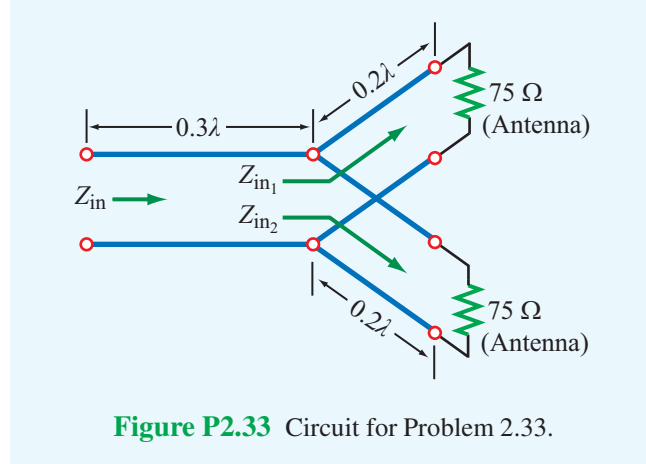


2.33 Two half-wave dipole antennas, each with an impedance of 75Ω , are connected in parallel through a pair of transmission lines, and the combination is connected to a feed transmission line, as shown in Fig. P2.33.



All lines are 50Ω and lossless.

- (a) Calculate Z_{in1} , the input impedance of the antenna-terminated line, at the parallel juncture.
- (b) Combine Z_{in1} and Z_{in2} in parallel to obtain Z'_L , the effective load impedance of the feedline.
- (c) Calculate Z_{in} of the feedline.

Solution:

(a)

$$\begin{aligned}
 Z_{in1} &= Z_0 \left[\frac{Z_{L1} + jZ_0 \tan \beta l_1}{Z_0 + jZ_{L1} \tan \beta l_1} \right] \\
 &= 50 \left\{ \frac{75 + j50 \tan[(2\pi/\lambda)(0.2\lambda)]}{50 + j75 \tan[(2\pi/\lambda)(0.2\lambda)]} \right\} = (35.20 - j8.62) \Omega.
 \end{aligned}$$

(b)

$$Z'_L = \frac{Z_{in1} Z_{in2}}{Z_{in1} + Z_{in2}} = \frac{(35.20 - j8.62)^2}{2(35.20 - j8.62)} = (17.60 - j4.31) \Omega.$$

(c)

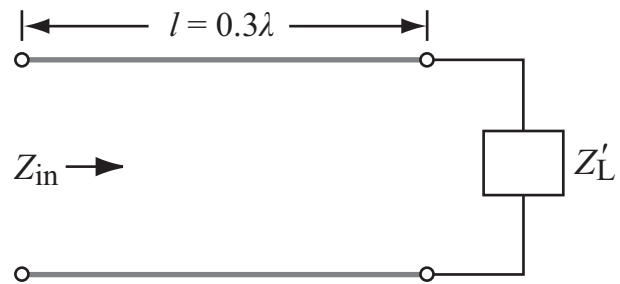


Figure P2.33(b) Equivalent circuit.

$$Z_{in} = 50 \left\{ \frac{(17.60 - j4.31) + j50 \tan[(2\pi/\lambda)(0.3\lambda)]}{50 + j(17.60 - j4.31) \tan[(2\pi/\lambda)(0.3\lambda)]} \right\} = (107.57 - j56.7) \, \Omega.$$
