cadence®

MathWorks®

Accelerating Design, Data Visualization and Analysis of Analog and Mixed-Signal Systems

Steven Lewis, Jesson John

MATLAB EXPO 2021

Agenda

Mixed-Signal Design & Verification

- Cadence design platform
- MATLAB/Simulink
  - Mixed-signal blockset

Integrated Workflows with Cadence

- Data post-processing (mixed-signal analyzer app) NEW!
- Code generation (SystemVerilog model export from Simulink)
- Co-simulation of mixed-signal systems with Simulink and Cadence Virtuoso AMS Designer

Summary

- Customer testimonial
- How to get started
- Q & A

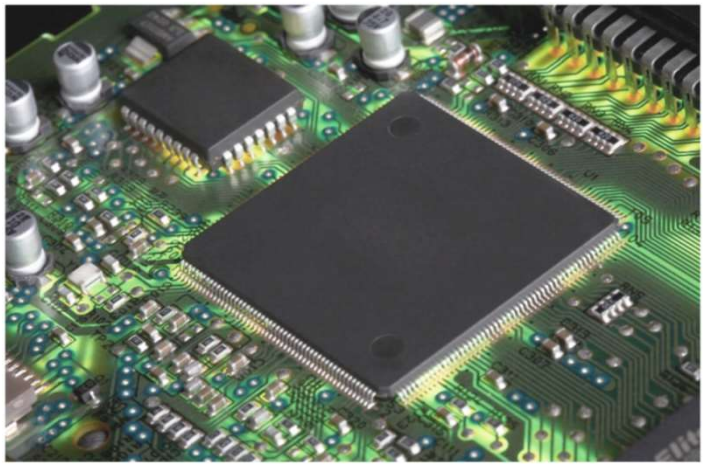
Problem Statement: *How do you …?*

How do you Design this?

How do you Analyze this?

How do you Implement this?

How do you Verify this?



Analog and RF Blocks
Mixed-Signal Blocks
Discrete Components and Memories
Packages and Board(s)

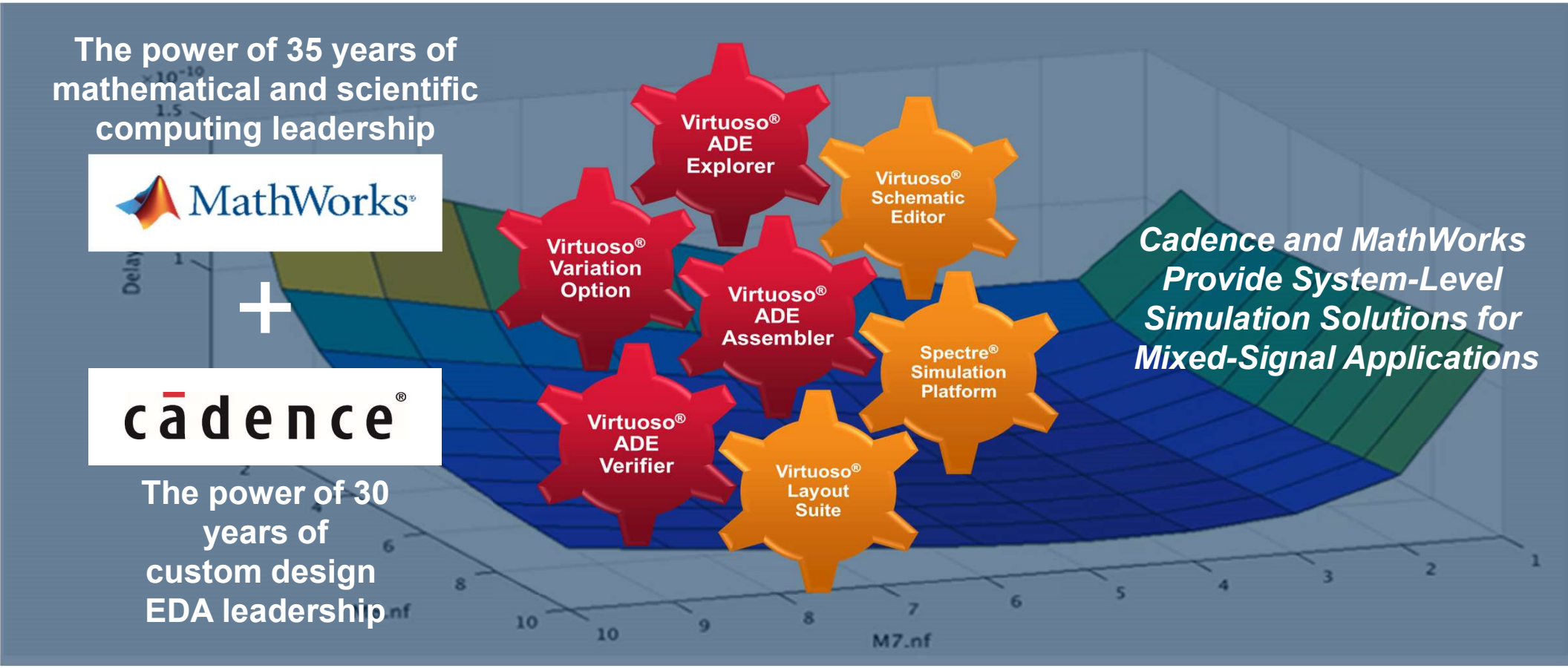
How do you know when you are done?

What's the common answer to all of these questions?

Cadence and MathWorks Partnership

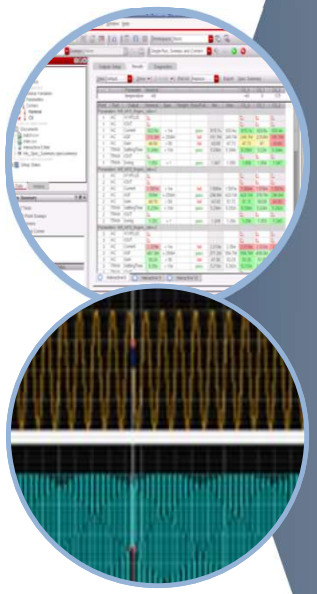
Experience Bridges the Divide Between ICs and Systems

