

*A 1-day training class with  
Dr. Eric Bogatin, Signal Integrity Evangelist*

# **BDPSI: Best Design Practices for Signal Integrity**

*Build your engineering intuition*

***Now with hands on labs!***

If you are going to take just one signal integrity class, Best Design Practices for SI should be the one. In this 1-day class, you will learn an efficient process to design signal integrity problems out of your next product, right from the beginning.

This process is based on identifying the six families of signal integrity problems, their root cause and the design guidelines which eliminate these problems. You will learn the nine essential principles of how signals interact with interconnects which will strengthen your engineering intuition.

In this introductory class, the math is stripped away to reveal the underlying truth of how interconnect design decisions affect signal quality. The most essential principles of signal integrity are introduced and applied to solve signal integrity problems related to:

• Characteristic impedance, return current	• Ground bounce and cross talk
• Reflections	• Bandwidth
• Inductance	• Terminations, routing and topology
• Impedance	• PDN and EMI
• Lossy lines and rise time degradation	• Differential pairs

Design guidelines are illustrated with examples of measurements and simulations using structures such as IC packages, connectors, printed circuit boards and cables.

## ***Now with hands on labs!***

The most common answer to all signal integrity questions is “it depends”. The way we answer it depends questions is by putting in the numbers. While this class introduces many rules of thumb and approximations, sometimes, to get a good answer requires a simulation. This is why numerical simulation tools are essential.

By special arrangement, we give you access to Mentor Graphics HyperLynx to run hands on labs we created specifically for this class. These labs illustrate the design principles and allow you to explore design space on your own, after the class.

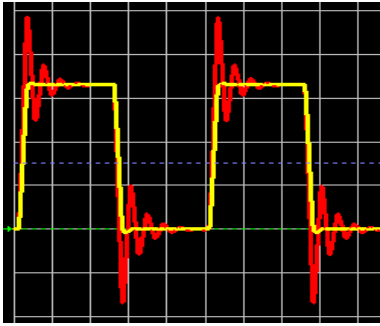
No previous simulation experience is necessary. Even if you have never done any simulation before, you will find the labs we have created easy to use and help you immediately apply the principles you learn in class to your next design.



## **How Do I Register?**

Online at [www.beTheSignal.com](http://www.beTheSignal.com),  
[info@beTheSignal.com](mailto:info@beTheSignal.com) for questions and group discounts.  
Schedule is online at [www.beTheSignal.com](http://www.beTheSignal.com)

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## **Class Outline**

### **01 The Secrets to Transmission Lines: Re-thinking Signals**

- The most efficient design process: root cause analysis and design tradeoffs
- Principles, problems and habits
- The instantaneous impedance all signals see
- Characteristic impedance and transmission lines
- Differential pairs
- Return currents in transmission lines

### **02 Eye Diagrams, Reflections, Terminations and Losses**

- Eye diagrams and inter-symbol interference
- Ringing as source of ISI
- The real story about terminations and which is the right one to use
- Routing and the highest data rate possible
- Conductor and dielectric losses as source of ISI
- Estimating interconnect bandwidth and highest data rate possible
- Equalization

### **03 Cross Talk and Ground Bounce**

- Principles of Inductance
- Cross talk in busses: why is NEXT so different from FEXT?
- Reducing NEXT, FEXT
- Total inductance of the return path and ground bounce
- Reducing ground bounce by circuit design
- Reducing ground bounce by physical design

### **04 PDN, Impedance and EMC Design**

- Impedance and the PDN
- Why a flat impedance profile
- Increasing your luck: low ESL design
- Passing EMC certification
- Common currents; the most important source of EMC failures
- Reducing radiated emissions in boards and connectors

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