

2.39 A $75\ \Omega$ resistive load is preceded by a $\lambda/4$ section of a $50\ \Omega$ lossless line, which itself is preceded by another $\lambda/4$ section of a $100\text{-}\Omega$ line. What is the input impedance? Compare your result with that obtained through two successive applications of CD Module 2.5.

Solution: The input impedance of the $\lambda/4$ section of line closest to the load is found from Eq. (2.97):

$$Z_{\text{in}} = \frac{Z_0^2}{Z_L} = \frac{50^2}{75} = 33.33\ \Omega.$$

The input impedance of the line section closest to the load can be considered as the load impedance of the next section of the line. By reapplying Eq. (2.97), the next section of $\lambda/4$ line is taken into account:

$$Z_{\text{in}} = \frac{Z_0^2}{Z_L} = \frac{100^2}{33.33} = 300\ \Omega.$$

Module 2.5 Wave and Input Impedance

Options: Set Line and Load

$z =$

Diagram illustrating a transmission line setup for Problem 1. The load impedance is $Z_L = 75.0 + j 0.0 \, \Omega$. The characteristic impedance is $Z_0 = 50.0 \, \Omega$ and the relative permittivity is $\epsilon_r = 1.0$. The distance from the load to the input is $d = 0.25\lambda = 250.0 \, \text{mm}$. The input impedance is $Z_{in} = 33.333 + j 0.0 \, \Omega$.

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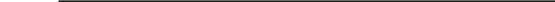
Diagram of a transmission line with a load and a short circuit. The line has a characteristic impedance $Z_0 = 50.0 \, \Omega$ and a relative permittivity $\epsilon_r = 1.0$. The load impedance is $Z_L = 75.0 + j0.0 \, \Omega$. The input impedance at a distance $d = 0.25\lambda$ is $Z_{in} = 33.333 + j0.0 \, \Omega$. The distance d is also given as $250.0 \, \text{mm}$. The load is connected at $d = 0$.

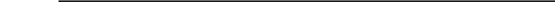
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300.0 MHz  frequency

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Choose length units: ☒ [λ] ☐ [m]
(press Update to activate choice)

Choose length units: ☒ [λ] ☐ [m]
(press Update to activate choice)

Set Line

Characteristic Impedance	$Z_0 =$	50	$[\Omega]$
Relative Permittivity	$\epsilon_r =$	1	
Line Length	$l =$	0.25	$[\lambda]$

Update

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Line Length	$l =$	0.25	$[\lambda]$

Update

Set Load

$Z_L =$ $+$ $[\Omega]$

☒ Impedance ☐ Admittance

Set Load

$Z_L =$ $+$ $[\Omega]$

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Set Load

$Z_L =$ $+$ $[\Omega]$

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