beTheSignal
Bogatin Enterprises. L.L.C.

Organizer:

Polar
Polar Instruments (Asia Pacific) Pte Ltd
Simplified Solutions

# Differential Pair Design (DPD)

## December 1st 2011

## &

# S-Parameters for Signal Integrity (SPSI)

## December 2nd 2011

### Intensive Workshops by Dr. Eric Bogatin of Bogatin Enterprises and beTheSignal.com

### We are bringing the expert to your doorstep!

Polar Instruments (Asia Pacific) Pte Ltd has partnered with Dr. Eric Bogatin, world's leading trainer and Signal Integrity Evangelist for High Speed PCB Design, Signal Integrity, Testing, Characterization and verification and to bring his expertise to Asia for the benefit of the PCB Design and Manufacturing industry in the region.

### Now with hands on labs!

New in 2011 classes, we show you how to use a very easy to use simulation tool, QUCS, and how you can quickly answer common signal integrity problems. This tool runs on any laptop with a Windows OS. We provide you a copy of the tool and all the circuits used in the labs. These are yours to take back.

No previous experience is necessary. Even if you have never done any simulation before, you will find this an incredibly easy tool to use. If you are familiar with SPICE, you will find QUCS to be far easier and more versatile.

To participate in the hands on labs, you must bring your own laptop to the class.

## Ideal for Design and Fab Engineers!

## REGISTER NOW!

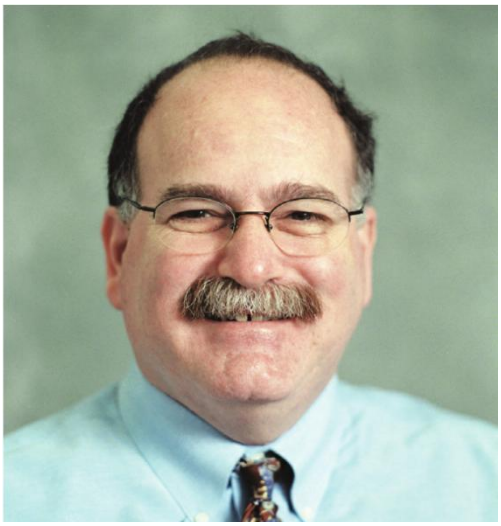
## polarinstruments.asia

**Email or Fax the completed form to**
**training@polarinstruments.asia or +65 68737471**
**or call +65 6873 7470**
**OR**
**bangalore@tridenttechlabs.com or +91-80-40328457**
**or call +91-80-41261512/ 41161759**

Partner:
TECHLABS
An ISO 9001:2008 Company

**December 1-2nd,2011**
**9.00am – 5.00 pm**

**Hotel Royal Orchid, Bangalore**



**Dr. Eric Bogatin - President, Bogatin Enterprises, LLC**

Dr. Bogatin received his BS degree in physics from MIT, and MS and PhD degrees in physics from the University of Arizona in Tucson. He has written five books on signal integrity and interconnects design, over 300 papers and articles and has taught over 4,000 engineers in the last 25 years. He is a distinguished lecturer for the IEEE EMC society and lectures worldwide on signal integrity topics.

## DON'T MISS THESE VALUABLE CLASSES!

**Registration Fee per Class:**
**Rs. 20,000***
**PLUS:** upto 5% group discounts

**Special Early Bird Fee:**
**Rs. 19,000***
**(before November 11th 2011)**

*Price incl. tax, course materials, lunch & 2 tea breaks.
**Also sign up for Essential Principles of Signal Integrity – 2 day class in Hyderabad on Nov. 28-29th 2011.

# DPD:Differential Pair Design

## Overcoming the obstacles in high speed serial channels

## The cure for FUD (Fear, Uncertainty and Doubt)

Are you designing one of the alphabet soup high speed serial links like PCIe, SATA, SAS, XAUI, GigE, USB or LVDS? Then all of your interconnects are differential pairs and eliminating signal integrity problems in your design will determine whether your product works or not.

This one-day, intensive training will bring you “up to speed” on how to design the physical interconnects of your channel to improve signal quality and achieve the bit rate you need. We eliminate the myth-conceptions that dominate the industry and show you the right way of designing differential pairs that operate above 10 Gbps.

We eliminate the confusion over:

- Tight or loose coupling
- Differential mode vs odd mode impedance
- Conductor loss and copper roughness
- Dielectric loss
- Transparent via design
- Mode conversion and length matching
- S-parameters without tears
- The limits to FR4

# Outline

### Module 1: Differential pairs

- **The four multi gigabit problems**
- **Differential and common signals**
- **Differential impedance, odd mode impedance**
- **Stack up design: walk the line principle**
- **Channel to channel cross talk**
- **Tight or loose coupling?**

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### Module 2: Losses and S-parameters

- Why frequency dependent loss is important
- Losses and jitter
- Conductor and dielectric loss
- SDD21 and attenuation
- Using equalization to compensate for attenuation
- Length- bandwidth tradeoffs

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### Module 3: Differential circuits

- Simulating differential pairs
- Unscrambling eyes: SBR, PDA, step response, PRBS
- Routing topologies and terminations
- Mode conversion and asymmetry
- When to terminate the common signal
- Impact from vias and discontinuities

3

### Module 4: Hands on Lab

- Differential and common signals: transient and single bit response
- Mode conversion and terminating common signals
- Impact from vias and stubs
- Impact from connectors
- Simulating the S-parameters: losses and discontinuities

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**Visit bethesignal.com or polarinstruments.asia for more details**

# SPSI: S-parameters for Signal Integrity

## Unlock the secrets of S-Parameters for Signal Integrity Applications

This one-day class, designed and offered by Signal Integrity Evangelist Dr. Eric Bogatin, shows you how to unlock the power of S-Parameters for signal integrity applications. In a 4 port measurement, there are more than 400 different S-Parameter terms, including single ended, differential, frequency domain and time domain formats, either as step response or impulse response. Each term tells another piece of the interconnect's story.

