

Lesson: VRPW-30-10: Yoshi's animations of current flow

Course VRPW: Video Recordings of Presentations and Webinars Section 30: In The Lab With Eric

With Eric Bogatin,
Dean, Teledyne LeCroy Signal Integrity Academy

- VRPW-30-10: Yoshi's animations of current flow
 - ✓ The way we learn about current flow in grade school leads to incorrect thinking about current flow in differential pairs
 - ✓ Current through a capacitor
 - ✓ The right way to think about current flow in single-ended transmission lines
 - ✓ With terminations at the end of the line

My good Buddy Yoshi Tsuji, Ace Application Engineering Manager with Teledyne LeCroy, Japan



A series of flash applications which illustrate important signal integrity principles:

- Current flow
- Cross talk
- Electric fields
- Reflections
- Return loss
- Me, being the signal!

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Current flow

- See EPSI-01-80 return current
- The wrong way: Battery and light bulb
- The wrong way: Differential pair
- The right way: signal line, terminated at the far end
- The right way: signal line, low impedance at the far end
- The right way: signal line, high impedance at the far end

Lesson: VRPW-30-12: Yoshi's Animations of Cross Talk

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- VRPW-30-12: Yoshi's Animations of Cross Talk
 - ✓ Capacitive and inductive coupling
 - ✓ Propagation of capacitive and inductive coupling
 - ✓ Scaling with coupling length
 - ✓ Difference between microstrip and stripline

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Current flow

- See EPSI-07: NEXT, FEXT
- Strongly recommended you review this section in the EPSI course to understand the root cause of NEXT, FEXT
- The nature of capacitive and inductive coupling and their combination
- How the length of the coupling region affects the NEXT and FEXT

7. Cross talk in uniform transmission lines (1hr 30min)

[EPSI-07-01 Download a pdf copy of the slides here](#)

[EPSI-07-10 Near and Far End Cross Talk](#)

[EPSI-07-20 Cross talk and fringe fields](#)

[EPSI-07-30 Why NEXT is different from FEXT](#)

[EPSI-07-40 Detailed analysis for NEXT and FEXT](#)

[EPSI-07-50 Engineering lower NEXT and FEXT](#)

[EPSI-07-60 Cross talk as affected by terminations](#)

Lesson VRPW-30-14: Yoshi's Animations of Electric Field Lines

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VRPW-30-14: Yoshi's Animations of Electric Field Lines

- ✓ Electric field lines and equipotentials when applying a differential signal
- ✓ Scaling with trace to trace separation
- ✓ Applying a common signal
- ✓ When second trace is gnded or floating

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Other Resources

1. The most important SI principles (2 hr)

[EPSI-01-01 Download pdf file here](#)

[EPSI-01-10 Why the essential principles are important](#) 

[EPSI-01-20 Design Methodology](#) 

[EPSI-01-30 Analysis tools](#)

[EPSI-01-40 The Six Families of SI Problems](#)

[EPSI-01-50 The First Three Essential Principles](#)

[EPSI-01-60 Instantaneous Impedance](#)

[EPSI-01-70 Characteristic Impedance](#)

[EPSI-01-80 Return Current](#)

4. Section 4: Channel to Channel Differential Cross Talk (2 hrs)

[AGCD-04-01 Download the pdf slides here](#)

[AGCD-04-10 Cross talk can ruin your day](#)

[AGCD-04-20 Near end cross talk and coupling](#)

[AGCD-04-30 Managing NEXT and a Pathological Case](#)

[AGCD-04-40 Saturated NEXT and Broadside Coupling](#)

[AGCD-04-50 Pathological cross talk: Far End Cross Talk](#)

[AGCD-04-60 Cross talk in connectors](#)

Lesson VRPW-30-16: Yoshi's Animations of Reflections

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- VRPW-30-16: Yoshi's Animations of Reflections
 - ✓ TDR and TDT, SBR, clocks and sine waves for uniform lines
 - ✓ TDR and TDT for uniform lines and mismatched ends
 - ✓ TDR and TDT for discontinuities and different rise time
 - ✓ TDR and TDT for stubs