Extensive relationship with MathWorks relationship

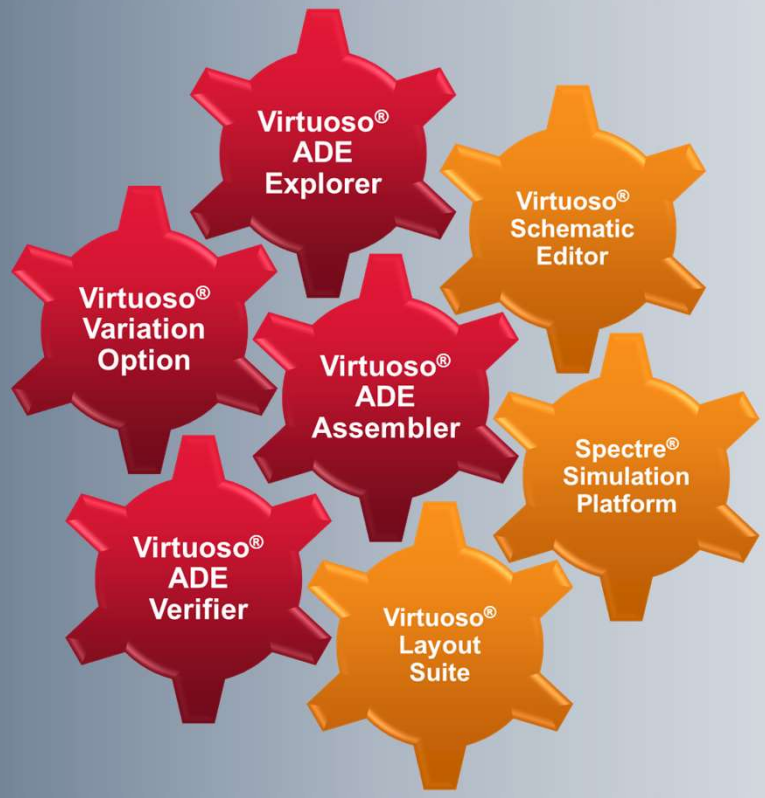


Under the Hood – Breakthrough Analysis, Simulation, and Verification

Analysis



Simulation



Virtuoso® ADE Assembler

- Interactive, multi-testbench environment that is designed to pull together all the parts of the design and their various specs to begin centering the design for manufacturing

Virtuoso® ADE Verifier

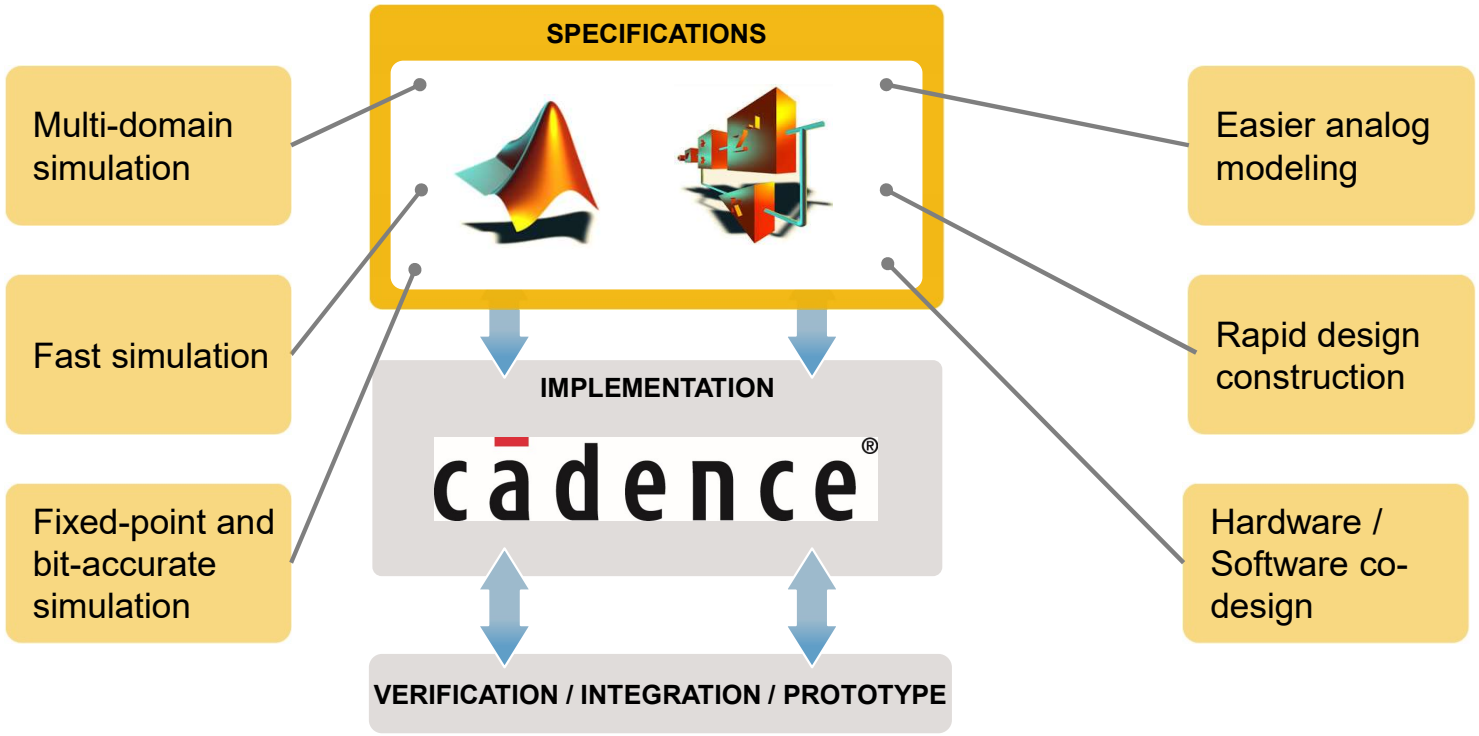
- Introduces a formalized method for doing overall electrical specification verification of analog circuits

Spectre® X Simulator

- Solves large-scale verification simulation challenges for complex analog, RF, and mixed-signal blocks and subsystems

