

FIGURES FOR CHAPTER 2

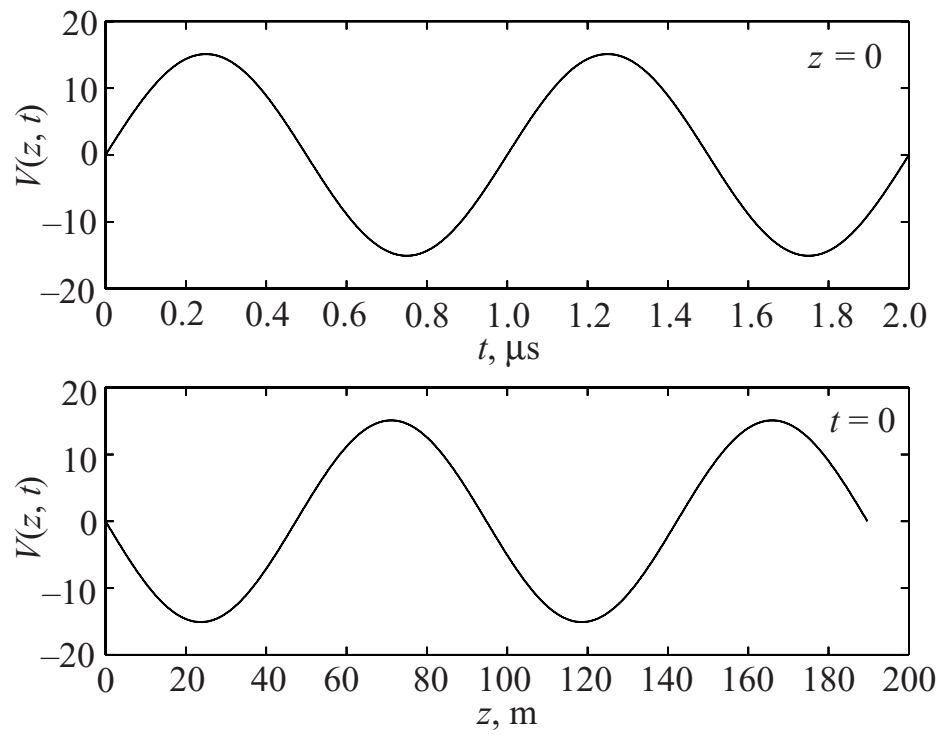


Figure 2-1 Voltage distribution as a function of time ($z = 0$) and as a function of space ($t = 0$).

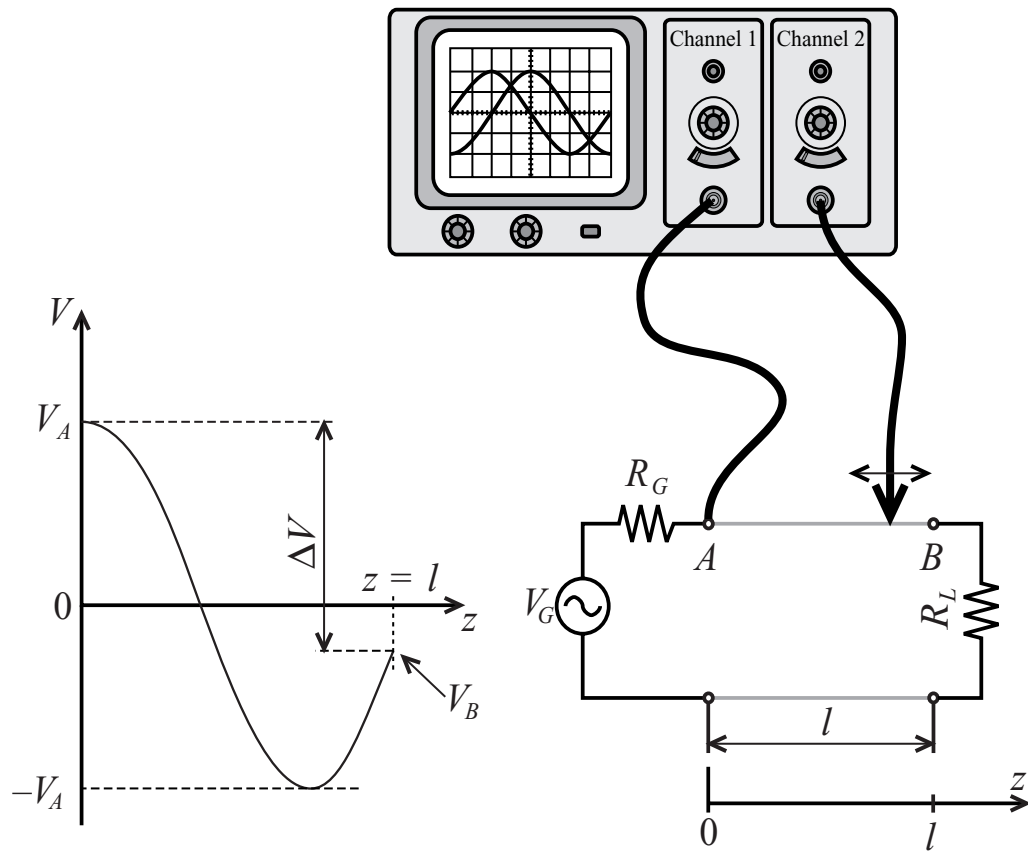


Figure 2-2 Amplitude measurements of 10 GHz voltage signal at the beginning (location A) and somewhere in between a wire connecting load to source.

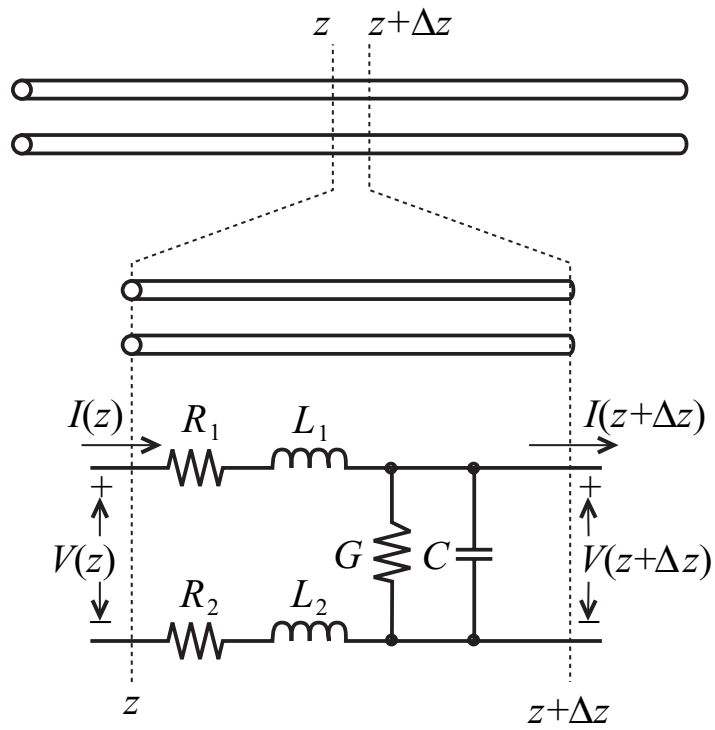


Figure 2-3 Partitioning an electric line into small elements Δz over which Kirchhoff's laws of constant voltage and current can be applied.

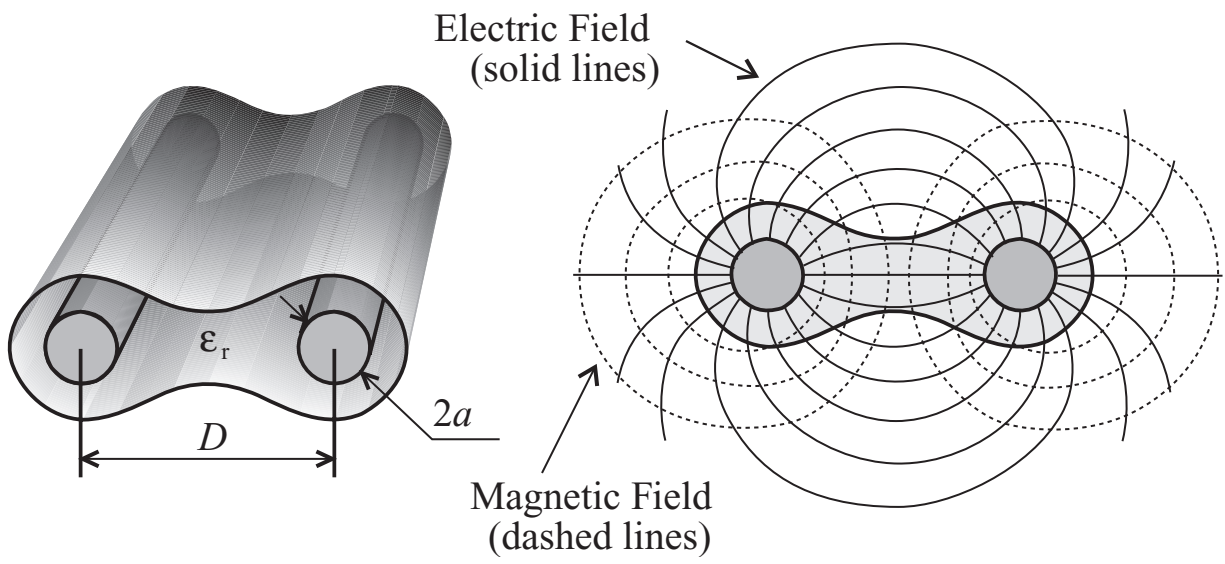


Figure 2-4 Geometry and field distribution in two-wire parallel conductor transmission line.

