GORE™ TLINESIM PRODUCT INFORMATION

Thomas Clupper (Sep 27, 2007)

Introduction

The **TLinesim.com** web site is an experimental 2-port linear network simulation tool. This "web-based" simulation program works with 2 port device models (no differential or coupled paths), so the calculations are very fast. The simulations are based on cascading S-parameter matrices that are created from linear models or from measured vector network analyzer (VNA) data. The application uses standard HTML format for all of its input and output, requiring only a web browser and internet connection to access it. This simulation tool is free to use and does not require any login information.

The user can choose from a number of voltage sources, such as a bit-pattern generator, a waveform generator (which includes sine, triangle, square, and step functions), or a VNA. The output can then be viewed using a number of test instruments, such as an oscilloscope, a spectrum analyzer, or a VNA. The software can be used for educational purposes, such as training or performing "what-if" scenarios with various 2-port devices or transmission lines.

Simulation of devices

The representation for each element is a box with two ports, or four terminals, as the input and output. The boxes are then connected together to show the cascaded 2-port network as the device under test (DUT) (shown in Figure #1).

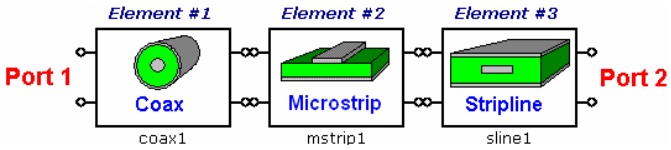

Figure #1 *Schematic representation of 2-port elements*

The list of elements currently includes coax, microstrip, stripline, rectangular waveguide, and a parametric based transmission line. Also available are an ideal stub, ladder network of discrete RLCs, and S-parameter data input. Future development work will include synthesis elements that design filters, delay lines, equalizers, and connector and cable models using existing elements. When a simulation is performed, the S-parameters for each of the elements are simply concatenated together using cascading matrices. The final result combines the voltage waveform of the source, the characteristics of the elements within the DUT, and the complex source and load impedances.

Virtual test bench

The test setup for the DUT can be configured several different ways. The user first chooses a source that will be connected to the input of the DUT and then a test instrument that will be connected to its output. *Note that the cables are shown symbolically to represent connection, but are not included as part of the simulation*. Figure #2 shows two possible test bench configurations. While in the program, the user simply clicks the source, the DUT, or the test instrument to edit its properties or view its output.

a) Vector Network Analyzer (VNA)

b) Bit-pattern generator and Oscilloscope

Figure #2 *Possible Test bench configurations.*

The VNA can view the S-parameters: S_{11}, S_{21}, S_{12}, and S_{22}, in several different formats, such as 20logMag, Magnitude, Real, Imaginary, Phase, Phase delay, Group delay, VSWR, Polar and Smith charts. It also allows the user to perform a time-domain transformation in order to view either a step or impulse response.

The bit-pattern generator supports pseudo-random bit sequences, such as 2^{7-1} PRBS or $K_{28.5}$ bit patterns, with several different clock rates. You can adjust the rise time, signal amplitude, and even include pre-emphasis. The waveform generator allows the user to select sine, triangle, sawtooth, square, or unit step functions. One can set the frequency and amplitude characteristics of the waveforms, or the rise time of the step function.

The oscilloscope can view the output or input voltage of the DUT as a function of time. For bit-patterns, it can also view eye-diagrams. The spectrum analyzer can view the output or input power of the DUT as a function of frequency. The graphing can be customized with adjustable axis settings and measurement annotations. Since the graph exists as a picture on a web page, it can be saved or brought into a document for report purposes.

This web site was developed as an experiment to see whether or not these types of simulations could be effectively performed on a standard web server. The target application is for educational purposes; however the powerful features and simple user interface allow the user to do much more.

If you have any questions, please email me at:
tclupper@wlgore.com

W. L. Gore & Associates

North America:
1 (800) 445-4673
International:
1 (302) 292-5100

Europe:
+49/91 44/6010
+44/1392-561511
www.gore.com/electronics