Lec-20

Friday, March 6, 2020 8:40 AM

Mapping b/w Impedance Plane & Complex Γ plane.

$$\bar{Z} = r + jx = \frac{1+\Gamma}{1-\Gamma}$$

$$r + jx = \frac{1 + u + jv}{1 - u - jv}$$

$$= \frac{(1+u+jv)(1-u+jv)}{(1-u)^2 + v^2}$$

$$r + jx = \frac{(1+u)(1-u) + jv(1+u) + jv(1-u) - v^2}{(1-u)^2 + v^2}$$

Separating real & imaginary terms

$$\boxed{r = \frac{(1+u)(1-u) - v^2}{(1-u)^2 + v^2}} \quad -(1)$$

$$\boxed{x = \frac{jv(1+u) + jv(1-u)}{(1-u)^2 + v^2}} \quad -(2)$$

$$= \frac{jv + \cancel{jvu} + jv - \cancel{jvu}}{(1-u)^2 + v^2}$$

→ After rearrangement of terms.

$$\boxed{u^2 - 2\left(\frac{r}{1+r}\right)u + v^2 + \frac{r-1}{r+1} = 0}$$

Constant Resistance Circle

→ After rearrangement.

$$\boxed{u^2+v^2-2u-\left(\frac{2}{x}\right)v+1=0}$$

Constant Reactance circle

Constant Resistance circle. (r)

Remember:
(normalized resistance & reactance)

- Locus of all reactance points for a fixed resistance

Circle Centre $= \left(\frac{r}{r+1}, 0\right)$ Radius $= \frac{1}{r+1}$

1. $r=0$ Centre $=(0,0)$ Radius $= \frac{1}{1} = 1$
2. $r=1$ Centre $=(0.5,0)$ Radius $= \frac{1}{2} = 0.5$

Observation:

1) As r increases, centre shifts to the right
2) " " ", radius reduces.
3) At $r=\infty$, radius $=0$
$\downarrow$
open in the resistance

Constant Reactance Circles (x)

Centre : $\left(1, \frac{1}{x}\right)$

Radius : $\frac{1}{x}$

- Locus of all resistance for a constant reactance.

a) $x=0$ Centre $= 1, \infty$
Radius $= \infty$ } Denotes a straight line

b) x is positive Centre $1, \frac{1}{x}$

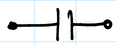
radius $= \frac{1}{x}$

$x = 1$ Centre $= (1, 1)$

Radius $= (1)$

$x = \infty$, Centre $= 1, 0$
Radius $= 0$

c) x is negative



$x = -1$ Centre $= (1, -1)$

Radius $= 1$

Smith chart → Super position of constant x circle & constant r circle.