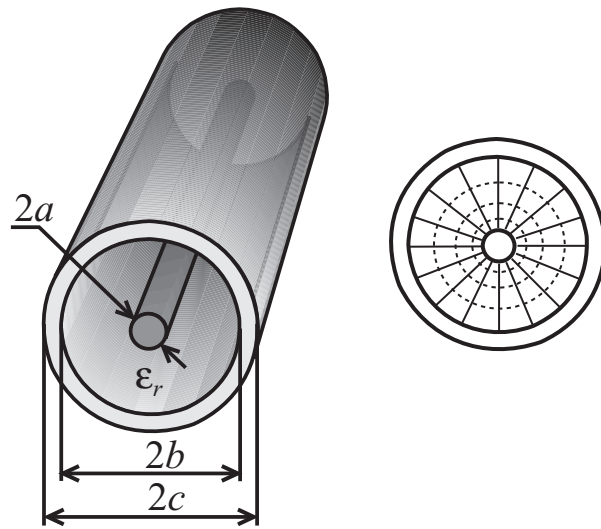


Figure 2-5 Coaxial cable transmission line.

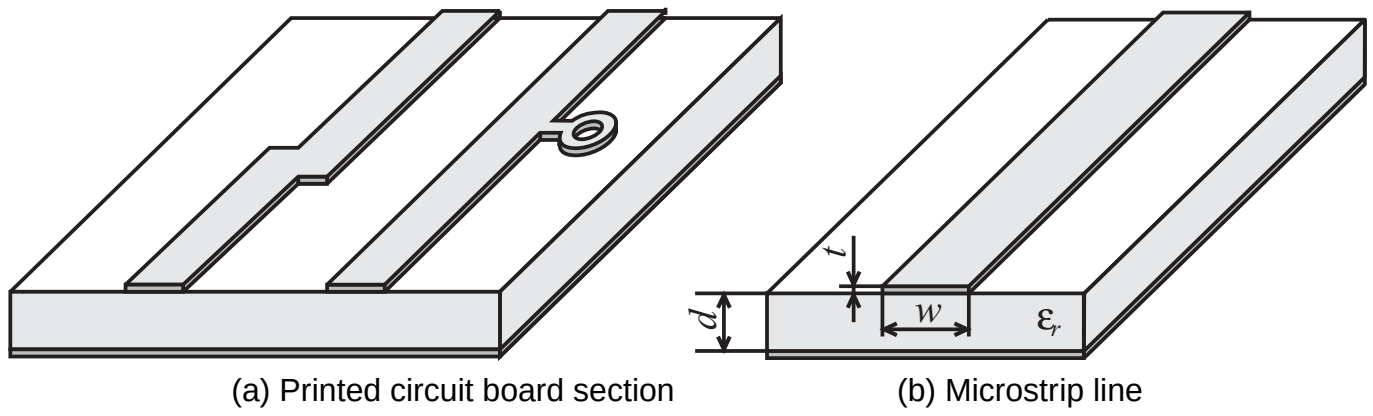
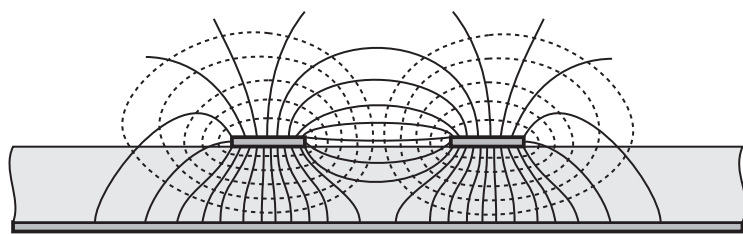
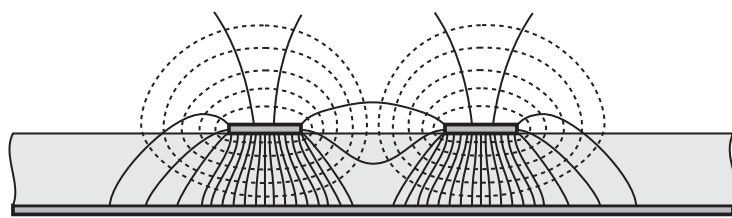


Figure 2-6 Microstrip transmission line representation.

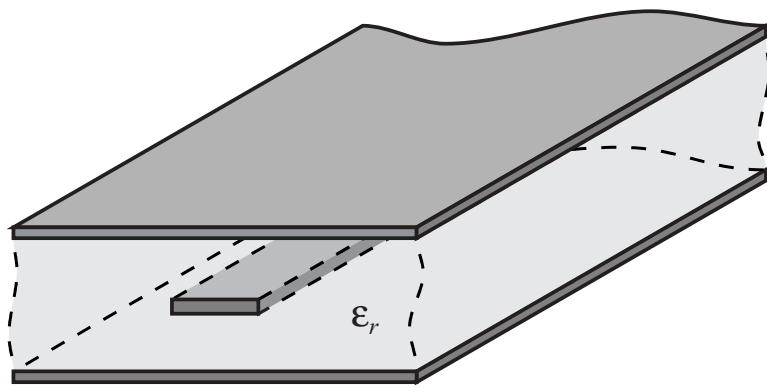


(a) Teflon epoxy ($\epsilon_r = 2.55$)

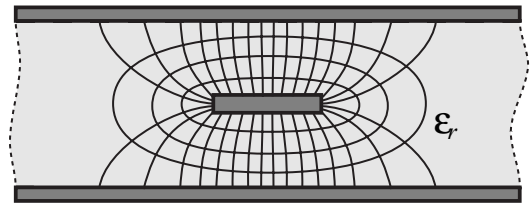


(b) Alumina ($\epsilon_r = 10.0$)

Figure 2-7 Electric field leakage as a function of dielectric constants.

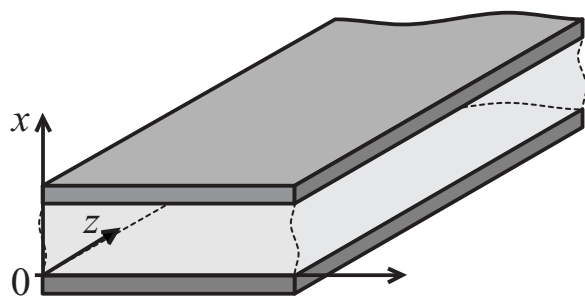


(a) Sandwich structure ($\epsilon_r = 2.55$)

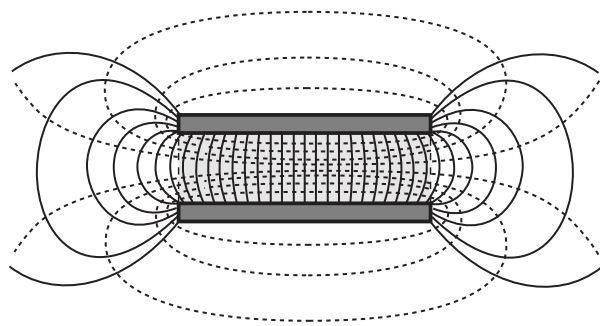


(b) Cross-sectional field distribution

Figure 2-8 Triple-layer transmission line configuration.



(a) Geometric representation



(b) Field distribution ($\epsilon_r = 2.55$)

Figure 2-9 Parallel-plate transmission line.

