**Problem 2.65** Use CD Module 2.7 to design a quarter-wavelength transformer to match a load with $Z_L = (50 + j10) \, \Omega$ to a 100-\(\Omega\) line.

**Problem 2.66** A 200-\(\Omega\) transmission line is to be matched to a computer terminal with $Z_L = (50 - j25) \, \Omega$ by inserting an appropriate reactance in parallel with the line. If \(f = 800\) MHz and \(\varepsilon_r = 4\), determine the location nearest to the load at which inserting:

(a) A capacitor can achieve the required matching, and the value of the capacitor.

(b) An inductor can achieve the required matching, and the value of the inductor.

**Problem 2.67** Repeat Problem 2.66 using CD Module 2.8.

**Problem 2.72** Determine $Z_m$ of the feed line shown in Fig. P2.72. All lines are lossless with $Z_0 = 50 \, \Omega$.

![Figure P2.72: (a) Circuit of Problem 2.72.](image-url)
Problem 2.74  A 25-Ω antenna is connected to a 75-Ω lossless transmission line. Reflections back toward the generator can be eliminated by placing a shunt impedance $Z$ at a distance $l$ from the load (Fig. P2.74). Determine the values of $Z$ and $l$.

![Circuit for Problem 2.74](image)

$Z_0 = 75 \, \Omega$, $Z = ?$, $Z_L = 25 \, \Omega$

**Figure P2.74:** Circuit for Problem 2.74.

Problem 2.77  In response to a step voltage, the voltage waveform shown in Fig. P2.77 was observed at the sending end of a lossless transmission line with $R_g = 50 \, \Omega$, $Z_0 = 50 \, \Omega$, and $\varepsilon_t = 2.25$. Determine the following:

(a) The generator voltage.
(b) The length of the line.
(c) The load impedance.

![Voltage waveform](image)

$V(0, t)$

5 V

3 V

0 6 μs

$t$

**Figure P2.77:** Voltage waveform for Problems 2.77 and 2.79.
Problem 2.78 In response to a step voltage, the voltage waveform shown in Fig. P2.78 was observed at the sending end of a shorted line with $Z_0 = 50$ $\Omega$ and $\varepsilon_t = 4$. Determine $V_g$, $R_g$, and the line length.

![Voltage waveform](image)

**Figure P2.78:** Voltage waveform of Problem 2.78.

Problem 2.79 Suppose the voltage waveform shown in Fig. P2.77 was observed at the sending end of a 50-\(\Omega\) transmission line in response to a step voltage introduced by a generator with $V_g = 15$ V and an unknown series resistance $R_g$. The line is 1 km in length, its velocity of propagation is $1 \times 10^5$ m/s, and it is terminated in a load $R_L = 100$ $\Omega$.

(a) Determine $R_g$.

(b) Explain why the drop in level of $V(0, t)$ at $t = 6 \mu s$ cannot be due to reflection from the load.

(c) Determine the shunt resistance $R_f$ and location of the fault responsible for the observed waveform.