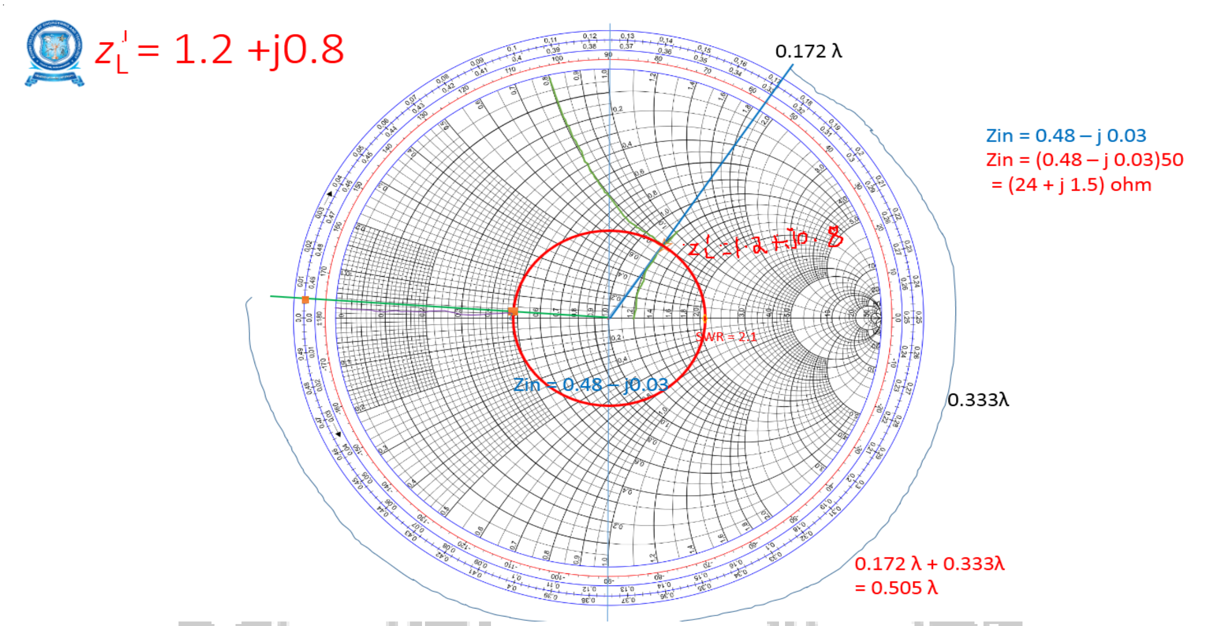

Fig: 3.5.5 Normalized input impedance

STEP 8:

- Fig 3.5.6, mark the reflection coefficient and phase angle in smith chart

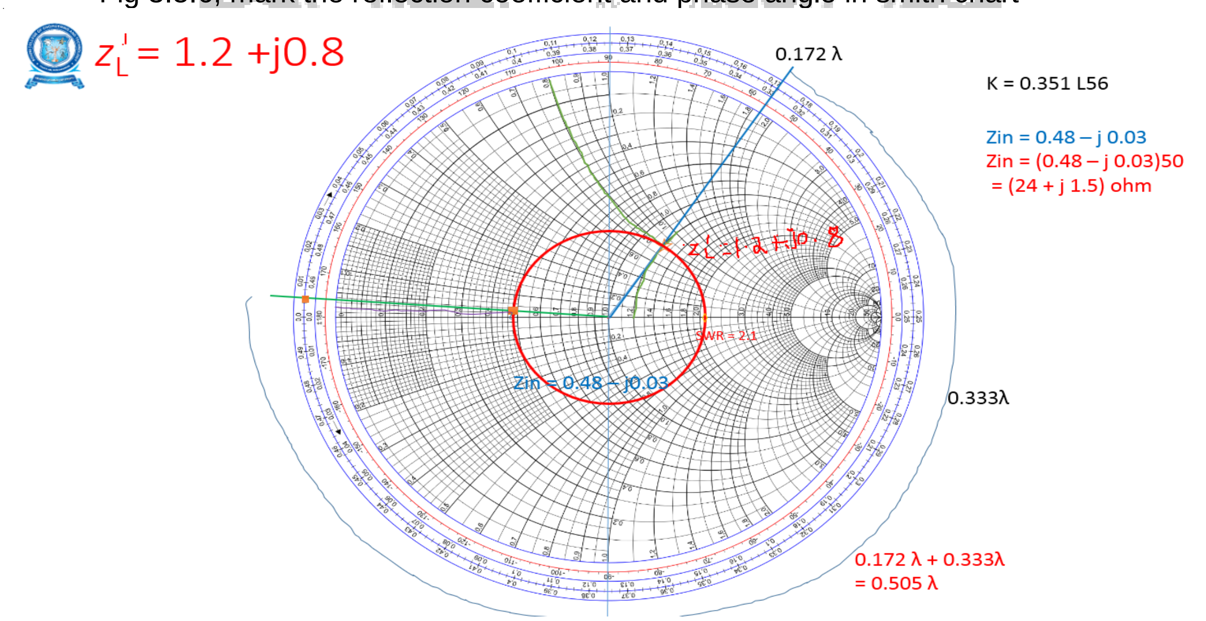

Fig: 3.5.6 Reflection coefficient and phase angle

[Source: John D Ryder, ―Networks, lines and fields‖, 2nd Edition, Prentice Hall India, 2015]