

Homework PHY 554 #8.

Due Nov. 27, 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

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

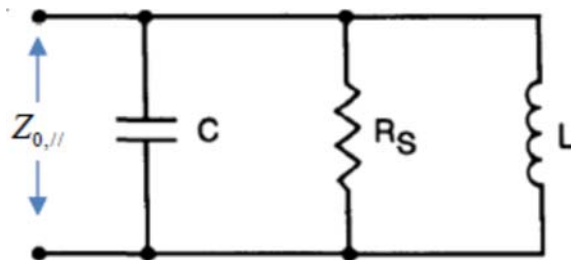
to prove Poisson summation formula:

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

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

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

and find the expression for Q and ω_R in terms of C , R_s , and L .