

EE 3113

INTRODUCTION INTO RF

CIRCUIT DESIGN

Lecture Notes for A-term 1999

LECTURE 8

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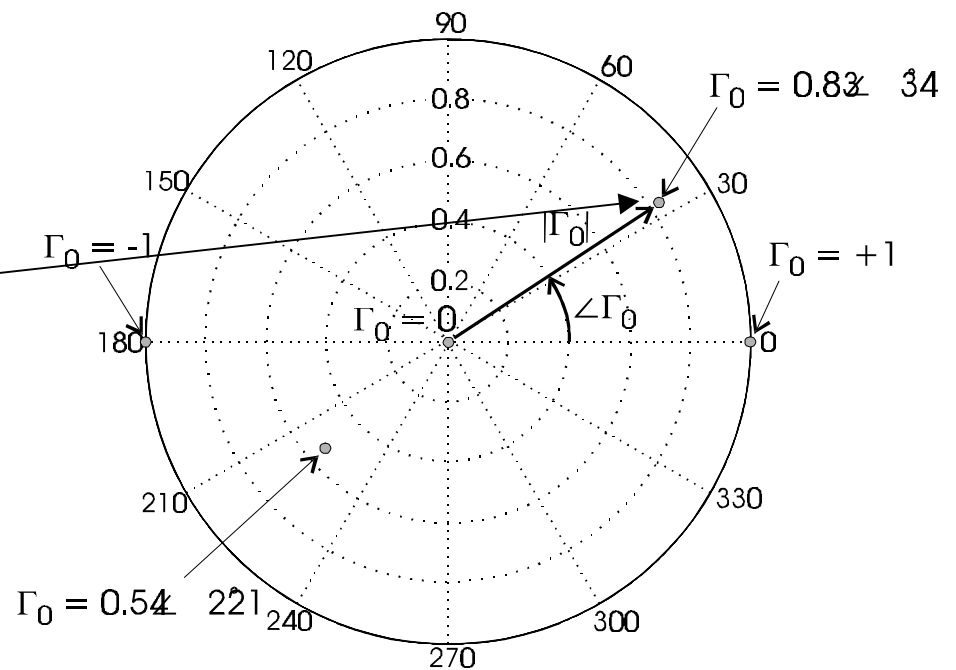
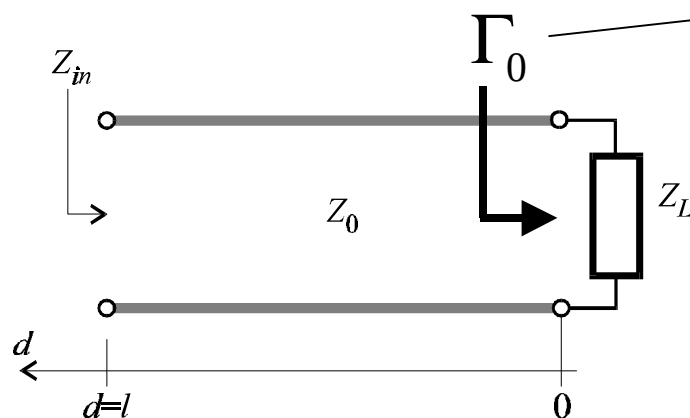
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From Reflection Coefficient to Load Impedance (Smith Chart)

- Reflection coefficient in phasor form

$$\Gamma_0 = \frac{Z_L - Z_0}{Z_L + Z_0} = \Gamma_{0r} + j\Gamma_{0i} = |\Gamma_0| e^{jq_L}$$

The load reflection coefficient is identified in the complex domain



Normalized impedance

$$Z_{in}(d)/Z_0 = z_{in} = r + jx = \frac{1 + \Gamma(d)}{1 - \Gamma(d)} = \frac{1 + \Gamma_r + j\Gamma_i}{1 - \Gamma_r - j\Gamma_i}$$