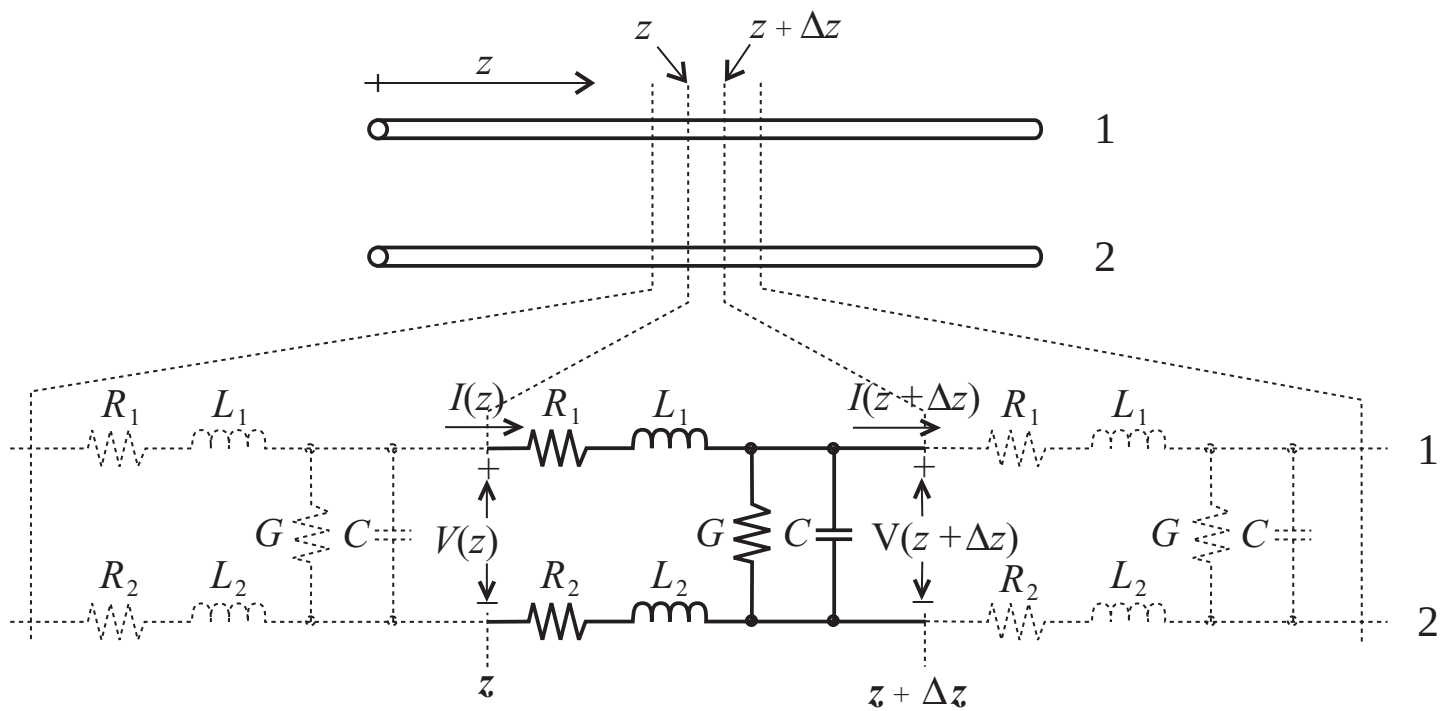


Figure 2-10 Segmentation of two-wire transmission line into Δz -long sections suitable for lumped parameter analysis.

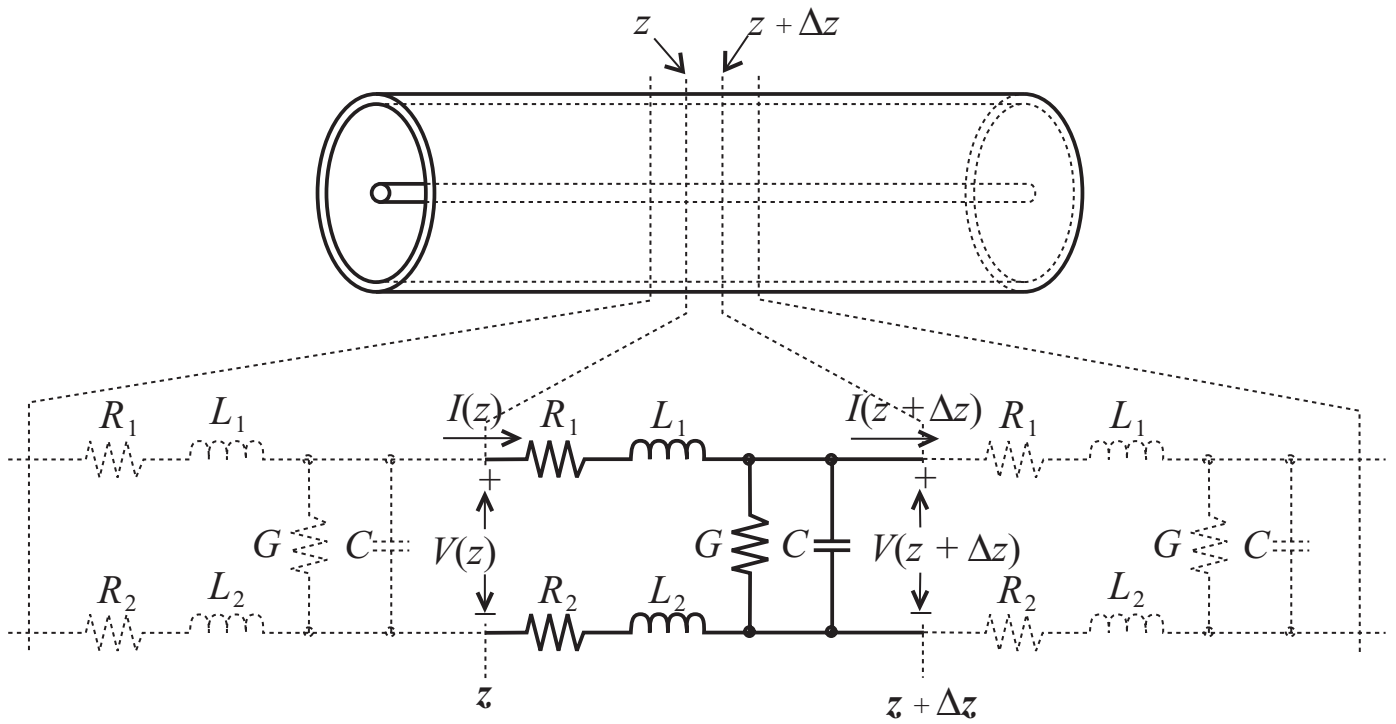


Figure 2-11 Segmentation of a coaxial cable into Δz length elements suitable for lumped parameter analysis.

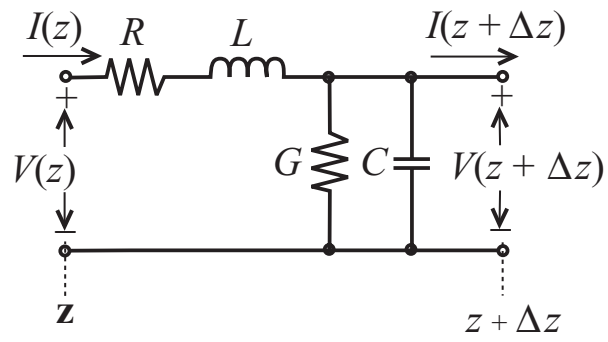


Figure 2-12 Generic electric equivalent circuit representation.

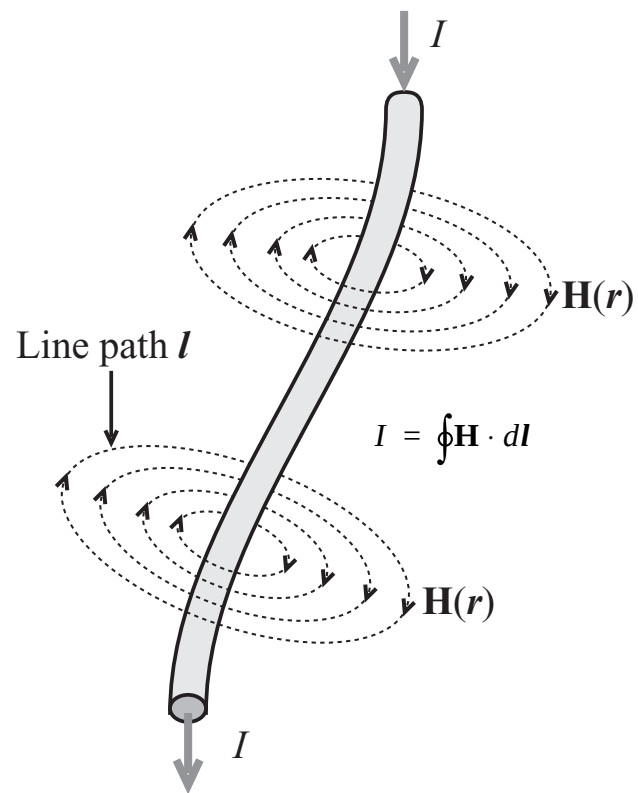


Figure 2-13 Ampère's law linking the current flow to the magnetic field.