This class enables you to tap into the secrets locked inside S-Parameters and walks through the details of interpreting the measured or simulated results of 1-port, 2-port, or 4-port S-Parameters as single ended, differential in the frequency domain and the time domain. Topics include:

- The value of Insertion and return loss
- Single ended and differential S-parameters
- How to extract characteristic impedance and differential impedance
- Identifying mode conversion problems and solutions
- The ten item check list to evaluate all S-parameters
- The four most important patterns you will see

# Outline

### Principles of S-parameters for SI Applications

- **The secret to understanding S-parameters**
- **S-parameters and touchstone files**
- **Common Applications**
- **The dB**
- **Insertion loss, return loss**

1

### Insertion and Return Loss

- Ripples in return and insertion loss
- Return loss and characteristic impedance
- Attenuation and insertion loss
- Resonances and insertion loss
- Time domain and frequency domain responses

2

### Differential S-parameters

- The secret to minimize confusion
- Converting from single ended to differential S-parameters
- Differential impedance from return loss
- Mode conversion
- Time domain and frequency domain responses

3

### Module 4: Hands on Lab

- A touchstone viewer for 1,2 and 4 port single ended S-parameters
- A touchstone viewer for 4 port differential S-parameters
- Data mining S-parameters of circuit board interconnects
- Data mining S-parameters of vias
- Data mining S-parameters of backplane interconnects

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**Visit bethesignal.com or polarinstruments.asia for more details**

# Recharge your Engineering Skills for SI Design, Test & Verification.

## Also Available:

### PUBLIC / IN-HOUSE CLASSES (2-Days) & BOOT CAMPS (1 Day)

Courses on High Speed Signal Integrity Design, Principals, Testing, Characterization and Validation techniques. Intensive one day boot camps on designing for high-speed serial links like PCIe, SATA, SAS, XAUI, GigE, USB or LVDS or designing, controlling, and characterizing transmission line losses.

### ONLINE CERTIFICATION / CONTINUING EDUCATION COURSES / TRAINING – WEBINARS / LECTURES / RESOURCES

Online Certification courses on topics like essential Principals of Signal Integrity, Continuing Education Courses (CEC) and other training courses through “Design Excellence Curricula" webinars and lectures at www.printedcircuituniversity.com

### CORPORATE / INDIVIDUAL – ANNUAL or QUARTERLY SUBSCRIPTIONS

Time limited – annual, quarterly and soon to be offered monthly - Corporate / Individual subscriptions are available to access a wealth of resources related to SI design, test, characterization and validation at www.printedcircuituniversity.com

## Other Courses from Bogatin Enterprises LLC., USA:

### PDN : Power Delivery networks

Topics covered include:

- How do you select capacitors? How many, what value?
- Where should they be placed?
- When does location matter?
- How will you know if you got it right?
- What’s important in the stack up design?
- When is it worth it to use ultra thin laminates?
- What are good habits every layout designer should know?

### EPSI: Essential Principles of Signal Integrity

Topics covered include:

- The value of Insertion and return loss
- Single ended and Differential parameters
- How to extract characteristic impedance and differential impedance
- Identifying mode conversion problems and solutions
- The ten item check list to evaluate all S-parameters
- The four most important patterns you will see and what they tell you

### TVD : Transparent Via Design

Topics covered include:

- Single ended Vias
- Differential Vias
- Corners, bends and serpentines
- Neck downs in BGA fields
- Solder balls
- Connectors
- Terminating resistors
- DC blocking capacitors

**Also register for Essential Principles of Signal Integrity at Hyderabad on 28th and 29th November 2011**

**For more details visit: www.bethesignal.com and www.polarinstruments.asia**

**About Polar Instruments, Asia Pac** **www.polarinstruments.asia**

Headquartered in Singapore and with offices in Japan and China, Polar Instruments (Asia Pacific) Pte Ltd was established in 1999, as a wholly owned subsidiary of Polar Instruments Ltd, Guernsey, UK to provide sales, marketing and after sales support to customers in the then emerging Asia Pacific region. Now an independent company, Polar Asia Pac provides a range of value added services that include market research and development, product sales, marketing, and after sales support for our principals in the Asia Pacific region covering Australasia, Japan, to the Middle East. Our services include application support, repair & calibration, on-site/off-site maintenance services, and a range of professional consulting services for training, design, test, failure/data analysis and co-relation studies related to our current market space.

**About Trident Techlabs, India** **www.tridenttechlabs.com**

Techlabs was established in 2000 to serve clients who have requirement of high technology and sophisticated computer- aided engineering tool to ensure that the product once designed and developed meet the quality and reliability requirements. Trident Techlabs is a pioneer for the past two decades in marketing & supporting state of art CAE software that address circuit simulation, PCB design engineering and simulation, VLSI design solutions, FPGA design solutions, CFD solutions, Power Electronic Simulations Solutions, 3D product design. Its supports state-of-the-art software from: Mentor Graphics, National Instruments, PTC, SES to name a few. The Trident advantage includes providing integrated state-of-the-art technology gained from its global partnerships to keep its clients always a step ahead with its presence in 7 strategic locations across India.

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