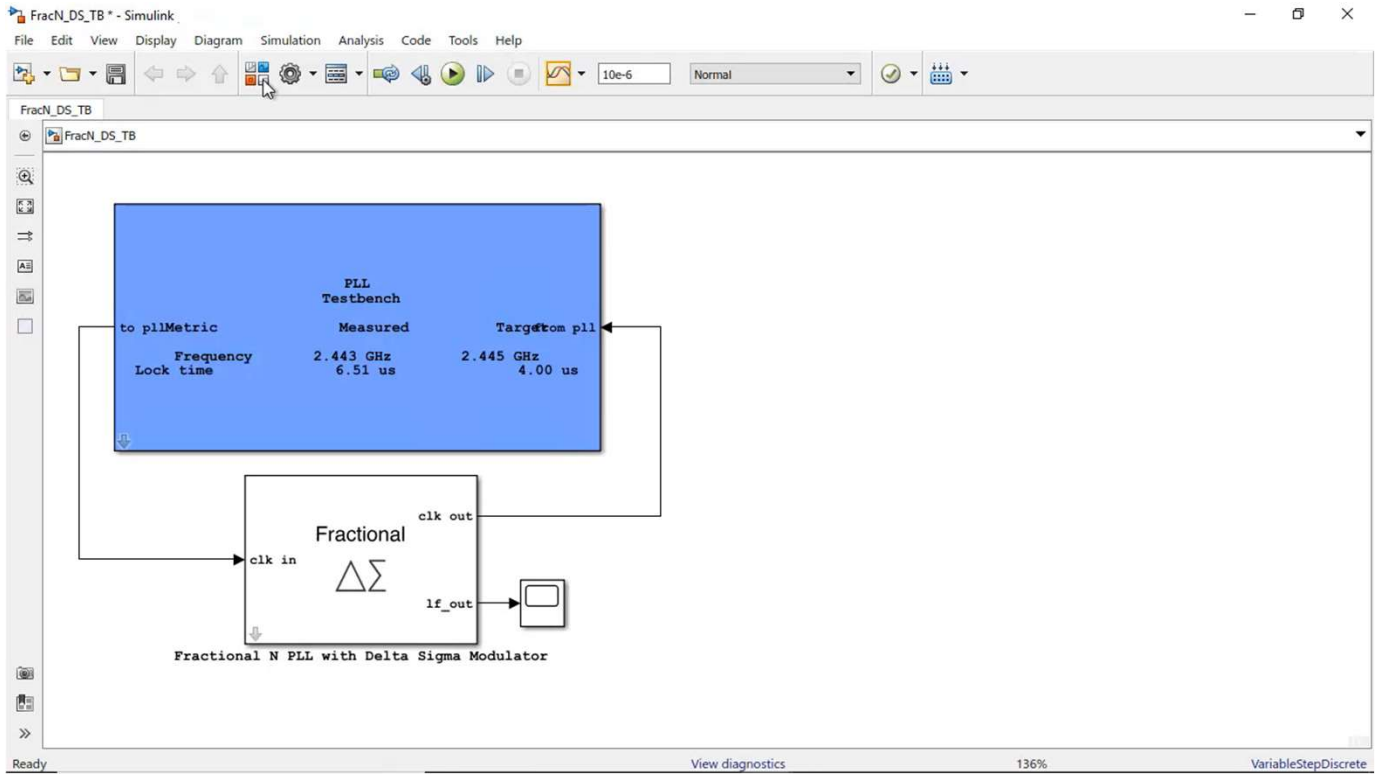
Mixed-Signal Design and Analysis with MATLAB and Simulink

Focus on Simulation and Model Refinement at the System Level



Mixed-Signal Blockset

Design, Simulate, and Analyze Analog and Mixed-Signal Systems



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Integrated Workflows with Cadence

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- Code generation (SystemVerilog model export from Simulink)
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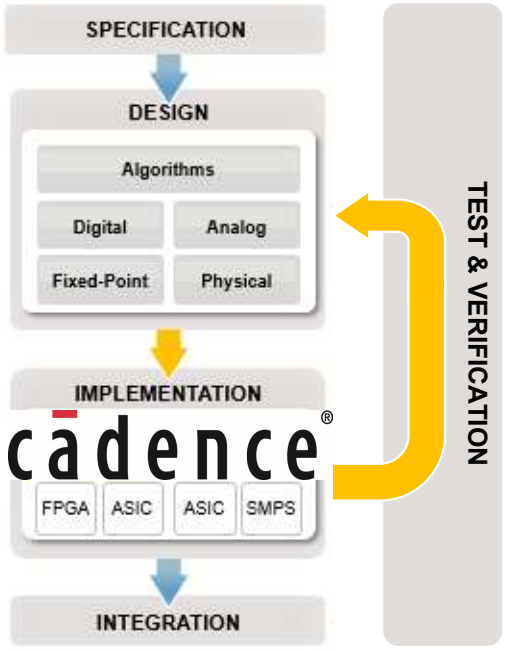
Cadence MATLAB/Simulink Integration Workflows

