Repeat problem 3) to get low-loss TL approximations for: a) input power, b) load power, and c) power lost in TL. Compare with problem 3) answers.

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Use information from problem 2) to find the **exact**: a) input power, b) load power, c) power lost in TL, d) power from generator, and e) power consumed by Z_g.

From earlier problem- $P_{in} = 0.62165$ W, $P_L = 0.3689$ W, and $P_{loss} = 0.25275$ W.

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Use a 1 m length of the coaxial transmission line from 1) to create a TL circuit with $V_g = 16\angle 0°$ V, $Z_g = 45 - j10\ \Omega$, and $Z_L = 100 - j50\ \Omega$ operating at 3.6 GHz. Find: a) the load reflection coefficient, b) input reflection coefficient, c) V_0^+, d) general phasor voltage & current equations.

From earlier problem- $\Gamma = \Gamma_L = 0.4691\angle\text{-}24.6237°$, $\Gamma(\ell) = \Gamma_{in} = 0.3202\angle\text{-}5.2318°$, and

$$V_0^+ = 6.6702\angle 13.9394° \text{ V}.$$

****

A coaxial transmission line, operating at 3.6 GHz, has the distributed parameters $R = 3.8\ \Omega$/m, $L = 248$ nH/m, $G = 6.4$ mS/m, and $C = 112$ pF/m. <snip>

From earlier problem-

$$\gamma = 0.19096 + j\,119.2113 \text{ 1/m},\quad Z_0 = 47.0561 + j\,0.435\ \Omega = 47.0561\angle 0.05297°\ \Omega$$

****

a) Input power approximation. Let $Z_0 = 47.0561\angle 0.05297°\ \Omega \approx 47.0561\ \Omega$

Per (2.92),

$$P_{in} \approx \frac{|V_0^+|^2}{2Z_0}\left(1-|\Gamma(\ell)|^2\right)e^{2\alpha\ell} = \frac{|V_0^+|^2}{2Z_0}\left(1-|\Gamma_{in}|^2\right)e^{2\alpha\ell} = \frac{6.6702^2}{2(47.0561)}\left(1-0.3202^2\right)e^{2(0.19096)1}$$

⇒ **$P_{in} \approx$ 0.62166 W, very close to exact P_{in} = 0.62165 W.**

b) Load power approximation. Let $Z_0 = 47.0561\angle 0.05297°\ \Omega \approx 47.0561\ \Omega$

Per (2.93),

$$P_L \approx \frac{|V_0^+|^2}{2Z_0}\left(1-|\Gamma|^2\right) = \frac{|V_0^+|^2}{2Z_0}\left(1-|\Gamma_L|^2\right) = \frac{6.6702^2}{2(47.0561)}\left(1-0.4691^2\right)$$

⇒ **$P_L \approx$ 0.3687 W, very close to exact P_{in} = 0.3689 W.**

c) Power lost in TL. Use approximate Pin and PL values in (2.94) to get

$$P_{loss} = P_{in} - P_L \approx 0.62166 - 0.3687$$

⇒ **$P_{loss} \approx$ 0.25296 W, very close to exact P_{loss} = 0.25275 W.**