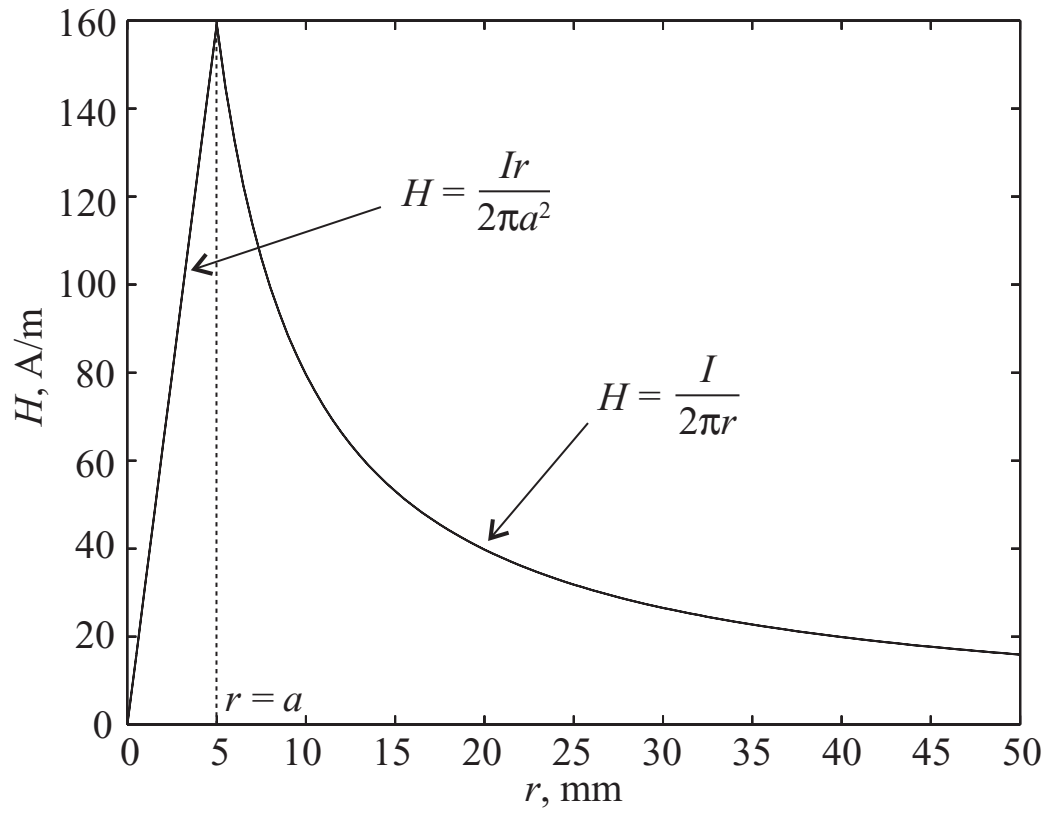


Figure 2-14 Magnetic field distribution inside and outside of an infinitely long wire of radius $a = 5$ mm carrying a current of 5 A.

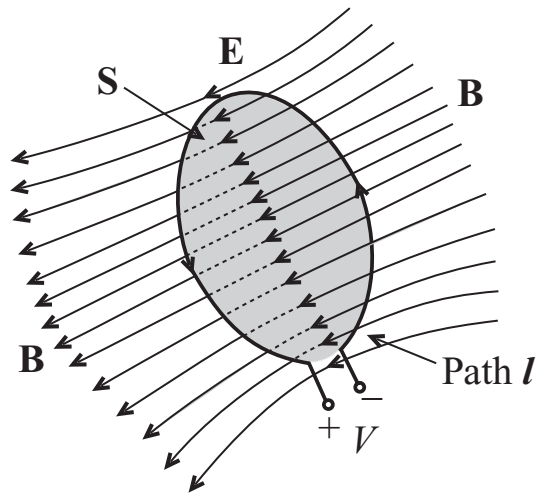


Figure 2-15 The time rate of change of the magnetic flux density induces a voltage.

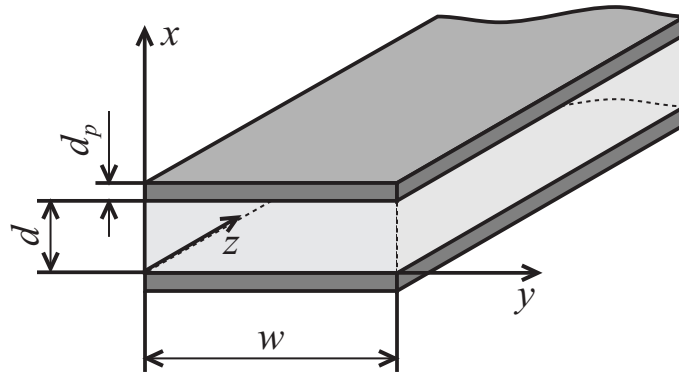


Figure 2-16 Parallel-plate transmission line geometry. The plate width w is large compared with the separation d .

Table 2-1 Transmission line parameters for three line types

Parameter	Two-Wire Line	Coaxial Line	Parallel-Plate Line	Unit
R	$\frac{1}{\pi a \sigma_{\text{cond}} \delta}$	$\frac{1}{2\pi \sigma_{\text{cond}} \delta} \left(\frac{1}{a} + \frac{1}{b} \right)$	$\frac{2}{w \sigma_{\text{cond}} \delta}$	Ω/m
L	$\frac{\mu}{\pi} \text{acosh} \left(\frac{D}{2a} \right)$	$\frac{\mu}{2\pi} \ln \left(\frac{b}{a} \right)$	$\mu \frac{d}{w}$	H/m
G	$\frac{\pi \sigma_{\text{diel}}}{\text{acosh}(D/(2a))}$	$\frac{2\pi \sigma_{\text{diel}}}{\ln(b/a)}$	$\sigma_{\text{diel}} \frac{w}{d}$	S/m
C	$\frac{\pi \epsilon}{\text{acosh}(D/(2a))}$	$\frac{2\pi \epsilon}{\ln(b/a)}$	$\epsilon \frac{w}{d}$	F/m

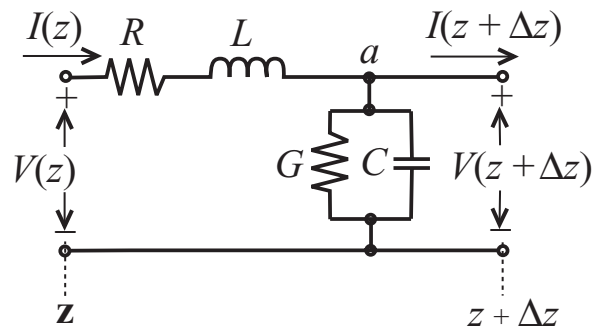


Figure 2-17 Segment of a transmission line with voltage loop and current node.

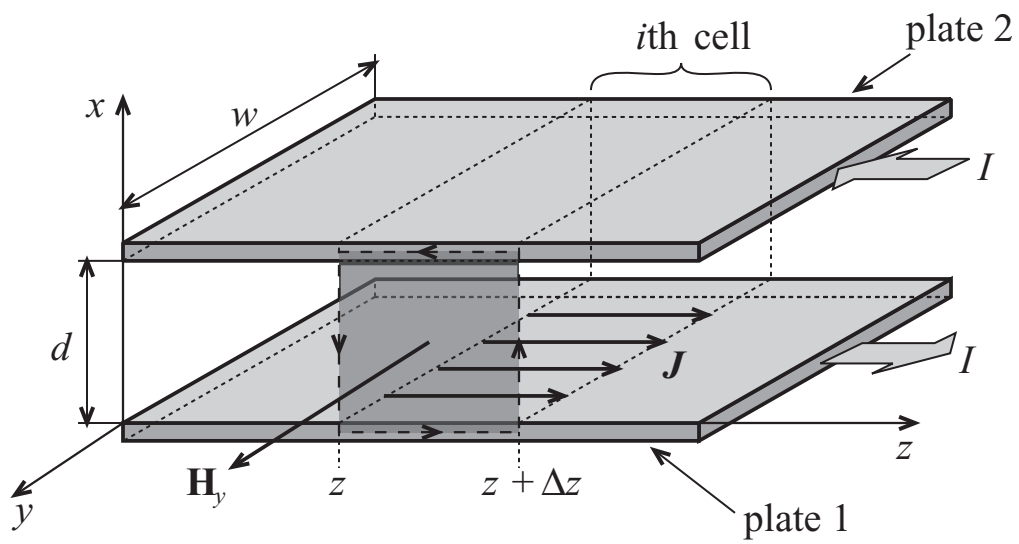


Figure 2-18 Integration surface element for Faraday's law application.

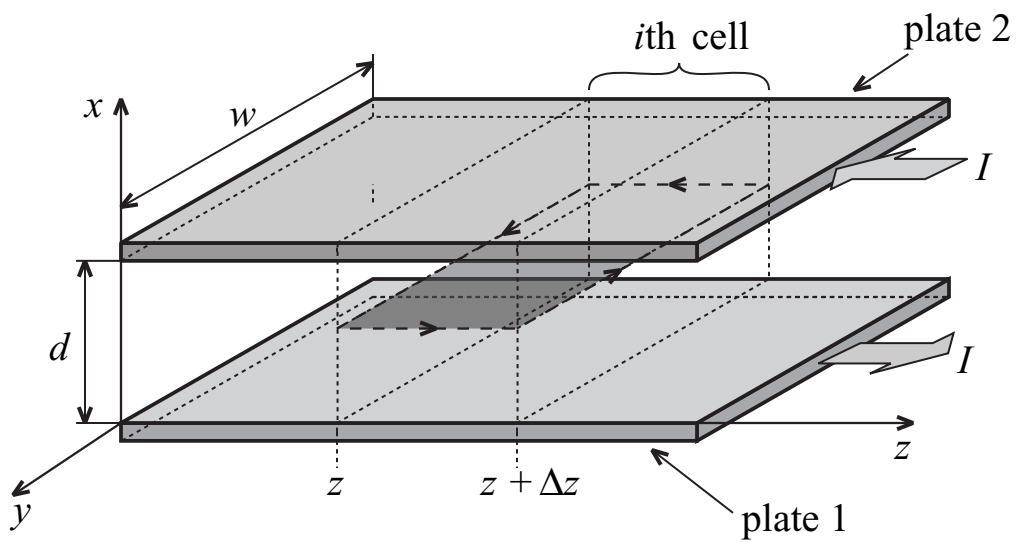


Figure 2-19 Surface element used to apply Ampère's law.