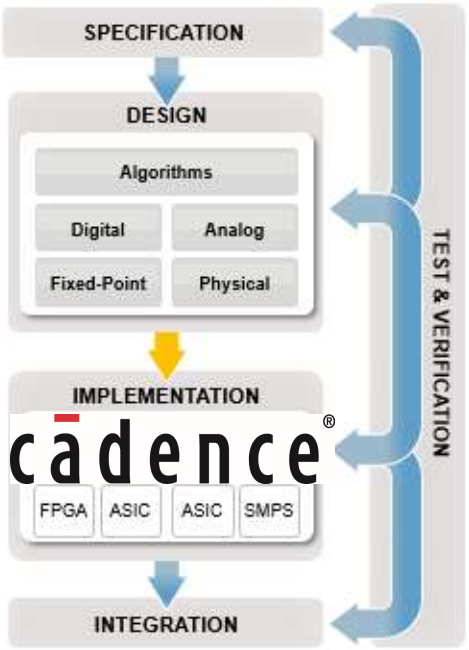
Data Post Processing

- Analyze trends in data
- Compare simulations
- Report & Document



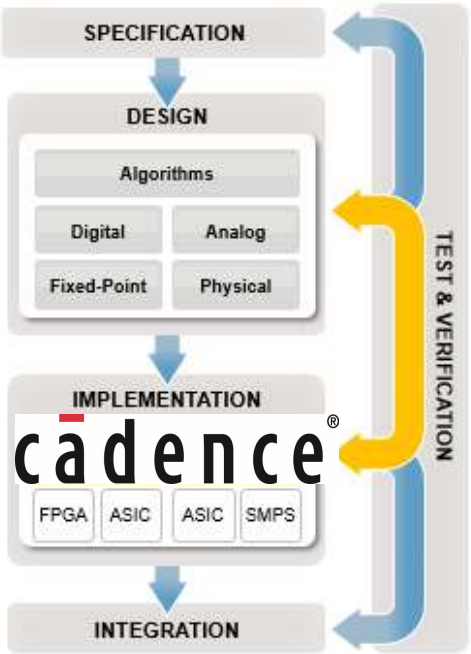
Code generation

- Testbench generation
- Regression testing



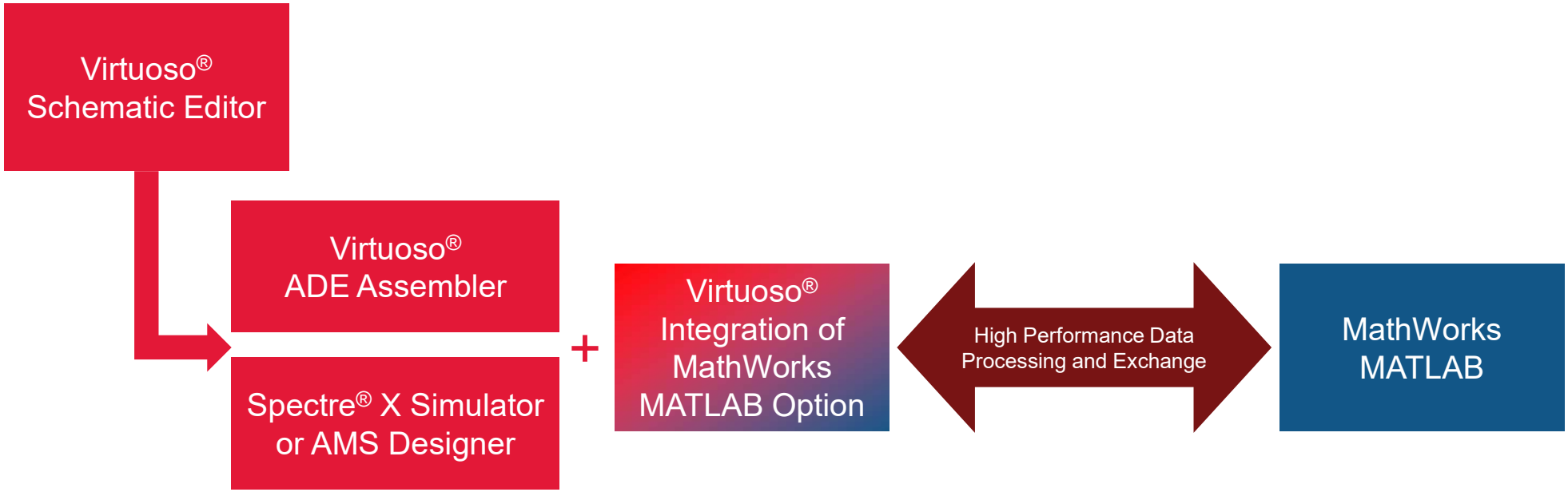
Co-simulation

- Debugging
- Validation of behavioral models



Overview of the Integration

Using MathWorks MATLAB for large data-processing



Standard design input methods including the creation of design tests inside Virtuoso ADE Assembler/Verifier. These tests can include MATLAB expressions or make calls to MATLAB scripts for post-processing. The expressions and tests are simulated by Spectre X or AMS Design simulators.

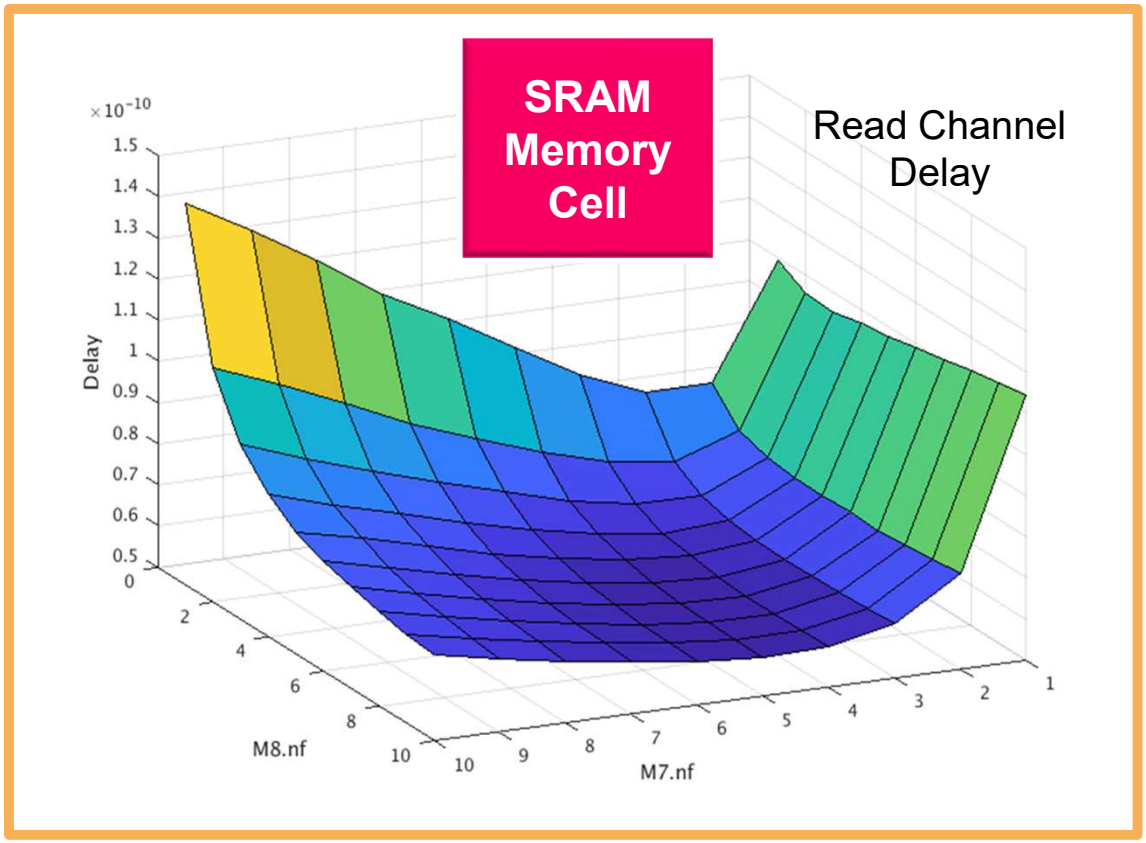
MATLAB can read and produce the same simulation database as ADE and ViVA. MATLAB can be launched in a real time mode from within ADE for on the fly data-processing.

Quickly Determine Trade-offs Even When Using Gigabytes of Data

MATLAB / Virtuoso ADE Product Suite integration

Q: What is the impact on the read channel delay if I change the size of my transistors?

A: Simulate the design in Virtuoso® ADE and visualize the trade-off results in MathWork's MATLAB



Mixed Signal Analyzer Demo

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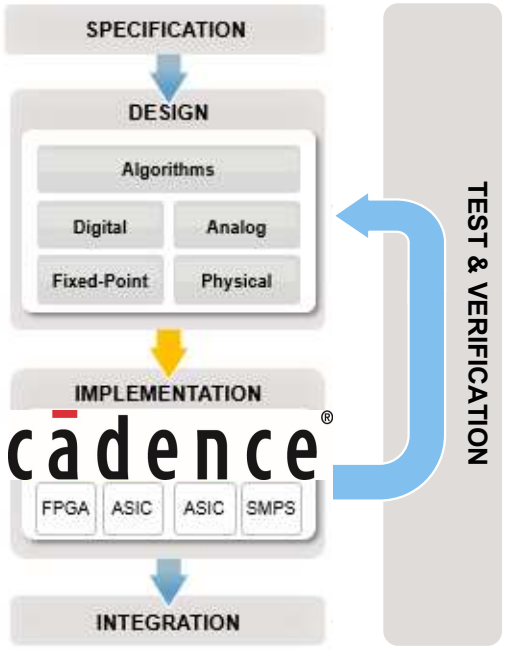
Cadence-MATLAB Integration Workflow

