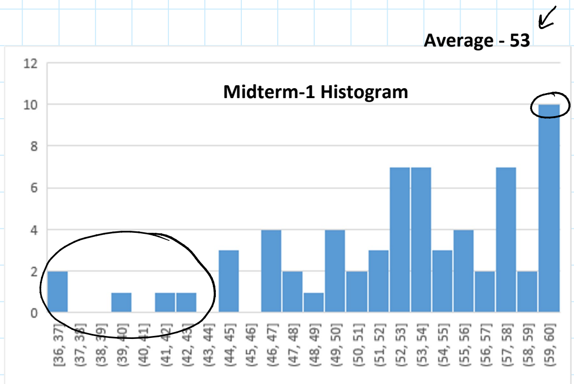
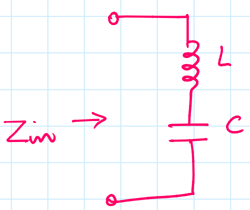
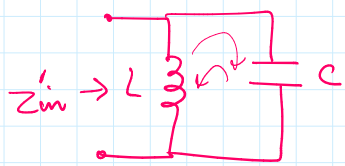
Lec-14

Thursday, February 13, 2020 5:00 PM



No class on Wednesday (2/19)





$\omega_{res} = \frac{1}{\sqrt{LC}}$

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$Z_{in} = 0$ at ω_{res}

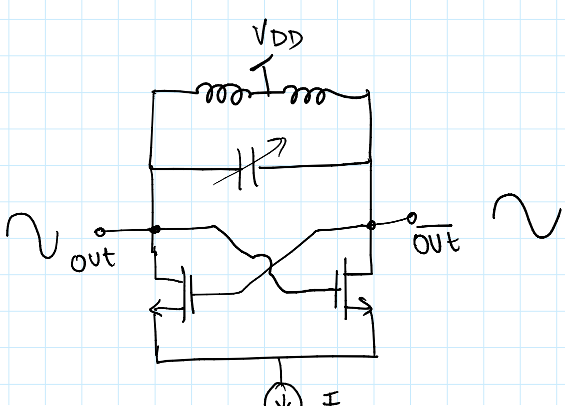
$Z_{in}' = \infty$ at ω_{res}

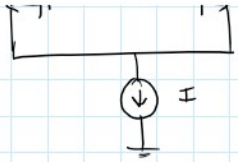
$Z_{in} = sL + \frac{1}{sC} = \frac{s^2LC+1}{sC}$, $s^2LC+1 \rightarrow 0$, $\omega = \frac{1}{\sqrt{LC}}$

$sL \,||\, \frac{1}{sC} = \frac{\frac{sL}{sC}}{sL + \frac{1}{sC}} = \frac{sL}{s^2LC+1}$

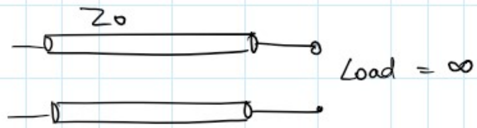
$= \frac{j\omega L}{-\omega^2LC+1}$, $-\omega^2LC+1 \rightarrow 0$, $\omega = \frac{1}{\sqrt{LC}}$

Parallel LC are used in oscillators.





Case 2: Standing Wave in Open Circuit Transmission Line.