$$\Gamma(d) = |\Gamma_0| e^{jq_L} e^{-j2bd} = \Gamma_r + j\Gamma_i$$

Real part of normalized impedance

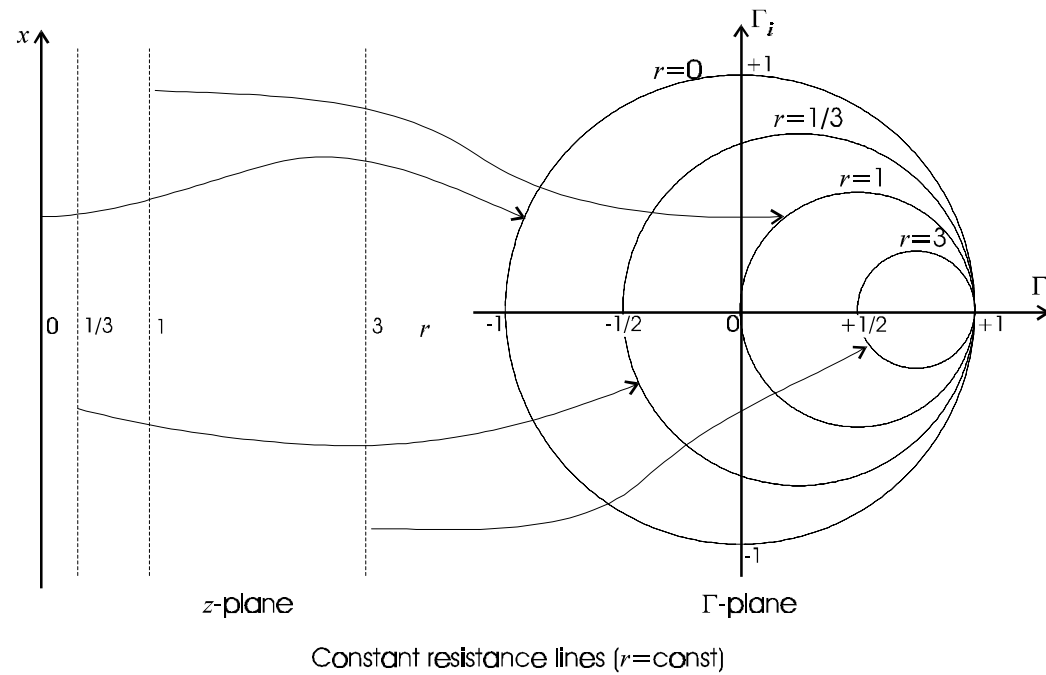
$$r = \frac{1 - \Gamma_r^2 - \Gamma_i^2}{(1 - \Gamma_r)^2 + \Gamma_i^2}$$

Imaginary part of normalized impedance

$$x = \frac{2\Gamma_i}{(1 - \Gamma_r)^2 + \Gamma_i^2}$$

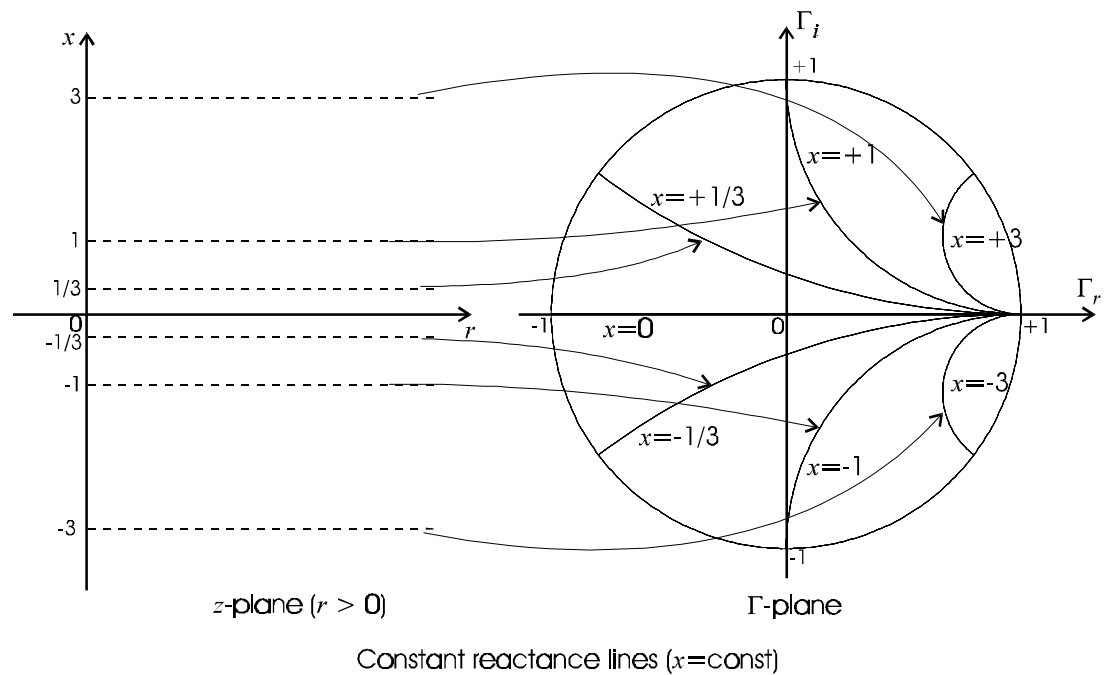
Inversion of complex reflection coefficient (constant normalized resistance)

$$\left(\Gamma_r - \frac{r}{r+1}\right)^2 + \Gamma_i^2 = \left(\frac{1}{r+1}\right)^2$$



Inversion of complex reflection coefficient (constant normalized reactance)

$$(\Gamma_r - 1)^2 + \left(\Gamma_i - \frac{1}{x}\right)^2 = \left(\frac{1}{x}\right)^2$$



Combined display: Smith Chart

