Lec-19

Monday, March 2, 2020 8:43 AM

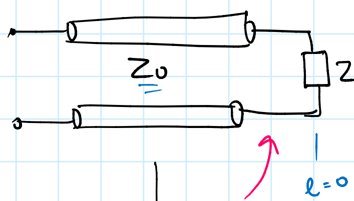
Midterm-2 on 03/04/2020

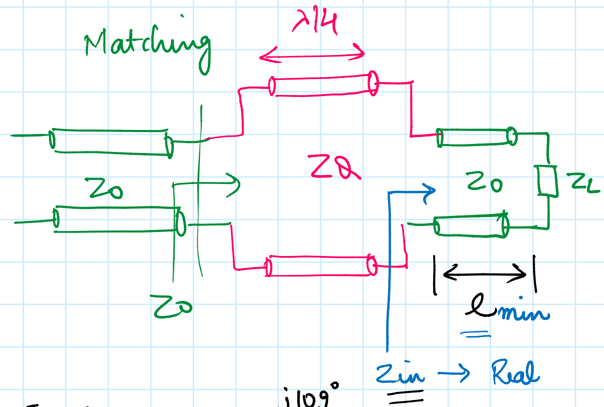
Contents : Lec-8 to Lec-18 (HW-3, HW-4)

Example 2: $\lambda/4$ matching in complex loads.

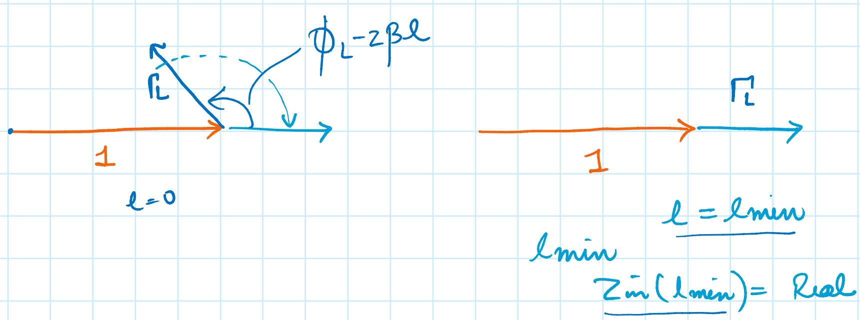
$Z_L = 73 + j42.50\,\Omega$

$Z_0 = 100\,\Omega$





$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{73 + j42.5 - 100}{73 + j42.5 + 100} = 0.283\,e^{j109^\circ}$$



$\phi_L - 2\beta l = 0$

$\phi_L \downarrow \quad l \downarrow$ lmin

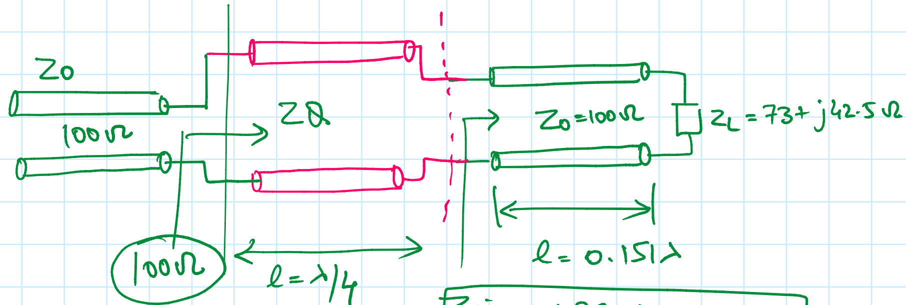
$$109^\circ \times \frac{\pi}{180^\circ} - 2 \cdot \frac{2\pi}{\lambda} \cdot l = 0$$

$l \downarrow$ lmin

$l_{min} = 0.151\lambda$

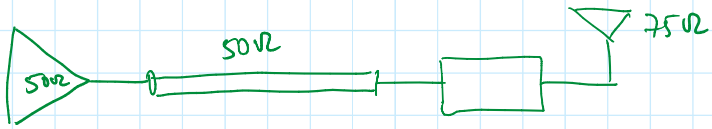
$$\bar{Z}(l = l_{min}) = \frac{\bar{Z}_L \cos\beta l + j\sin\beta l}{\cos\beta l + j\bar{Z}_L \sin\beta l}$$

