

## Homework PHY 554 #8.

Due Nov. 22, 2023

1. (2 points): Show that the longitudinal and transverse impedances satisfy the following relations

$$Z_{//}^*(\omega) = Z_{//}(-\omega)$$

$$Z_{\perp}^*(\omega) = -Z_{\perp}(-\omega).$$

2. (4 points)

Use the following identity

$$\sum_{p=-\infty}^{\infty} \delta(x-p) = \sum_{l=-\infty}^{\infty} e^{i2\pi lx},$$

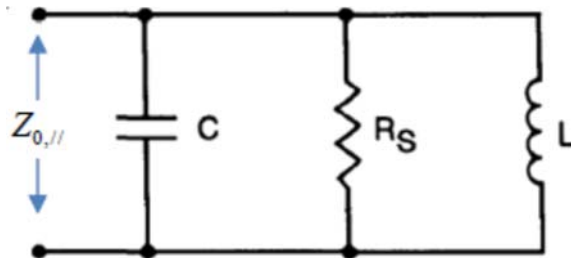
to prove Poisson summation formula:

$$\sum_{l=-\infty}^{\infty} F(lC) = \frac{1}{C} \sum_{p=-\infty}^{\infty} \tilde{F}\left(\frac{2\pi p}{C}\right),$$

where  $F(z)$  and  $\tilde{F}(k)$  are Fourier pairs related by

$$F(z) = \frac{1}{2\pi} \int_{-\infty}^{\infty} e^{ikz} \tilde{F}(k) dk.$$

3. (4 points)



Show the impedance of above circuit can be expressed as

$$Z_{0, //} = \frac{R_s}{1 + iQ \left( \frac{\omega_R}{\omega} - \frac{\omega}{\omega_R} \right)},$$

and find the expression for  $Q$  and  $\omega_R$  in terms of  $C$ ,  $R_s$ , and  $L$ .