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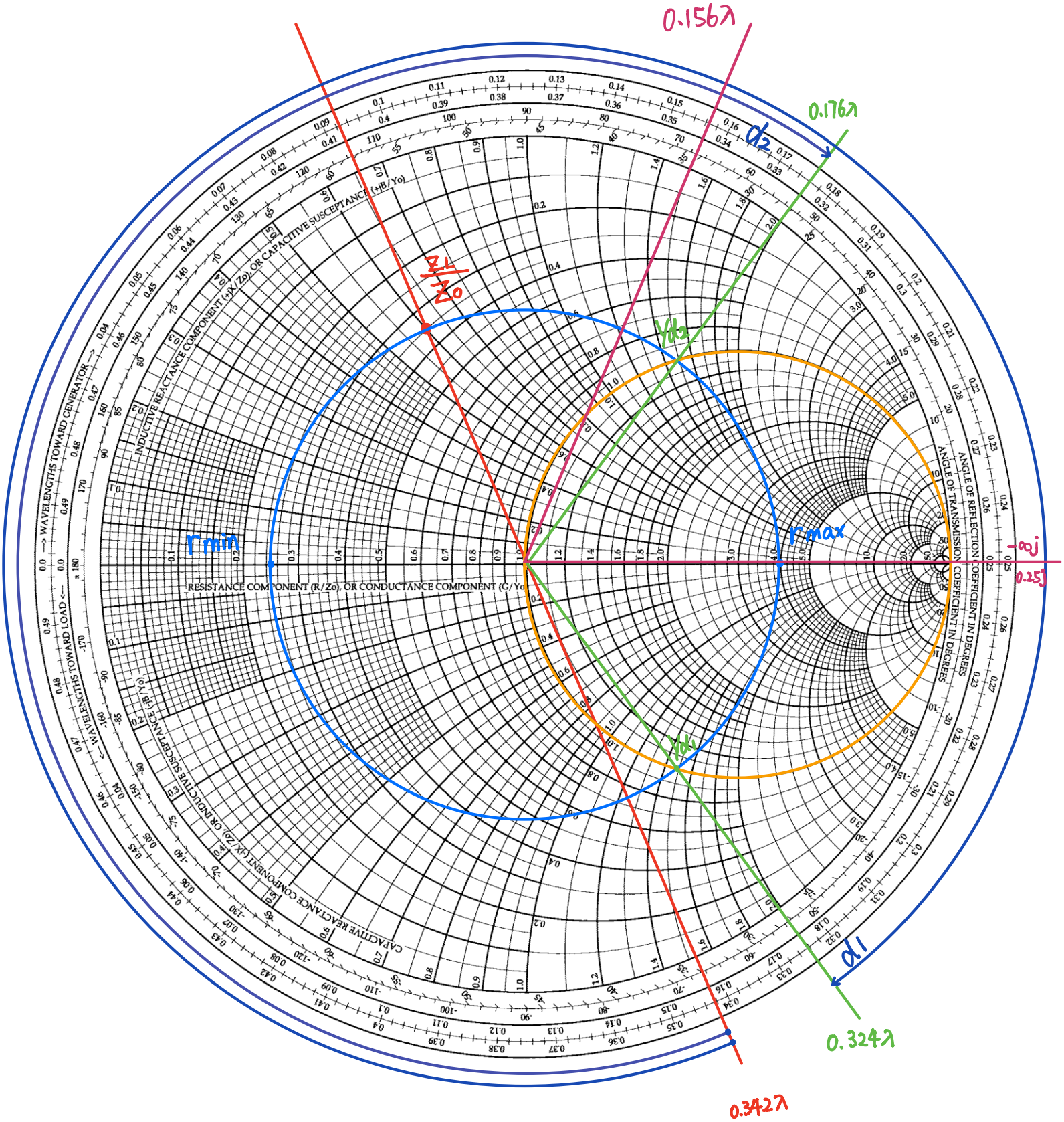
Smith impedance chart



2006

(a) The normalised impedance for load is :

$$\text{Normalised impedance} = \frac{Z_L}{Z_0} = \frac{17.5 + j30\Omega}{50\Omega} = 0.35 + j0.6$$

The $0.35 + j0.6$ is plotted on the Smith Chart.

(b) The voltage standing wave ratio (VSWR) is equal to 4, draw this circle on the Smith chart. The normalised admittance y_L is obtained by rotating $\frac{Z_L}{Z_0}$ by 180°

Then plotting the matched condition circle ($G=1$).

Rotating y_L with a distance d to intercept with $G=1$ circle, There will be two intercepts, Yd_1 and Yd_2

For d_1: $d_1 = 0.5\lambda - 0.342\lambda + 0.324\lambda$

$= 0.482\lambda$

For d_2: $d_2 = 0.5\lambda - 0.342\lambda + 0.176\lambda$

$= 0.334\lambda$

Since $\lambda = \frac{c}{f} = \frac{3 \times 10^8 \, ms^{-1}}{1.5 \times 10^9 \, Hz} = 0.2m = 20cm$

$d_1 = 0.482 \times 20cm = 9.64cm$

$d_2 = 0.334 \times 20cm = 6.68cm$

Since $d_1 = 9.64\text{cm}$ which is greater than 8 cm, the d should be 9.64cm.

Therefore, the $y_d = 1 - j1.5$, and $d = 9.64\text{cm}$.

(c) $$Y_{in} = Y_s + Y_d$$

Since $Y_{in} = 1$, $Y_d = 1 - j1.5$

$$Y_s = Y_{in} - Y_d$$

$$= 1 - (1 - j1.5)$$

$$= j1.5$$

The Y_s is moving from the end of stub to j1.5.

The required stub $= 0.156\lambda + 0.25\lambda = 0.406\lambda$

The length $= 0.406 \times 20\text{cm} = 8.12\text{cm}$