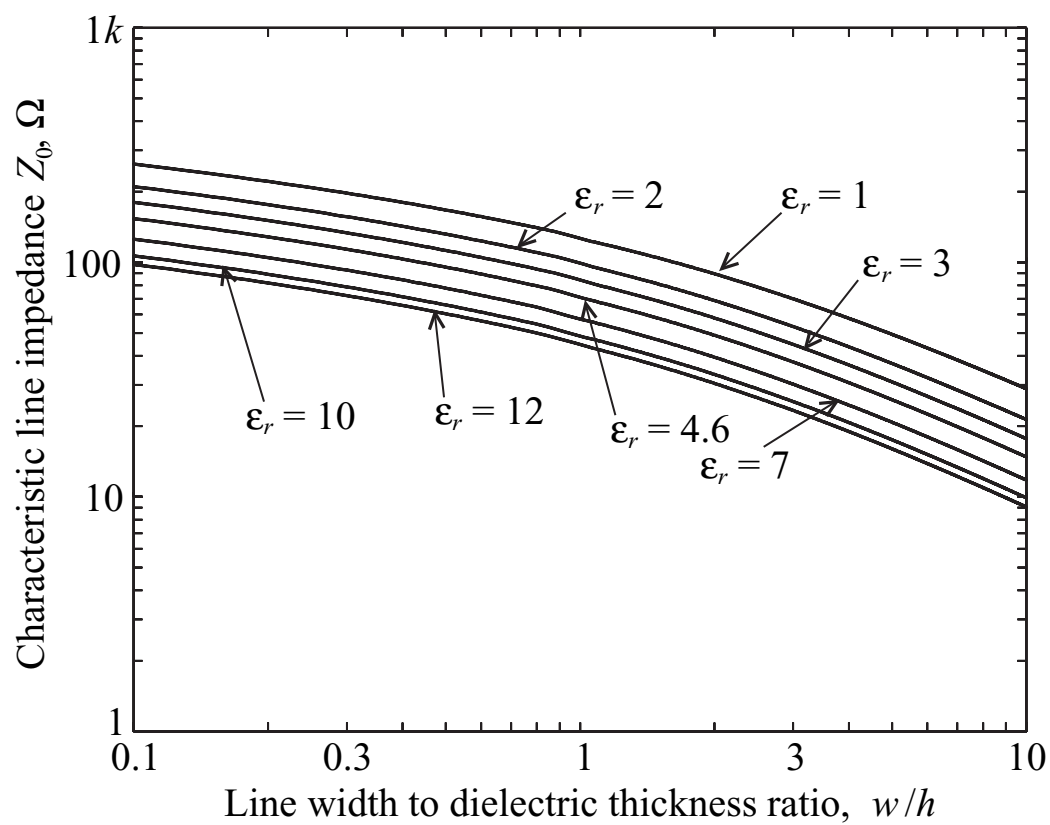


Figure 2-20 Characteristic line impedance as a function of w/h .

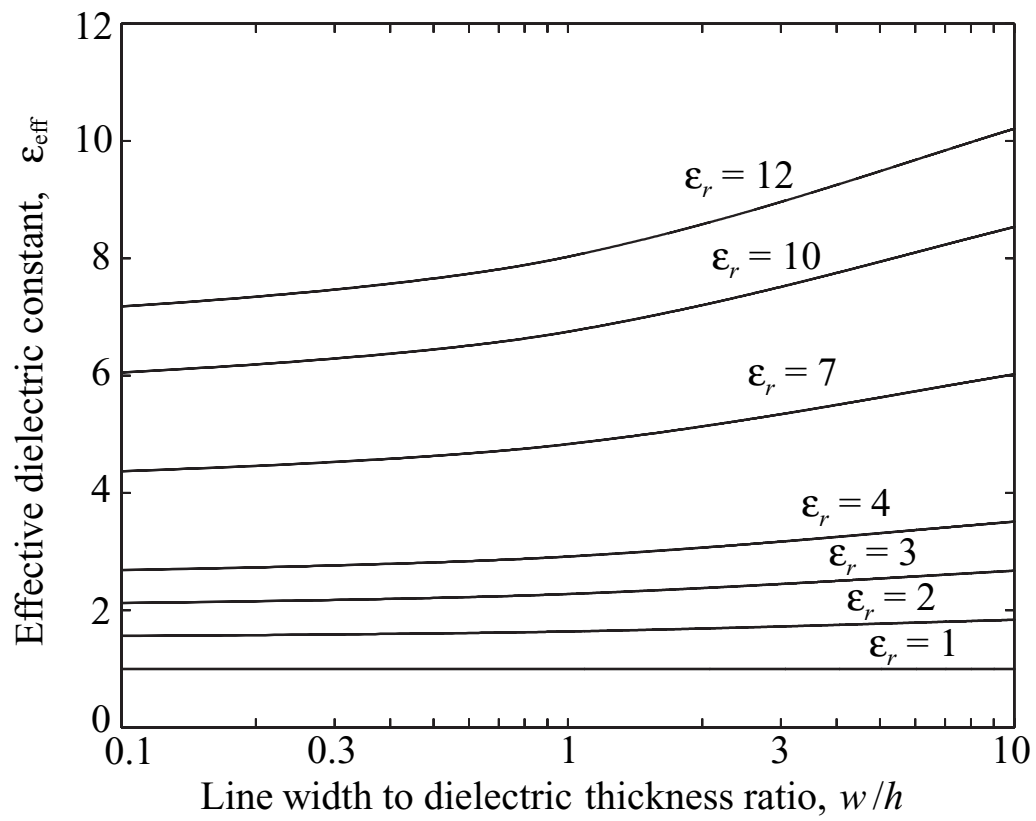


Figure 2-21 Effective dielectric constant as a function of w/h for different dielectric constants.

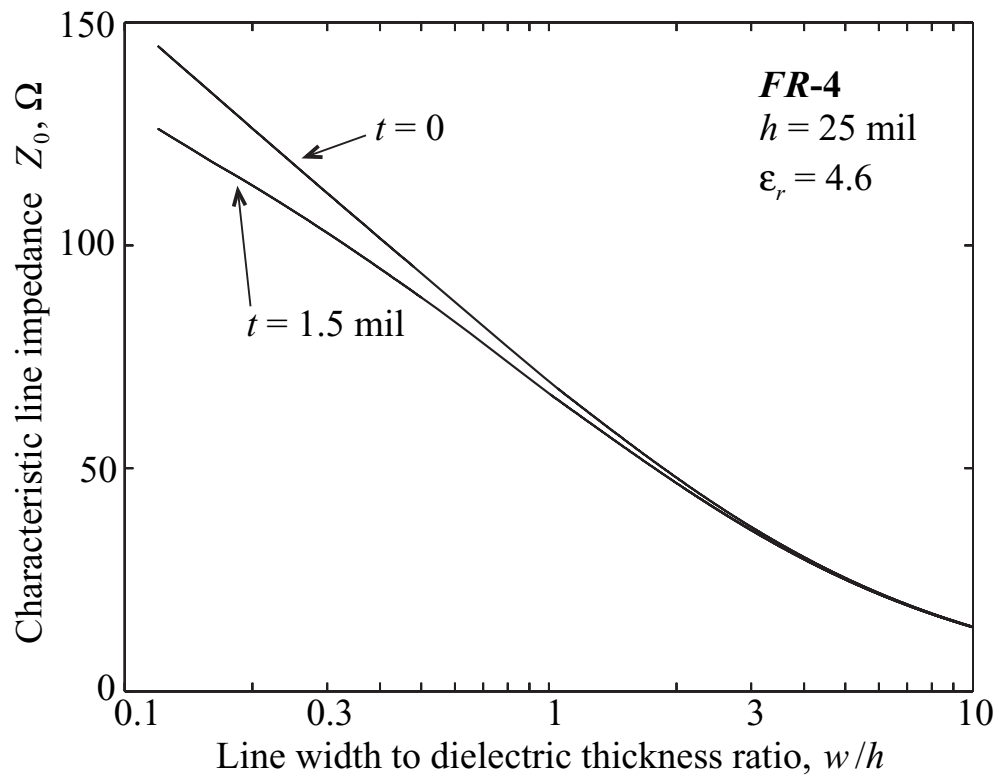


Figure 2-22 Effect of conductor thickness on the characteristic impedance of a microstrip line placed on a 25 mil thick FR-4 printed circuit board.