Cadence MATLAB/Simulink Integration Workflows

Data Post Processing

- Analyze trends in data
- Compare simulations
- Report & Document



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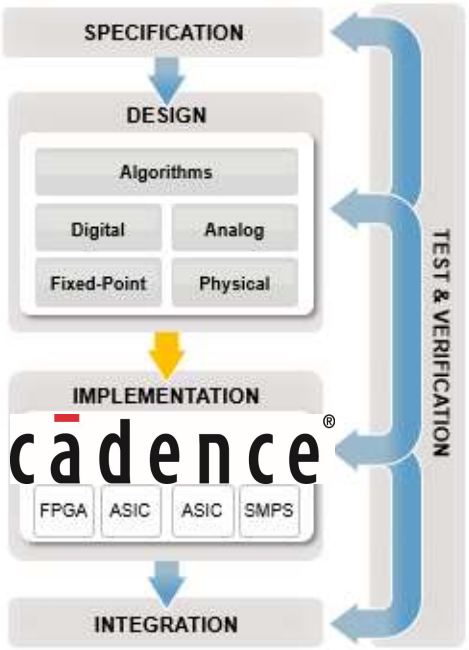

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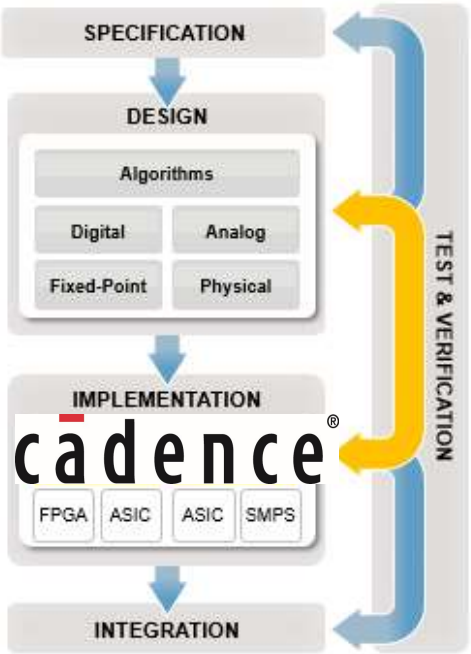
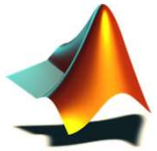


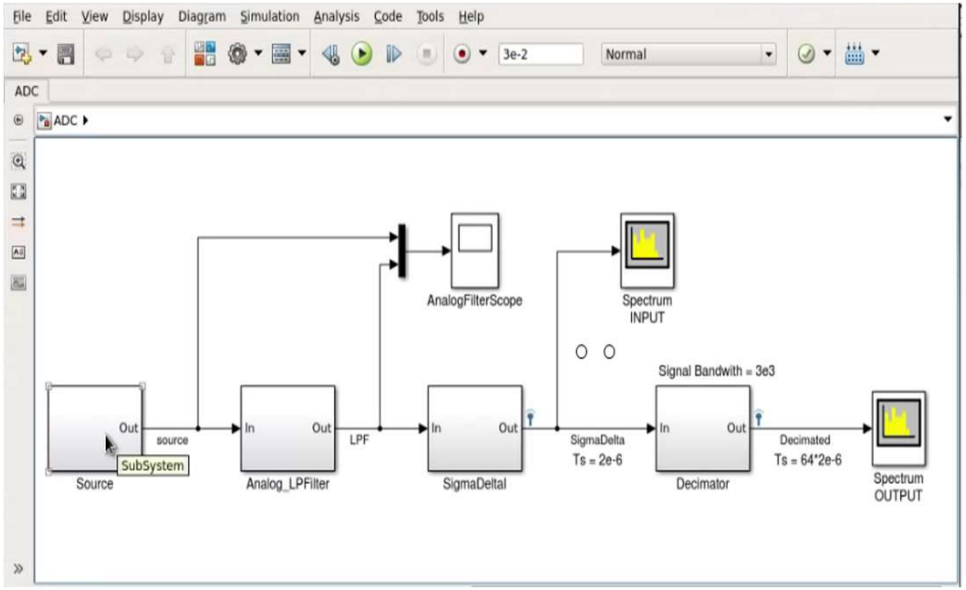
SystemVerilog Model Export from Simulink/MATLAB (1)

- What is the benefit of this workflow?



MATLAB/Simulink

cadence®



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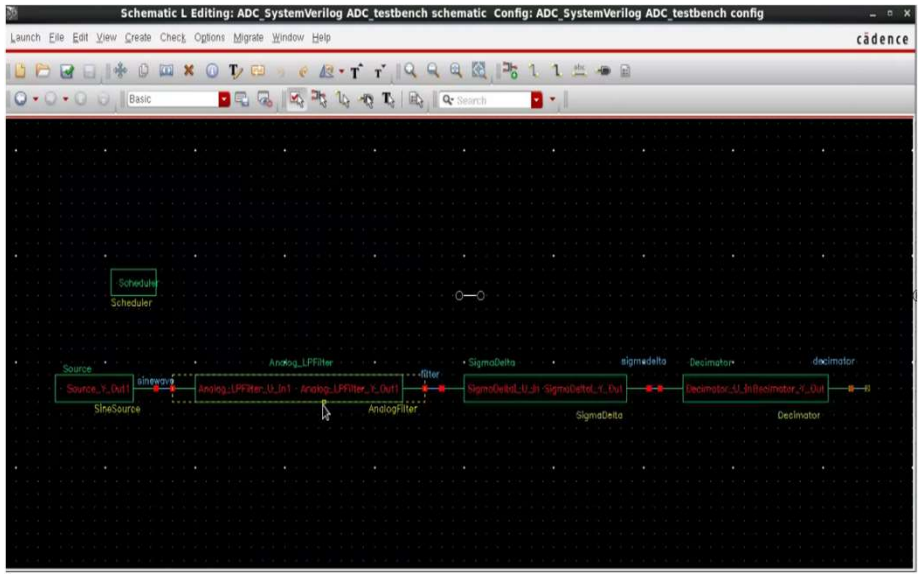
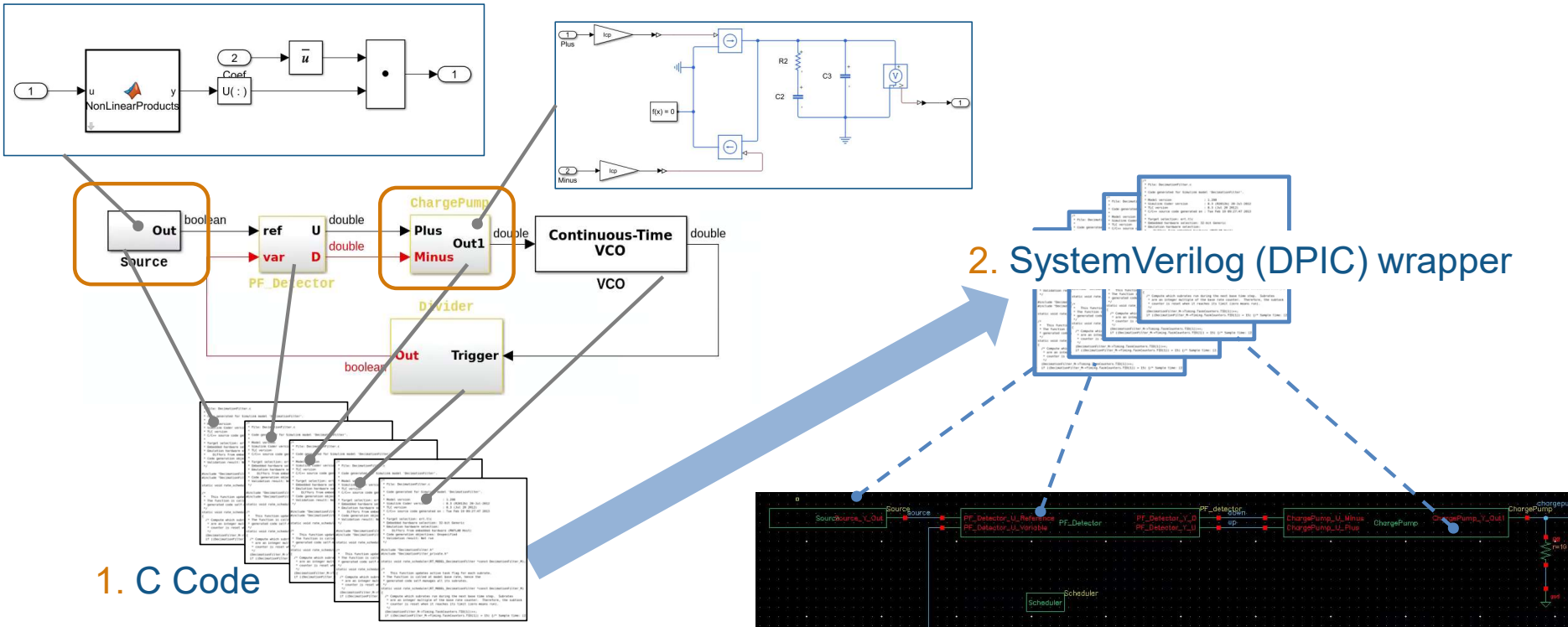


