Problem 2.38 The input impedance of a 31-cm–long lossless transmission line of unknown characteristic impedance was measured at 1 MHz. With the line terminated in a short circuit, the measurement yielded an input impedance equivalent to an inductor with inductance of 0.064 µH, and when the line was open-circuited, the measurement yielded an input impedance equivalent to a capacitor with capacitance of 40 pF. Find $Z_0$ of the line, the phase velocity, and the relative permittivity of the insulating material.

Problem 2.40 A 100-MHz FM broadcast station uses a 300-Ω transmission line between the transmitter and a tower-mounted half-wave dipole antenna. The antenna impedance is 73 Ω. You are asked to design a quarter-wave transformer to match the antenna to the line.
(a) Determine the electrical length and characteristic impedance of the quarter-wave section.
(b) If the quarter-wave section is a two-wire line with $D = 2.5$ cm, and the wires are embedded in polystyrene with $\varepsilon_r = 2.6$, determine the physical length of the quarter-wave section and the radius of the two wire conductors.

Problem 2.41 A 50-Ω lossless line of length $l = 0.375\lambda$ connects a 300-MHz generator with $V_g = 300$ V and $Z_g = 50$ Ω to a load $Z_L$. Determine the time-domain current through the load for:
(a) $Z_L = (50 - j50) \Omega$
(b) $Z_L = 50 \Omega$
(c) $Z_L = 0$ (short circuit)