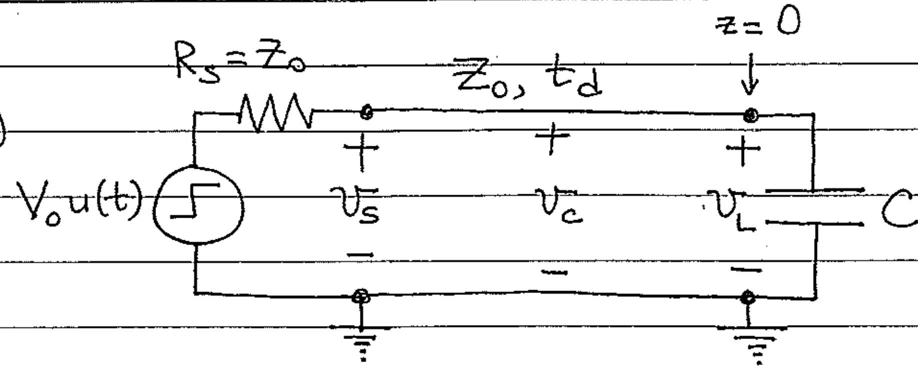
EE 301

SPRING 2012 HOMEWORK # 3

A. INAN

(#1)



For the transmission-line circuit shown, find the complete mathematical expression and sketch $v_S(t)$, $v_L(t)$, $v_c(t)$ and $v_1^-(z=0,t)$.

(#2)

Problem 4.30.* No energy is stored in the system of Fig. 4.56 when $t < 0$. If the switch S is closed at $t = 0$, give dimensional sketches of: (a) The voltage across C_1 versus time. (b) The space distribution of voltage along the *entire* line ($0 \leq z < \infty$) at times $t = l/2v_p$, $t = 3l/2v_p$, and $t = 2l/v_p$. (c) Sketch the time functions for

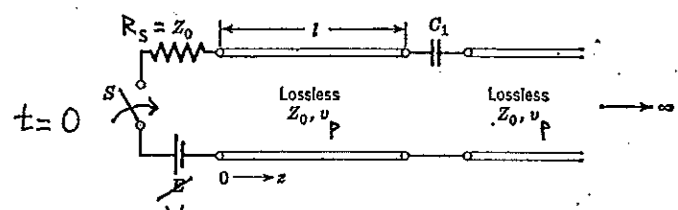


Fig. 4.56. Problem 4.30.

the voltages and currents at $z = l/2$, $z = l$, and $z = 3l/2$. (d) Repeat the above parts if C_1 is placed in parallel rather than in series with the line. (e) Repeat (a)–(d) with an inductance L_1 instead of the capacitance C_1.

* Note that this problem is taken from "Electromagnetic Energy Transmission and Radiation" by R. B. Adler, L. J. Chu and R. M. Fano, John Wiley & Sons, 1960, page 178.

(#3) In the figure below, write the complete mathematical expression for each waveform.

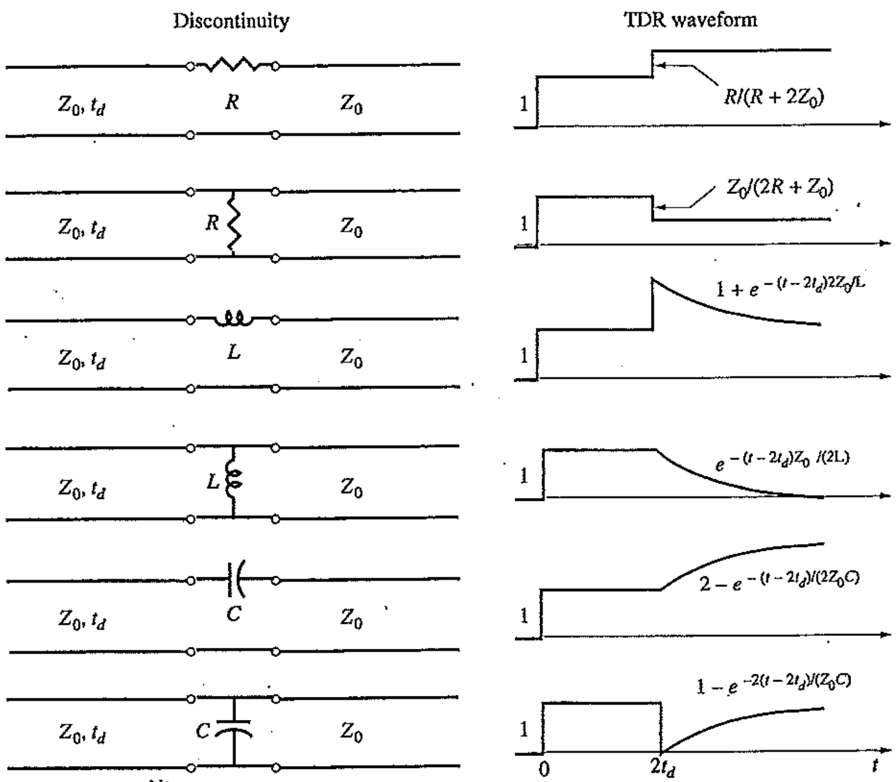


FIGURE 2.34.* **TDR signatures produced by simple discontinuities.** Source-end TDR voltage signatures for shunt or series purely resistive, inductive, and capacitive discontinuities. In terms of excitation by a step voltage source of amplitude V_0 and source resistance R_s, the TDR voltage waveforms shown are drawn for $V_0 = 2$ V and $R_s = Z_0$, and one-way travel time t_d from the source to the disconuity. (This figure was adapted from Figure 6 of B. M. Oliver, Time domain reflectometry, *Hewlett-Packard Journal,* 15(6), pp. 14–9 to 14–16, February, 1964. ©Hewlett-Packard Company 1964. Reprinted with permission.)

* Note that this figure is taken from "Engineering Electromagnetics" by U.S. Inan and A.S. Inan (page 80), Addison Wesley, 1999.