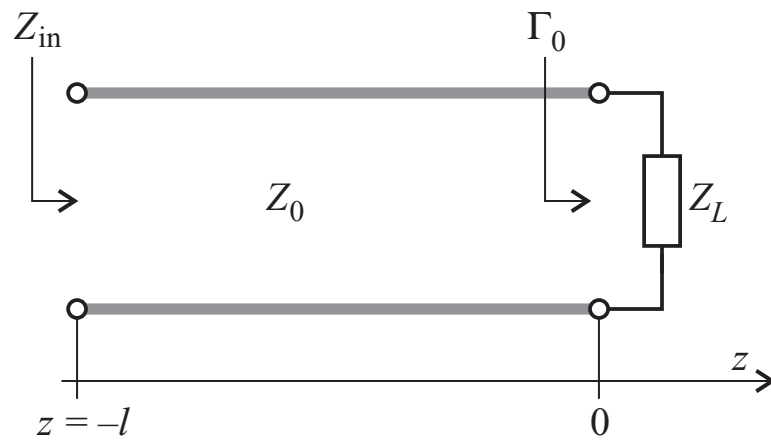


Figure 2-23 Terminated transmission line at location $z = 0$.

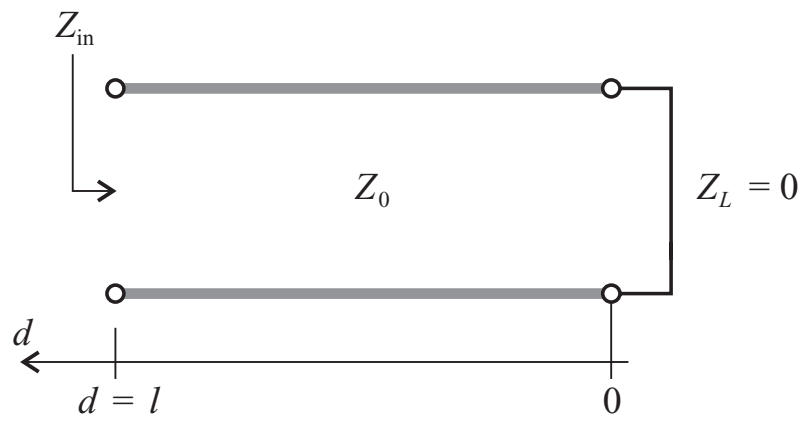


Figure 2-24 Short-circuit transmission line and new coordinate system d .

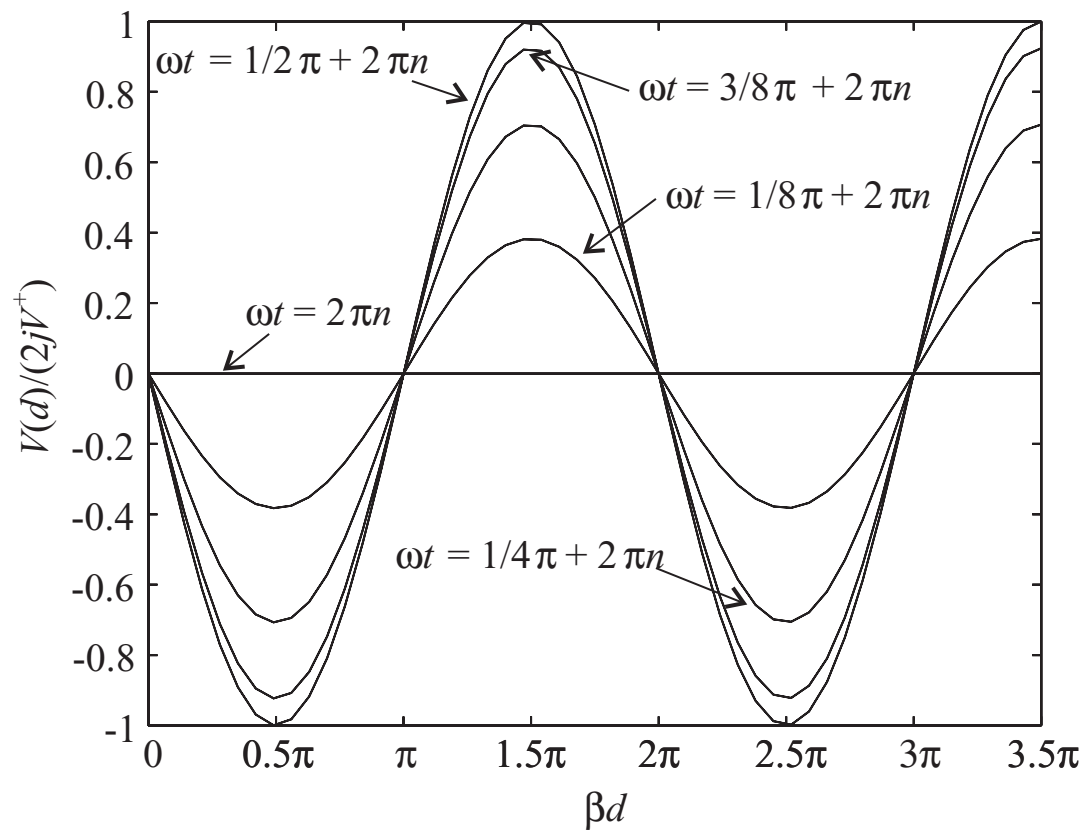


Figure 2-25 Standing wave pattern for various instances of time.

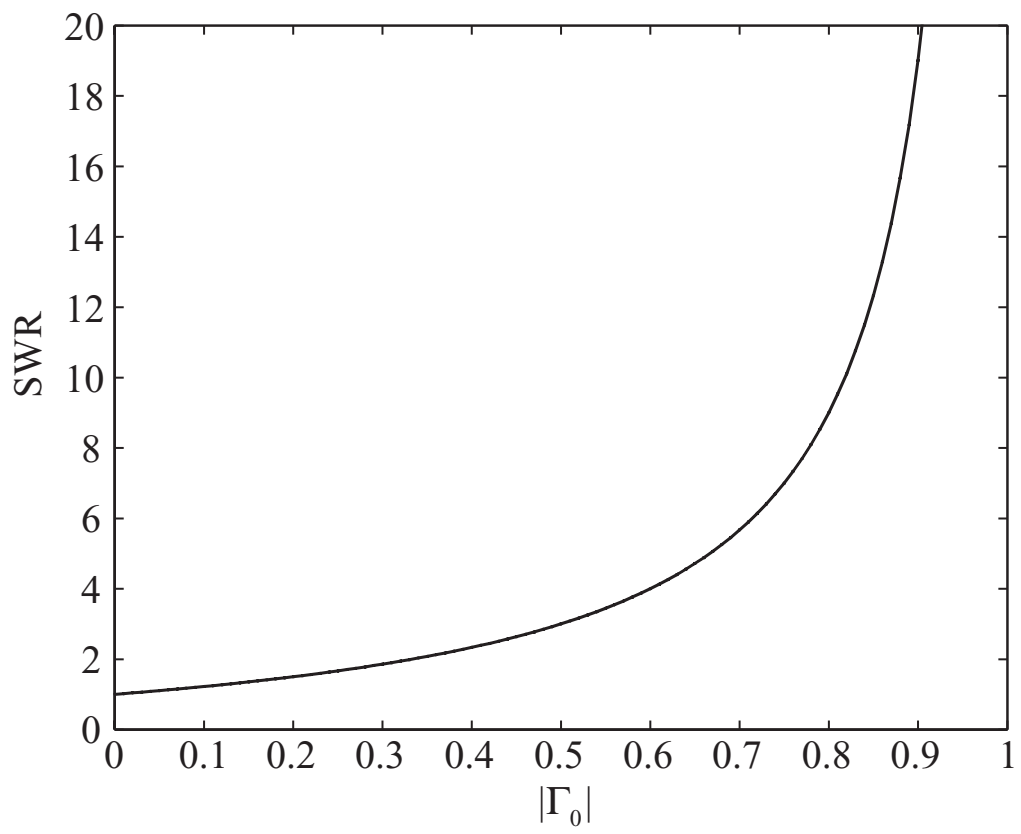


Figure 2-26 SWR as a function of load reflection coefficient $|\Gamma_0|$.

