

Problem 2.30 Show that at the position where the magnitude of the voltage on the line is a maximum, the input impedance is purely real.

Solution: From Eq. (2.70), $d_{\max} = (\theta_r + 2n\pi)/2\beta$, so from Eq. (2.61), using polar representation for Γ ,

$$\begin{aligned} Z_{\text{in}}(d_{\max}) &= Z_0 \left(\frac{1 + |\Gamma| e^{j\theta_r} e^{-j2\beta l_{\max}}}{1 - |\Gamma| e^{j\theta_r} e^{-j2\beta l_{\max}}} \right) \\ &= Z_0 \left(\frac{1 + |\Gamma| e^{j\theta_r} e^{-j(\theta_r + 2n\pi)}}{1 - |\Gamma| e^{j\theta_r} e^{-j(\theta_r + 2n\pi)}} \right) = Z_0 \left(\frac{1 + |\Gamma|}{1 - |\Gamma|} \right), \end{aligned}$$

which is real, provided Z_0 is real.
