The Teledyne LeCroy Signal Integrity Academy

presents

A New Workshop on

Practical S-parameter Measurement and Analysis

Never be intimidated by S-parameters again

With Dr. Eric Bogatin

Do you use S-parameters in your design flow? Are you confused, intimidated, or just plain unsure of either the quality of the S-parameter or even what they mean? Have you been frustrated in not being able to wade through the mathematics that usually hides the important information locked inside S-parameters? Want to finally understand what S-parameters are really telling you? If you answered “yes” to any of these questions, then this workshop is for you.

This new, live workshop, presented by Dr. Eric Bogatin, applies the principles laid out in the Signal Integrity Academy to show how to take a new S-parameter file, either from a measurement or simulation and data mine all of its valuable information.

We introduce a few simple to use, free tools that will help you inspect the touchstone file in the frequency or time domain, as single ended or as differential, and make sense of what you have.

We’ll look at tools that measure S-parameters and simulate S-parameters and identify some of the common pitfalls to watch out for. In the end, we’ll walk through our 22 point check list to evaluate the most important quality metrics and interconnect features.

We'll show you how to do forensic analysis of a channel by opening up the black box of the S-parameters and look inside to find the root cause of performance limitations.

If you use S-parameters, either from measurements or from simulations, this workshop is for you.

All the example files and free tools will be posted on the Signal Integrity Academy for download.

You can bring your laptop and play along with the demos, or try them back home. The lectures and demos will be recorded and posted on the SI Academy for future viewing.

Because we leverage so much content from the SI Academy, this workshop is only open to subscribers. If you are not a subscriber, it's not too late. Sign up today, at www.SignalIntegrityAcademy.com .

We leverage the following tools to measure, simulate, and analyze S-parameters:

- Teledyne LeCroy SPARQ
- Teledyne LeCroy SI Studio
- QUCS
- Polar Instruments SI9000
- Mentor Graphics HyperLynx
- Samtec Solutionator
- Keysight ADS
- Simberian Simbeor

Day 1

1. What are S-parameters
   a. Basic definitions and Applications
   b. Ports and definition of the terms
   c. From simulation, from measurement
   d. Viewing touchstone files
   e. Plotting in frequency and time domain

2. Crash course in S-parameters
   a. Return and insertion loss of uniform transmission lines
   b. How return loss gets its ripples
   c. Impact of launch discontinuities
   d. Losses and attenuation
   e. Resonances and what they mean

Lunch

3. Interpreting S11 in the time and frequency domain
   a. S11 and impedance
   b. The TDR
   c. Masking
   d. Two common artifacts and how to avoid them
   e. When high series resistance dominates

4. Insertion loss and uniform transmission lines
   a. Phase, time delay and Dk
   b. When the Z0 is not 50 ohms- port re-normalization
   c. Total loss
   d. Intro to hacking and extracting material properties
   e. Reflection coefficient of a thru path and input impedance of a via

Day 2

1. Differential S-parameters

a. Differential pairs, differential signaling and differential S-parameters
b. Single ended to differential S-parameter conversion
c. Insertion loss and coupling
d. Differential impedance and common impedance
e. Differential TDR

2. Mode conversion

a. The fundamental root cause
b. Interpreting mode conversion S-parameter elements
c. The three most common sources of mode conversion
d. Typical measurements of mode conversion
e. Why simulations rarely show this effect and how to fix it

Lunch

3. Cross talk

a. Single ended in the frequency domain
b. Single ended in the time domain and where coupling occurs
c. Differential cross talk
d. Common to differential cross talk
e. Return path discontinuities

4. The S-parameter check list

a. 22 features to look for in every S-parameter file
b. The three amigos: reciprocity, passivity and casualty
c. Practical de-embedding principles
d. Forensic analysis
e. Leveraging the Signal Integrity Academy resources