$\bar{Z}(l = l_{min}) = 1.79$



$\boxed{Z_{in} = 1.79 \times 100 = 179\,\Omega}$

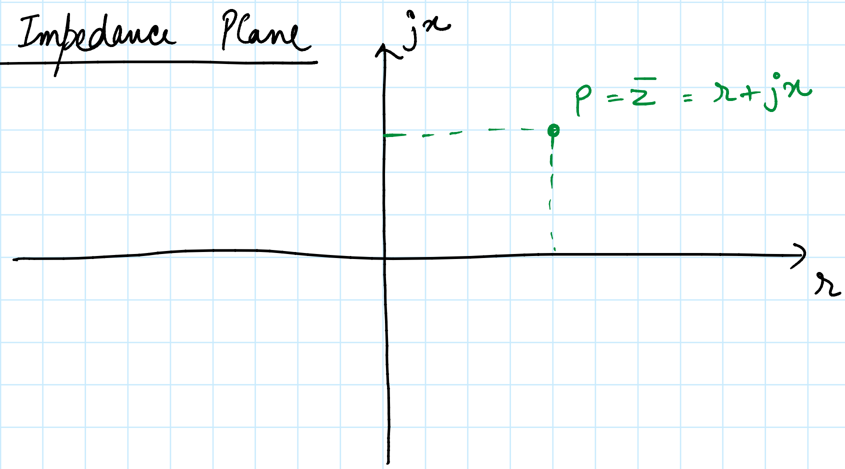
$\boxed{Z_Q = \sqrt{179 \times 100} = 133.7\,\Omega}$



Smith Chart

- Impedance represented on smith chart are normalized to Z_o → Char Imp

1) Complex Impedance Plane



Observation

1. All points of P on the imaginary axis represents reactive load
2. All points on real axis represents real load
3. All points on right half plane represents all possible impedance values on a transmission line.

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Reflection Coefficient

$$\Gamma = \frac{Z - Z_0}{Z + Z_0} \quad ; \quad \Gamma(\ell) = \frac{Z(\ell) - Z_0}{Z(\ell) + Z_0}$$

$$\boxed{\Gamma(\ell) = \frac{\bar{Z}(\ell) - 1}{\bar{Z}(\ell) + 1}} = u + jv$$

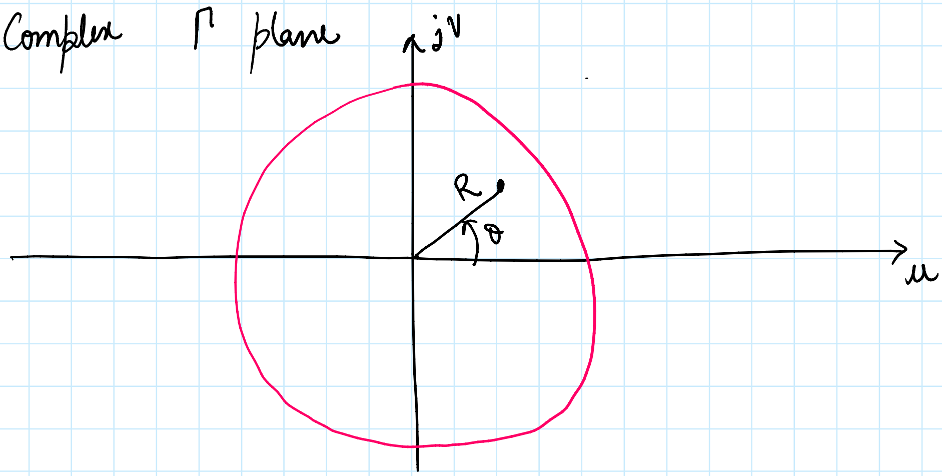
$$= \underline{R}e^{j\theta} \quad \text{(Polar representation)}$$

$$\boxed{\bar{Z}(\ell) = \frac{1 + \Gamma(\ell)}{1 - \Gamma(\ell)}}$$

Observation

1. If we know $\Gamma(\ell)$, we can get $\bar{Z}(\ell)$
2. If we know $\bar{Z}(\ell)$, we can get $\Gamma(\ell)$

2) Complex Γ plane



Observation : 1. All possible points of $\Gamma(\ell)$ are inside the unit circle.

2. All possible normalized impedance can be mapped on a complex Γ plane inside a unit circle.

Mapping b/w Γ plane and $\bar{Z}$ plane.

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

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

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