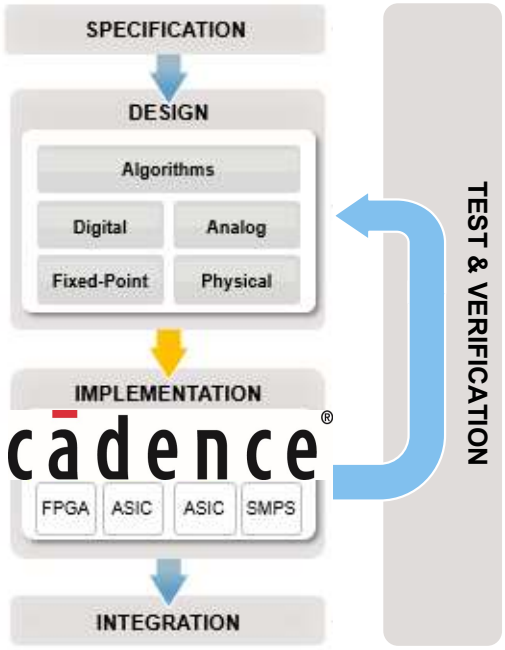
SystemVerilog Model Export from Simulink/MATLAB (2)



Cadence MATLAB/Simulink Integration Workflows

Data Post Processing

- Analyze trends in data
- Compare simulations
- Report & Document



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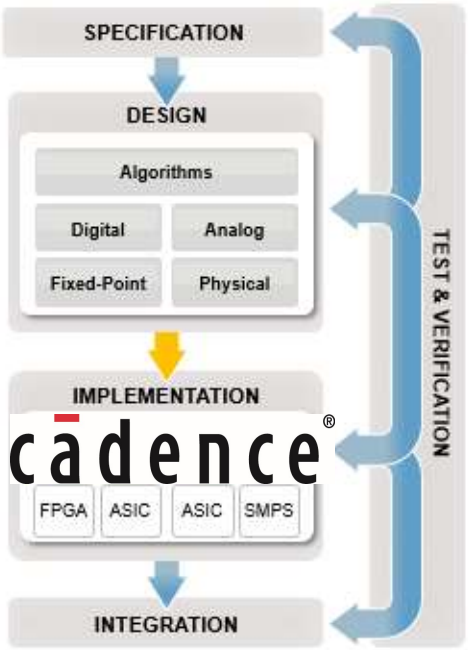