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Reflections

3. Reflections and terminations (2hr)

[EPSI-03-01 Download a pdf copy of the slides](#)

[EPSI-03-10 How to Think About Reflections](#) 

[EPSI-03-20 Voltage and Current Reflections](#)

[EPSI-03-30 Practice safe simulation](#) 

[EPSI-03-40 Noise margins](#)

[EPSI-03-50 Four sources of reflections](#)

[EPSI-03-60 Termination topologies](#)

[EPSI-03-70 Balancing Power and Signal Quality](#)

[EPSI-03-80 Flyby Termination](#)

3. Section 3: Data mining return loss (2 hrs)

[SPSI-03-01 Download the pdf slides here](#)

[SPSI-03-03 Special bonus: Download a book here](#)

[SPSI-03-10 S11 as a direct measure of input impedance](#)

[SPSI-03-20 Turning any VNA into an impedance analyzer](#)

[SPSI-03-30 Measuring very low impedance with a VNA](#)

[SPSI-03-40 Example of measuring the impedance of a via](#)

[SPSI-03-50 Thinking of impedance in the time domain](#)

[SPSI-03-60 Interpreting S11 in the frequency and time domains](#)

[SPSI-03-70 Examples of S-parameter measurements](#)

Lesson VRPW-30-18: Yoshi's Animations of S11 Ripples

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- VRPW-30-18: Yoshi's Animations of S11 Ripples
 - ✓ The origin of S11 and S21
 - ✓ When the length is $\frac{1}{4}$ a wavelength
 - ✓ When the length is $\frac{1}{2}$ a wavelength
 - ✓ Why we see ripples in S11

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Other Resources

2. Section 2: Four common patterns in insertion and return loss (2 hrs)

- [SPSI-02-01 Download the pdf slides here](#)
- [SPSI-02-10 The four common patterns in S-parameters](#)
- [SPSI-02-20 The connection between insertion and return loss](#)
- [SPSI-02-30 How large an impedance discontinuity is significant](#)
- [SPSI-02-40 Why do we have ripples in return loss?](#)
- [SPSI-02-50 Ripples in S11 and sometimes in S21](#)
- [SPSI-02-60 Impact from impedance discontinuities](#)
- [SPSI-02-70 Applying the principles to measured examples](#)
- [SPSI-02-80 Attenuation](#)
- [SPSI-02-90 Measured backplane channel insertion loss](#)
- [SPSI-02-100 Quarter wave stub resonances](#)
- [SPSI-02-110 Coupling to High Q Resonances](#)
- [SPSI-02-120 Measured insertion loss through a cavity](#)
- [SPSI-02-130 Further analysis of coupling into cavity resonances](#)

2. No Myths Allows Webinars (10 hrs)

- [VRPW-20-10 How to practice safe simulation](#)
- [VRPW-20-20 Practical Differential Pair Design](#)
- [VRPW-20-30 S-Parameters for SI Applications](#)
- [VRPW-20-40 Return Path Discontinuities and Link Analysis](#)
- [VRPW-20-50 Stack up Design for Differential Pairs !\[\]\(448bd415caa8b52d2aeb4d58499267b2_img.jpg\)](#)
- [VRPW-20-60 Capacitors for PDN Design](#)
- [VRPW-20-70 Frequency Domain Material Properties- so what?](#)
- [VRPW-20-80 Reading S-parameters like a book](#)
- [VRPW-20-90 Which is better- 1 capacitor value or 3 capacitor values?](#)

Lesson VRPW-30-20: Yoshi's Animations of me Being the Signal

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- VRPW-30-20: Yoshi's Animations of me Being the Signal
 - ✓ A signal launching into a transmission line
 - ✓ A signal propagating on a transmission line
 - ✓ Instantaneous impedance the signal sees
 - ✓ How to think about characteristic impedance

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[EPSI-01-80 Return Current](#)