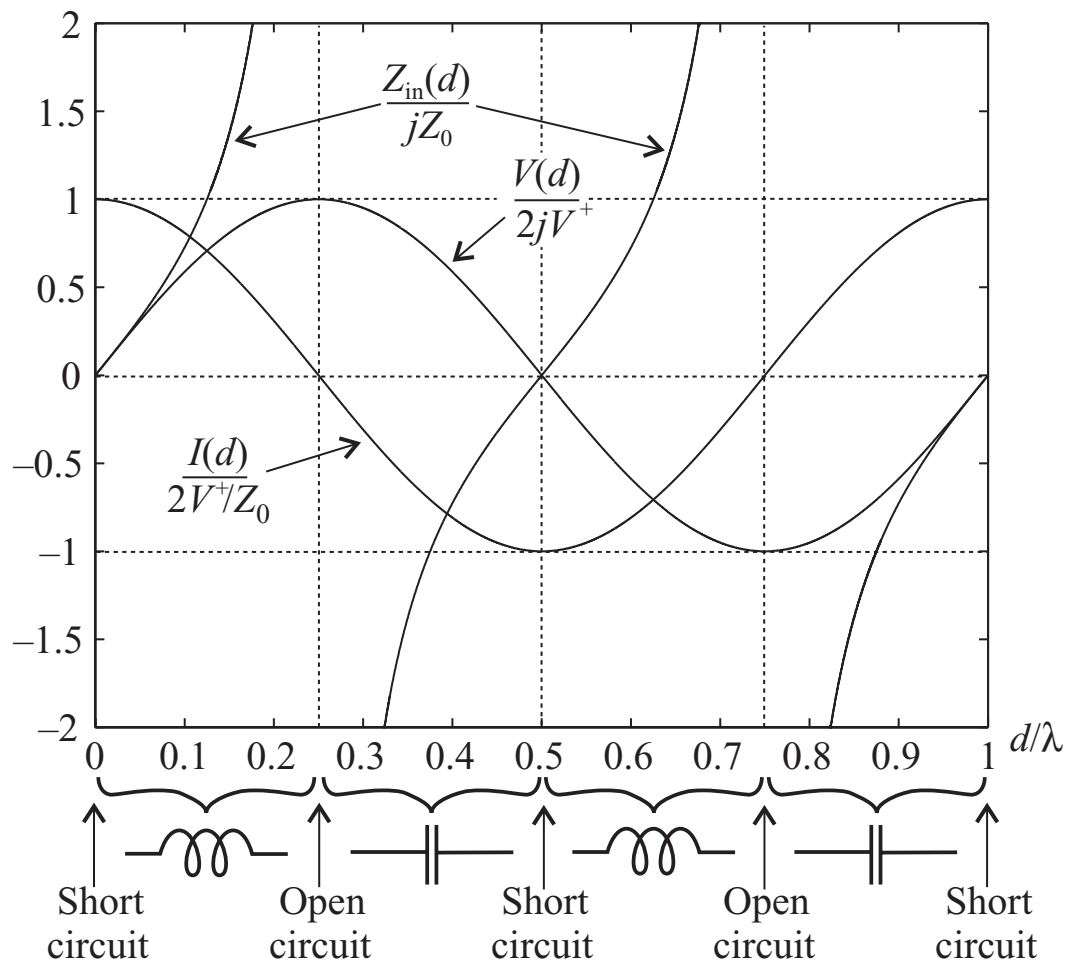


Figure 2-27 Voltage, current, and impedance as a function of line length for a short circuit termination.

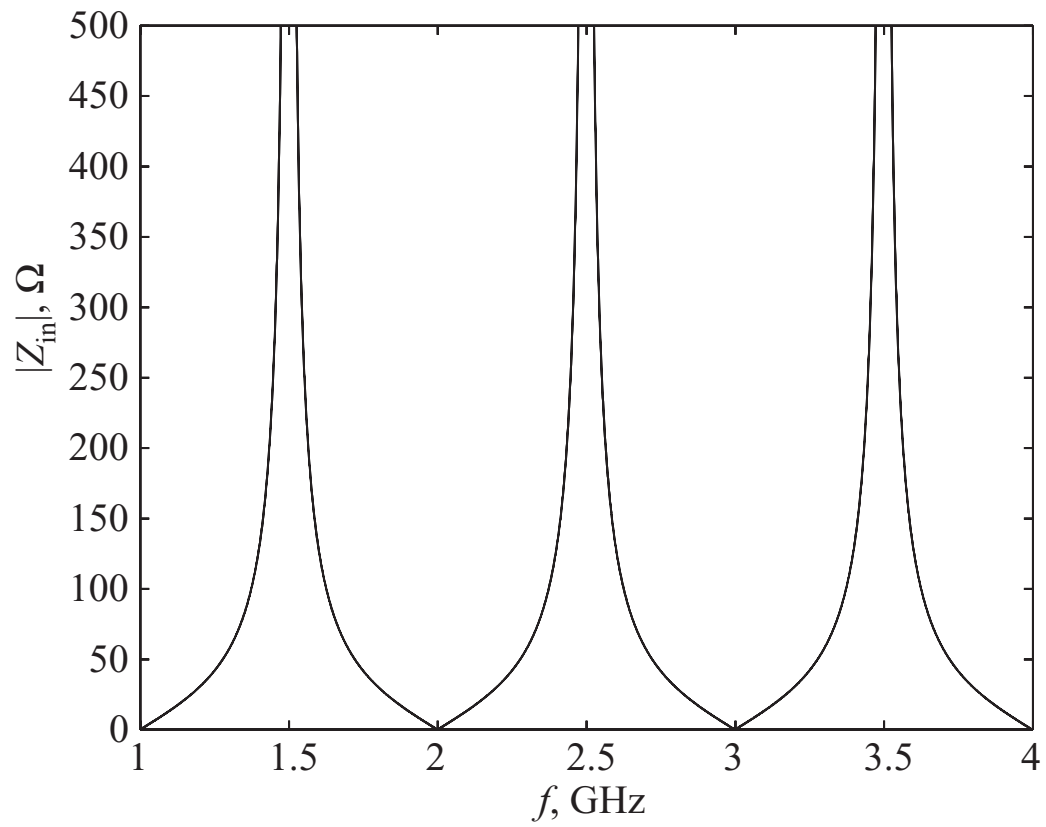


Figure 2-28 Magnitude of the input impedance for a 10 cm long, short-circuit transmission line as a function of frequency.

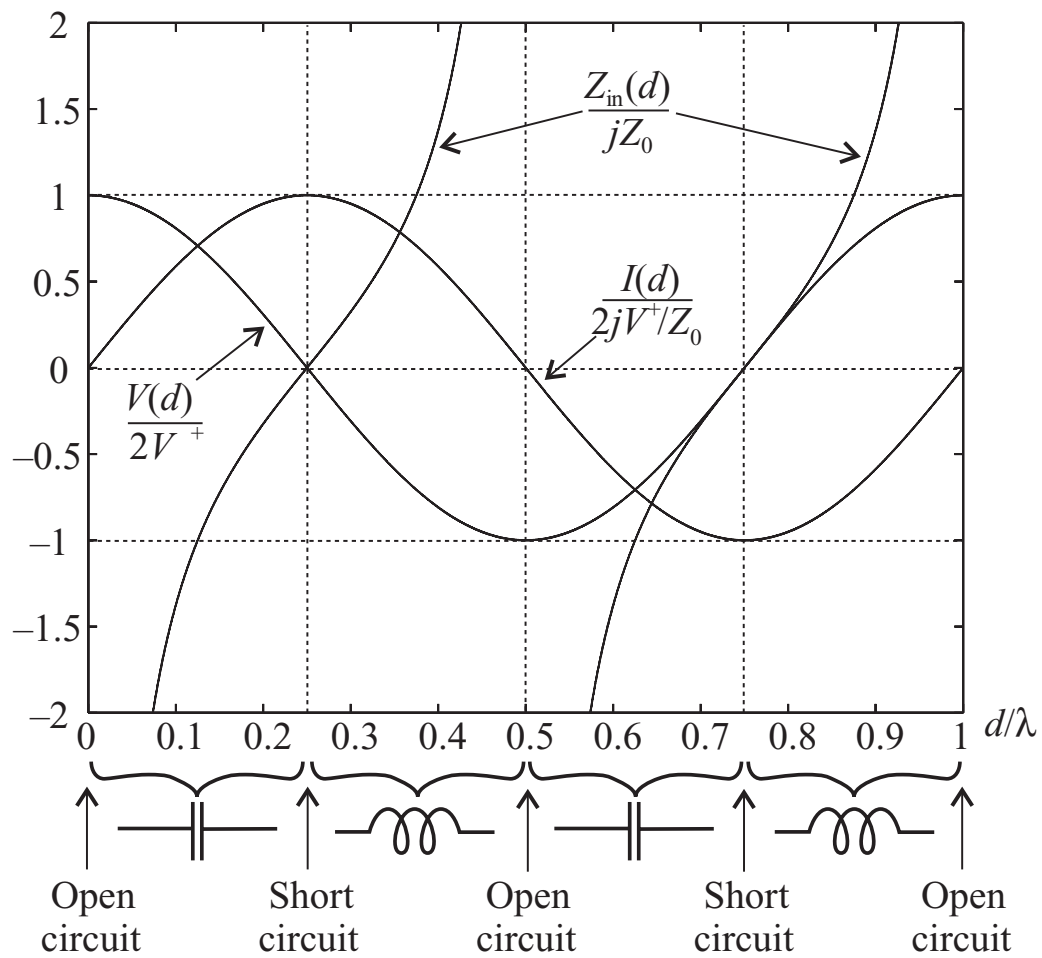


Figure 2-29 Voltage, current, and impedance as a function of line length for an open-circuit termination.