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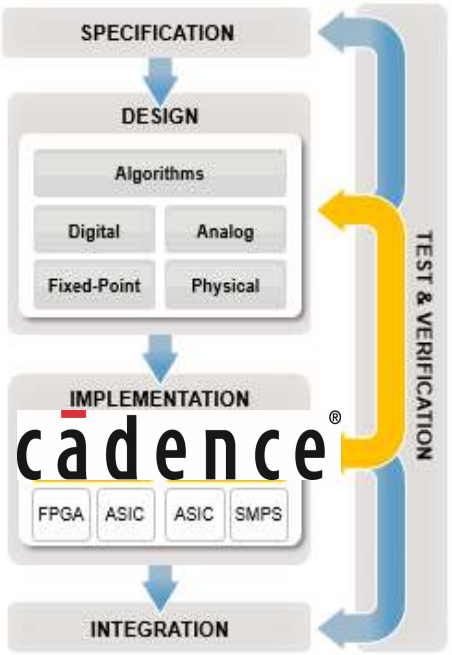
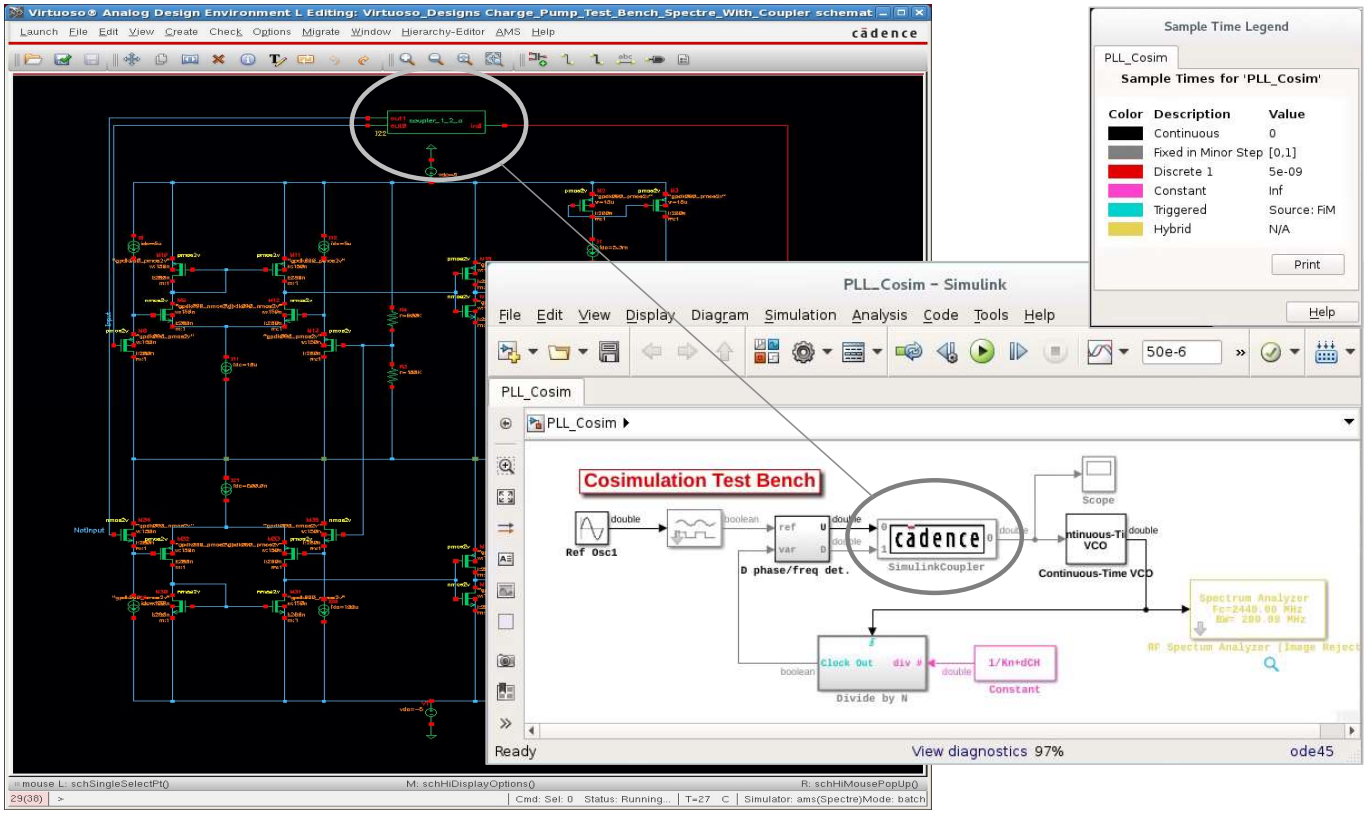
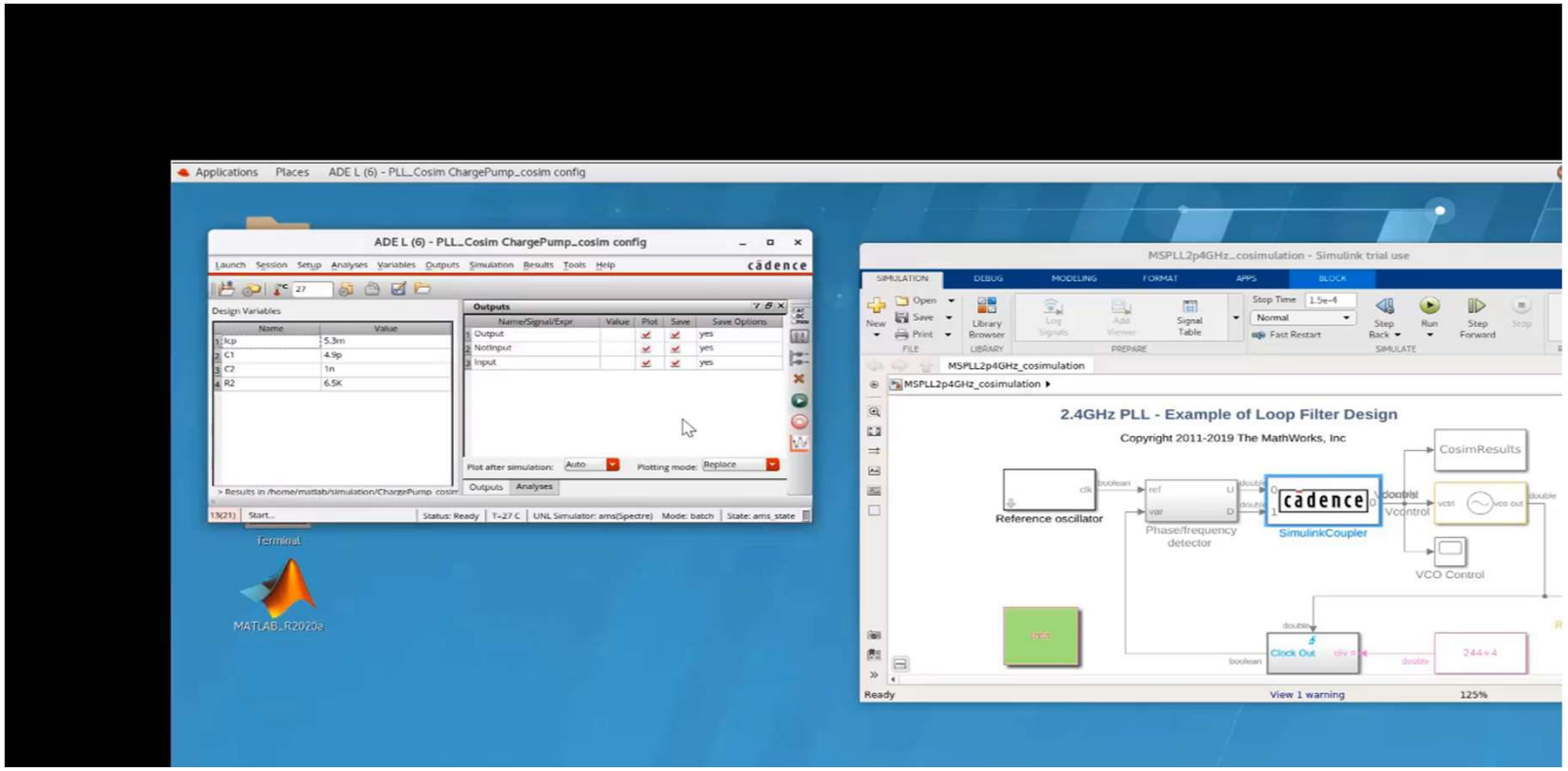