$$V(\ell) = V^+ e^{j\beta\ell} + V^- e^{-j\beta\ell}$$

$$I(\ell) = \frac{V^+}{Z_0} e^{j\beta\ell} - \frac{V^-}{Z_0} e^{-j\beta\ell}$$

$\Gamma_L = 1$

$V^- = V^+$

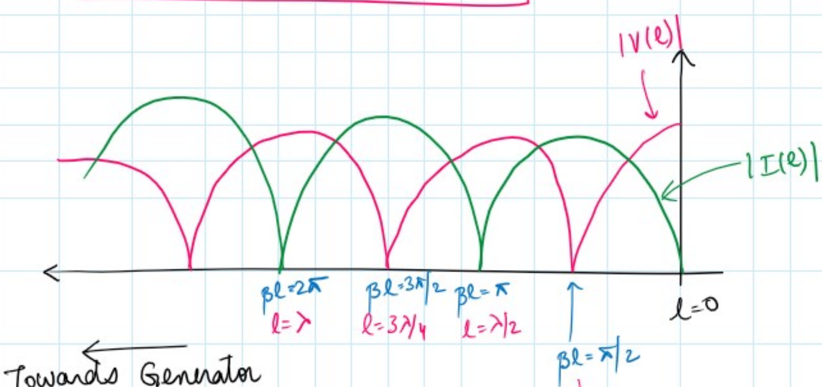
$$V(\ell) = V^+ \left(e^{j\beta\ell} + e^{-j\beta\ell} \right)$$

$$I(\ell) = \frac{V^+}{Z_0} \left(e^{j\beta\ell} - e^{-j\beta\ell} \right)$$

$$V(\ell) = V^+ . 2 . \cos(\beta\ell)$$

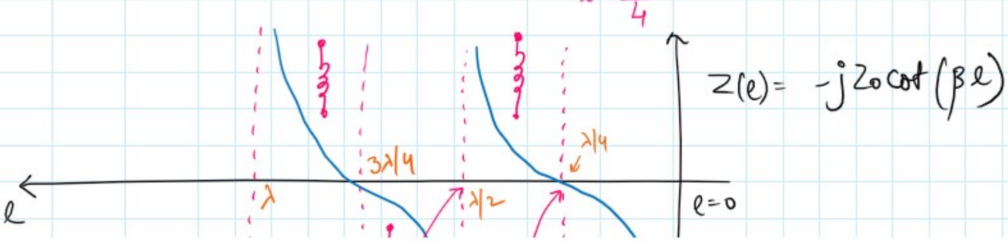
$$I(\ell) = j \frac{2V^+}{Z_0} \sin(\beta\ell)$$

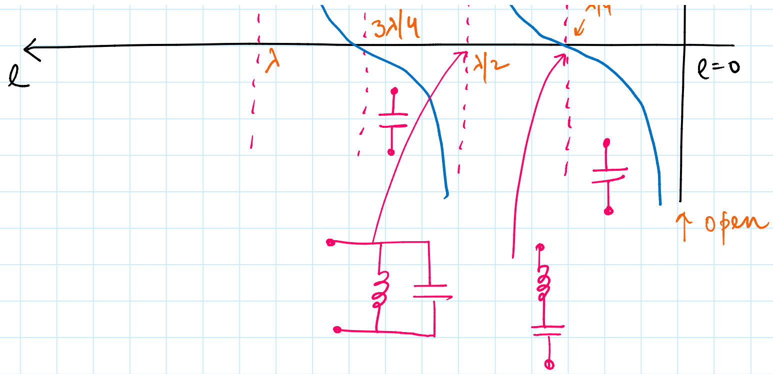
$$Z(\ell) = \frac{V(\ell)}{I(\ell)} = -jZ_0 \cot(\beta\ell)$$



