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Subject: Transients on Transmission Lines

Appendix 1: Tabulated Initial and Final Voltages

Appendix 2: Pulse Velocity Calculation

In this lab, a transmission line was connected to a voltage source and oscilloscope. The reflections produced of the voltage source were studied when the transmission line (a coaxial cable in this lab) was capped in a matching load resistor and a capacitor, as well as a short and also left open.

When the transmission line was left open, the voltage was simply stepped up from it's minimum to it's maximum value in 2.4 volt steps. When the cable was shorted, the voltage seemed to be zero and then stepped up to about 2.75 volts, and then back to zero. When a 50 Ω resistor was used as a matched load on the end of the cable, the voltage simply stepped once from -.875 volts to 1.594 volts. With a capacitor at the end of the cable, the voltage would step up and down, but only exponentially. Before it started decreasing or increasing, the voltage would momentarily drop (or rise) to zero and then presume it's original value and continue to decrease in an exponential manner.

A matched termination would provide maximum power transfer, and would therefore be very desirable. The only effect seen in lab from adding a matched load was that the voltage was decreased slightly.

Considering a TDR was unavailable for the lab, its value is unknown (obviously, it must be very useful for diagnosing transmission lines) and therefore cannot be discussed.

Appendix I - Initial and Final Voltages

Transients on Transmission Lines

Voltages:

	Initial	***Final***
Open Cable:	-2.063 V	2.844 V
Shorted Cable:	.3125 V	2.75 V
Matched Termination:	-.875 V	1.594 V
Capacitive Termination:	-2.0 V	2.75 V

Graphs:

Open Circuit ***Shorted Circuit***

With 50 Ohm Resistor ***With Capacitor***

Appendix II

Transients on Transmission Lines

Transmission Line Length: 4 meters

Delay Time for Open: 55 *ns*

Pulse Velocity: (4 + 4) meters / 55 *ns* = **146.45 x 10^6 m/s**

Delay Time for Open: 29 *ns*

Pulse Velocity: (4 + 4) meters / 29 *ns* = **275.86 x 10^6 m/s**

Delay Time for Resistor: 8 *ns*

Pulse Velocity: (4 + 4) meters / 8 *ns* = **1 x 10^9 m/s**