Verification of Circuit Design: Analog Co-simulation

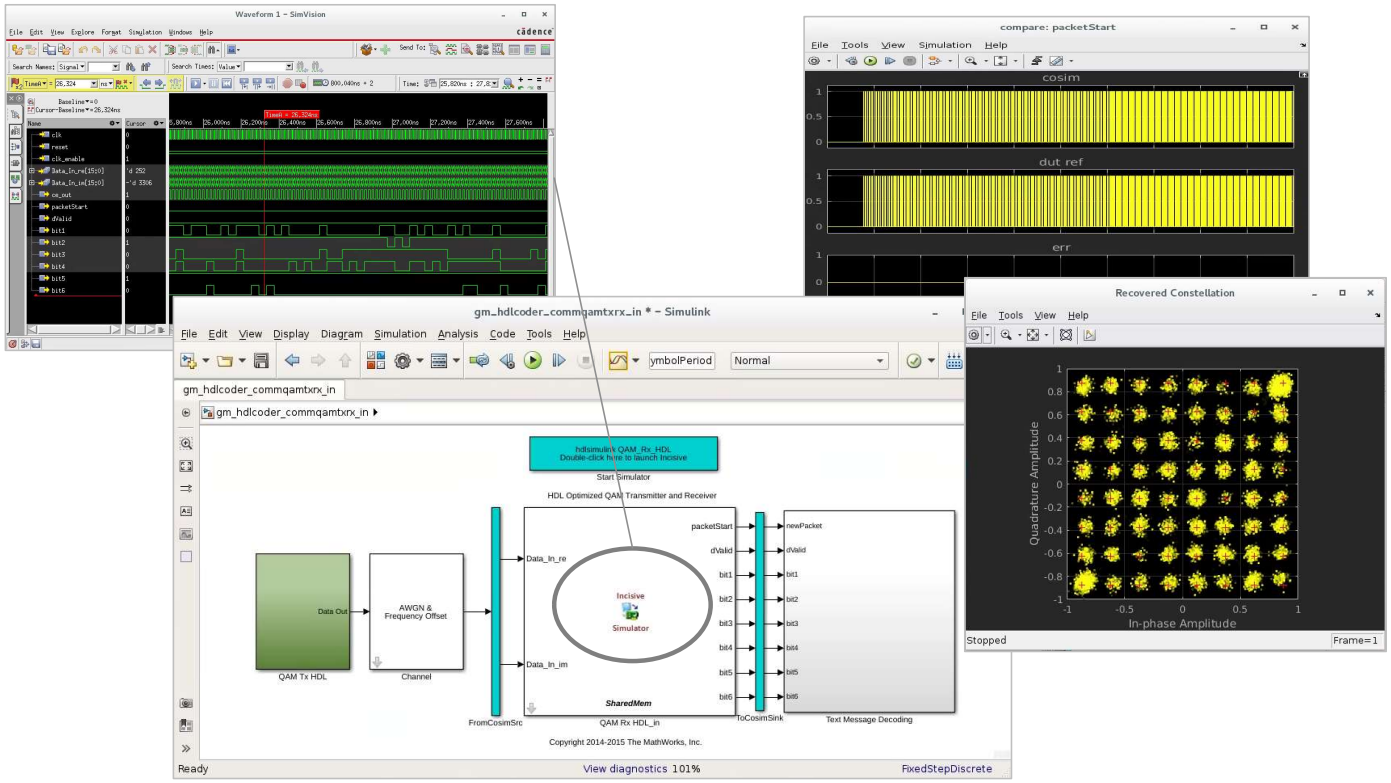


Verification of Circuit Design: Analog Co-simulation (2)



Verification of Circuit Design: Digital Co-simulation

- Verify the HDL implementation against the executable specifications



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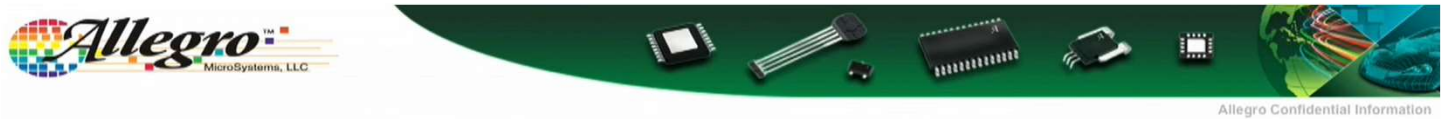
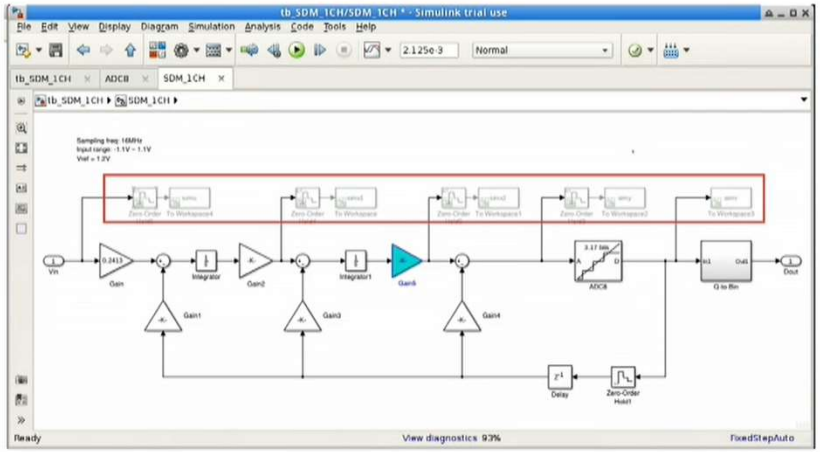
Mixed-Signal Model-Based Design Flow for Automotive Sensors



Simulink Analog Models using DPI-C: Continuous Time Sigma Delta ADC



- Make sure and "comment out" any elements in the subsystem that you do not want in the generated code.
  - Those elements are shown inside the red box.

For 15 years, Cadence's Virtuoso and MATLAB from MathWorks have been our tools of choice for automotive ASIC sensor development. Now that the MATLAB and Virtuoso platforms are inherently compatible, we can easily move between environments and utilize the powerful capabilities of each solution. With ever-increasing product complexity and aggressive schedules, the integration enables thorough verification in the analog domain so that we can meet our time-sensitive deadlines.

– Jamie Haas, Director of Design Engineering, Allegro Microsystems

Mixed-Signal Model-Based Design Flow for Automotive Sensors

Summary

- Cadence and MathWorks integrated workflows for design, visualization and verification of mixed-signal systems.
  - MATLAB + Cadence for data post-processing w/ mixed-signal analyzer app
  - SystemVerilog model export from MATLAB/Simulink into Cadence
  - Analog/Digital co-simulation with Simulink + Cadence

How to get started

- Useful resources
  - MATLAB & Simulink for Mixed-Signal Systems
  - Cadence Virtuoso ADE - MATLAB Integration Option
  - Mixed-Signal Blockset
  - Mixed-Signal Analyzer app
  - SystemVerilog Model Export for AMS Verification
  - Co-simulation with Cadence and Simulink

- Hands-on Analog Mixed-Signal Workshop
  - Delivered via AWS cloud (at no cost)

- Virtuoso ADE + MATLAB Integration Rapid Adoption Kit available from Cadence

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Thank you