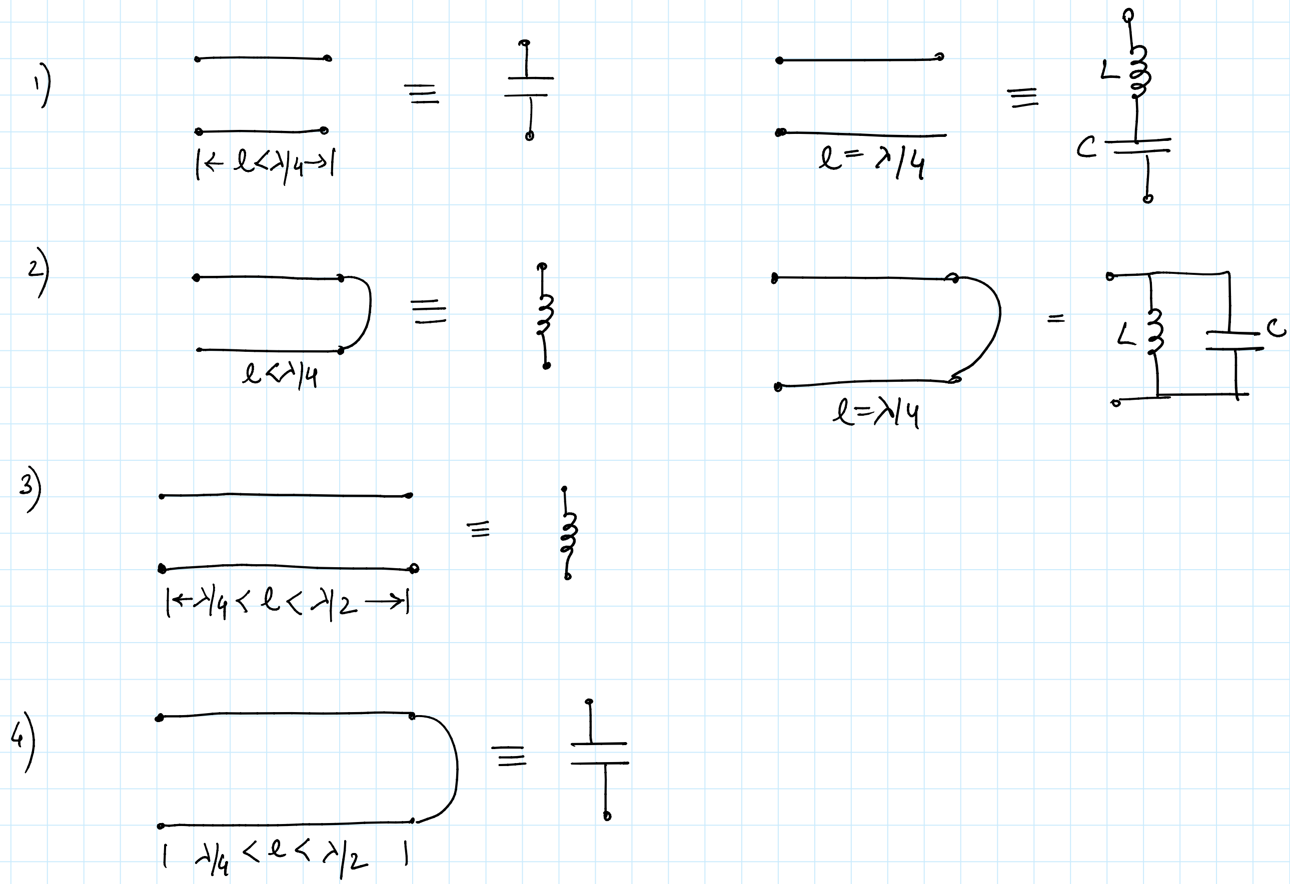
$$\frac{2\pi}{\lambda} . \ell = \frac{\pi}{2}$$

$$\ell = \frac{\lambda}{4}$$

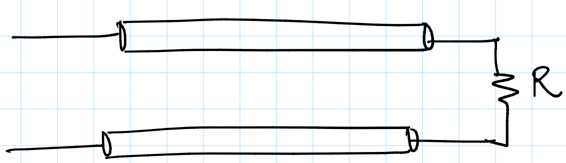




Summary



Case 3: VSWR in a transmission line with Resistive Load.



Loss Less Transmission Line : $Z_0 = R_0$
Pure resistive

Loss Less Transmission Line : $Z_0 = R_0$ pure resistive

$$V(l) = V^+ e^{j\beta l}\left(1 + |\Gamma_L| e^{j(\phi_L - 2\beta l)}\right)$$

$$I(l) = \frac{V^+}{Z_0} e^{j\beta l}\left(1 - |\Gamma_L| e^{j(\phi_L - 2\beta l)}\right)$$

$$\Gamma_L = |\Gamma_L| e^{j\phi_L}$$

$\phi_L \rightarrow 0$

$$\Gamma_L \rightarrow \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{R_L - R_0}{R_L + R_0}$$