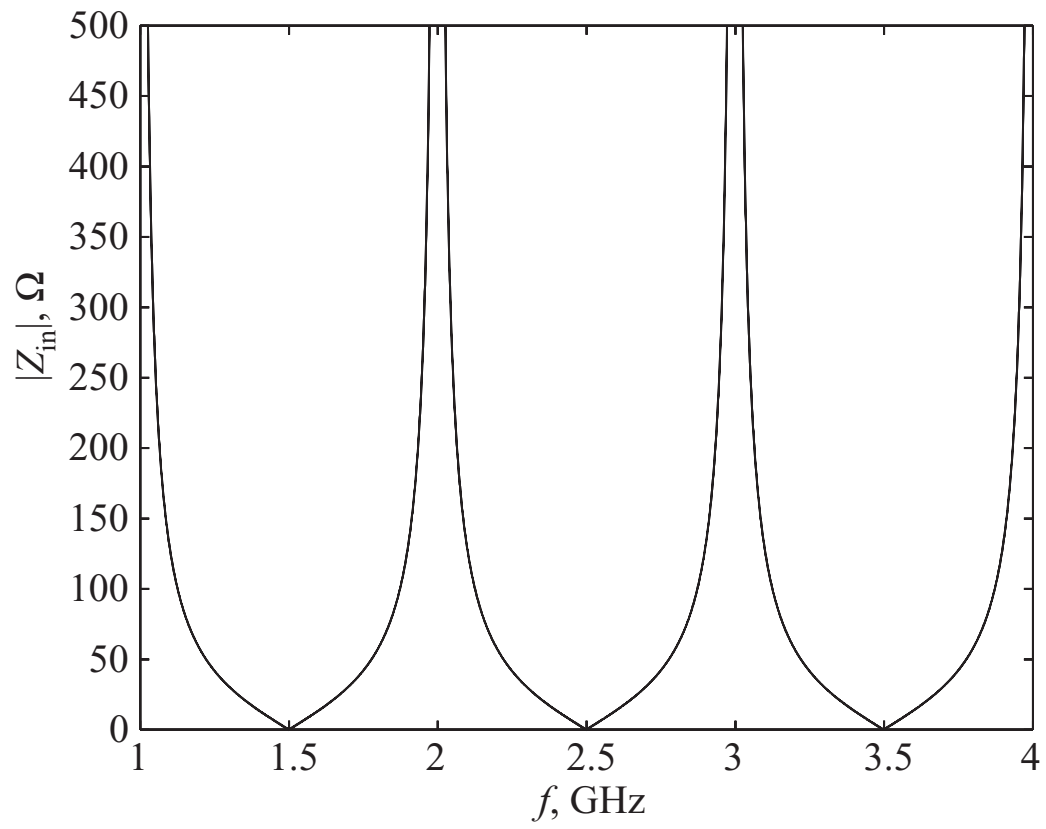


Figure 2-30 Magnitude of impedance for a 10 cm long, open-circuit transmission line as a function of frequency.

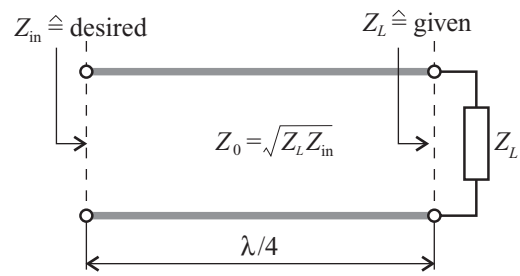


Figure 2-31 Input impedance matched to a load impedance through a $\lambda/4$ line segment Z_0 .

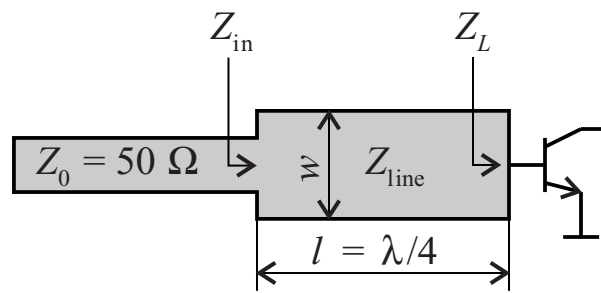


Figure 2-32 Input impedance of quarter-length transformer.

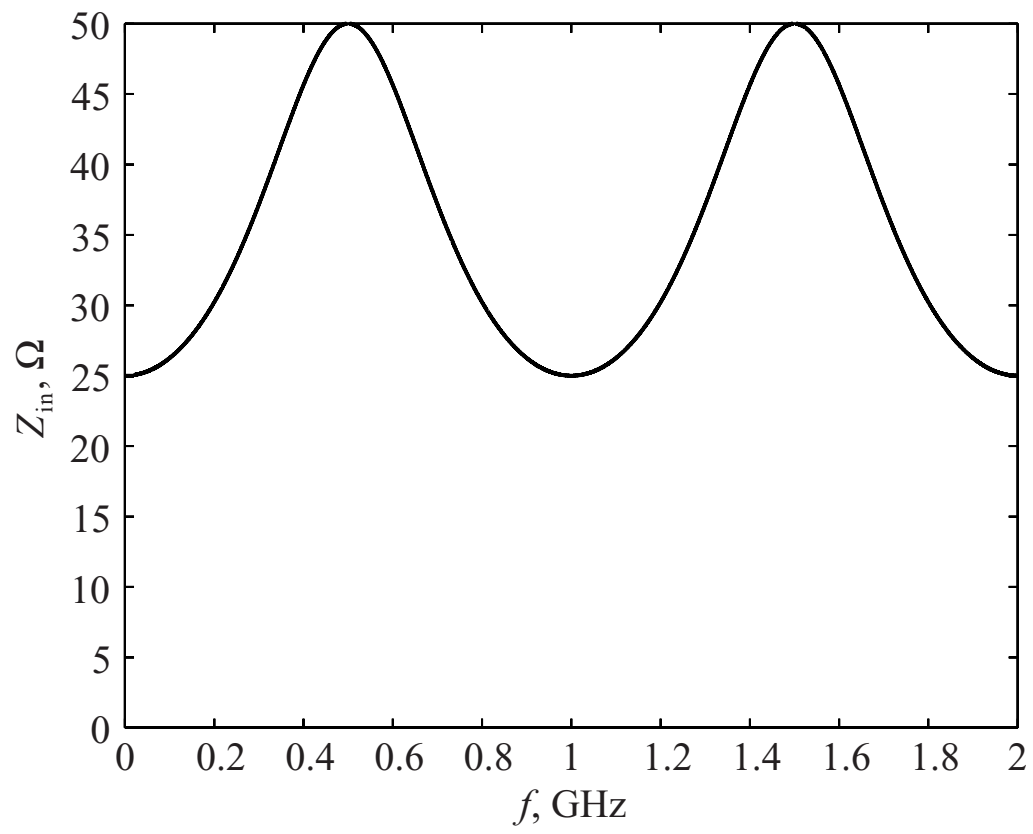


Figure 2-33 Magnitude of Z_{in} for frequency range of 0 to 2 GHz and fixed length d .

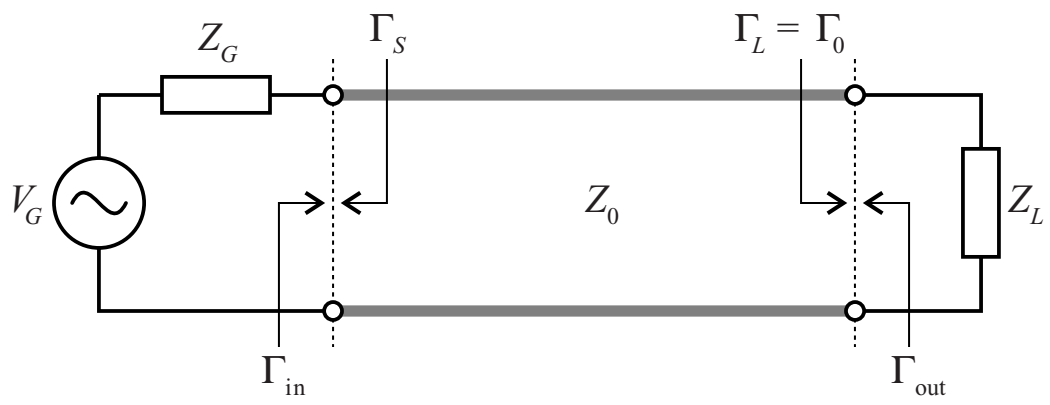


Figure 2-34 Generic transmission line circuit involving source and load terminations.

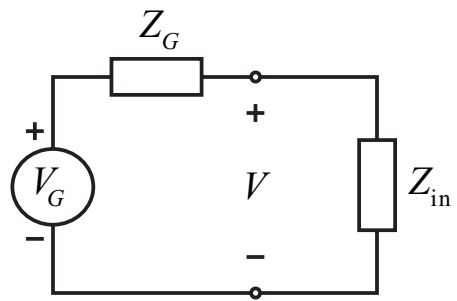


Figure 2-35 Equivalent lumped input network for a transmission line configuration.