Model-Based Design with MATLAB®, Simulink®, and Altera DSP Builder

MathWorks and Altera Partnership

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Agenda

- A Model-Based Design Methodology
  - What is Model-Based Design?
- From MATLAB and Simulink to Altera FPGA
  - Step by step design and implementation of an edge detection algorithm on FPGA
- Future of Model-Based Design and next steps

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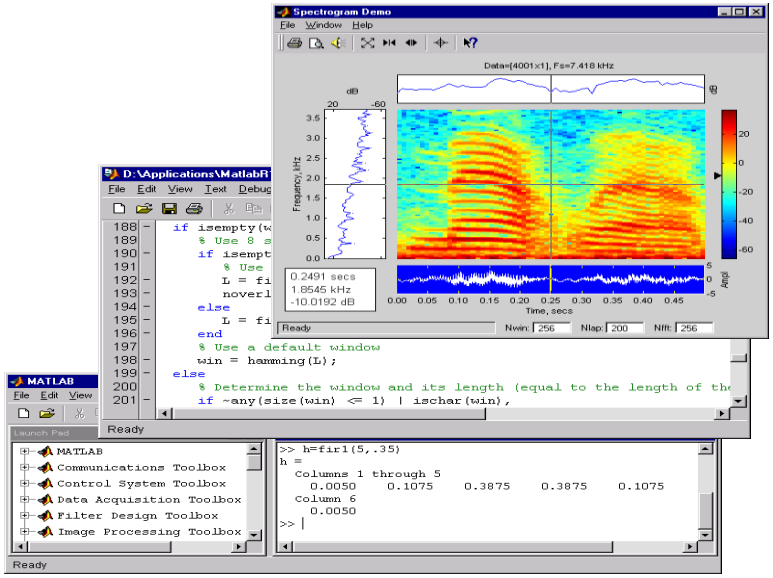
The MathWorks Mission

Accelerating the Pace of Engineering and Science

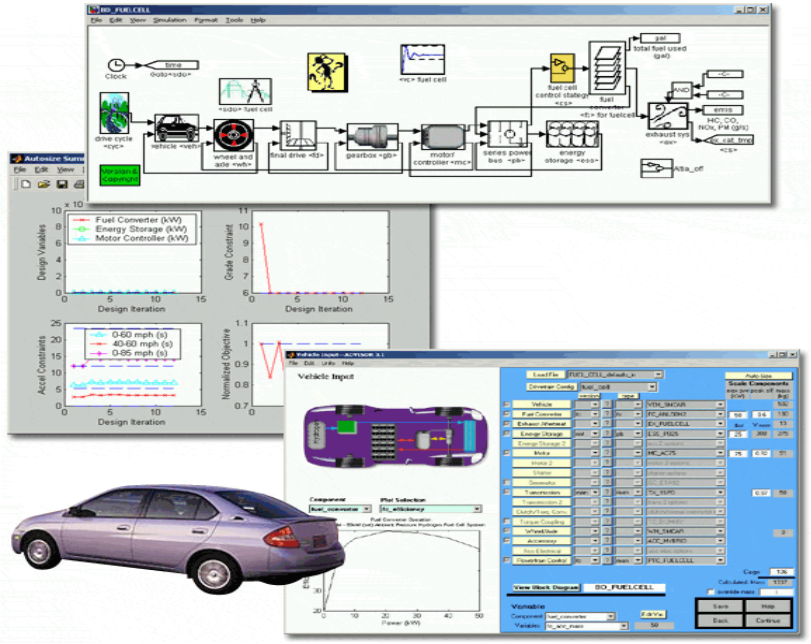
MATLAB®

The leading environment for technical computing



SIMULINK®

The leading environment for modeling, simulating, and implementing dynamic and embedded systems



The MathWorks

NASA Lands Mars Rover Missions Relying on MathWorks Software

Nissan Cuts Evaporation Emissions by 100% and Development Time By 50%

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Session Goal:

Partner to Overcome Today's Main Design Challenges

- Inconsistent and unintegrated design flows
- As designs get more complex, implementation becomes almost impossible
- Model-Based Design approach
  - One integrated environment to simulate, implement, test, and verify complex systems
  - Path to implementation on FPGA and DSPs

Deliver better products in less time

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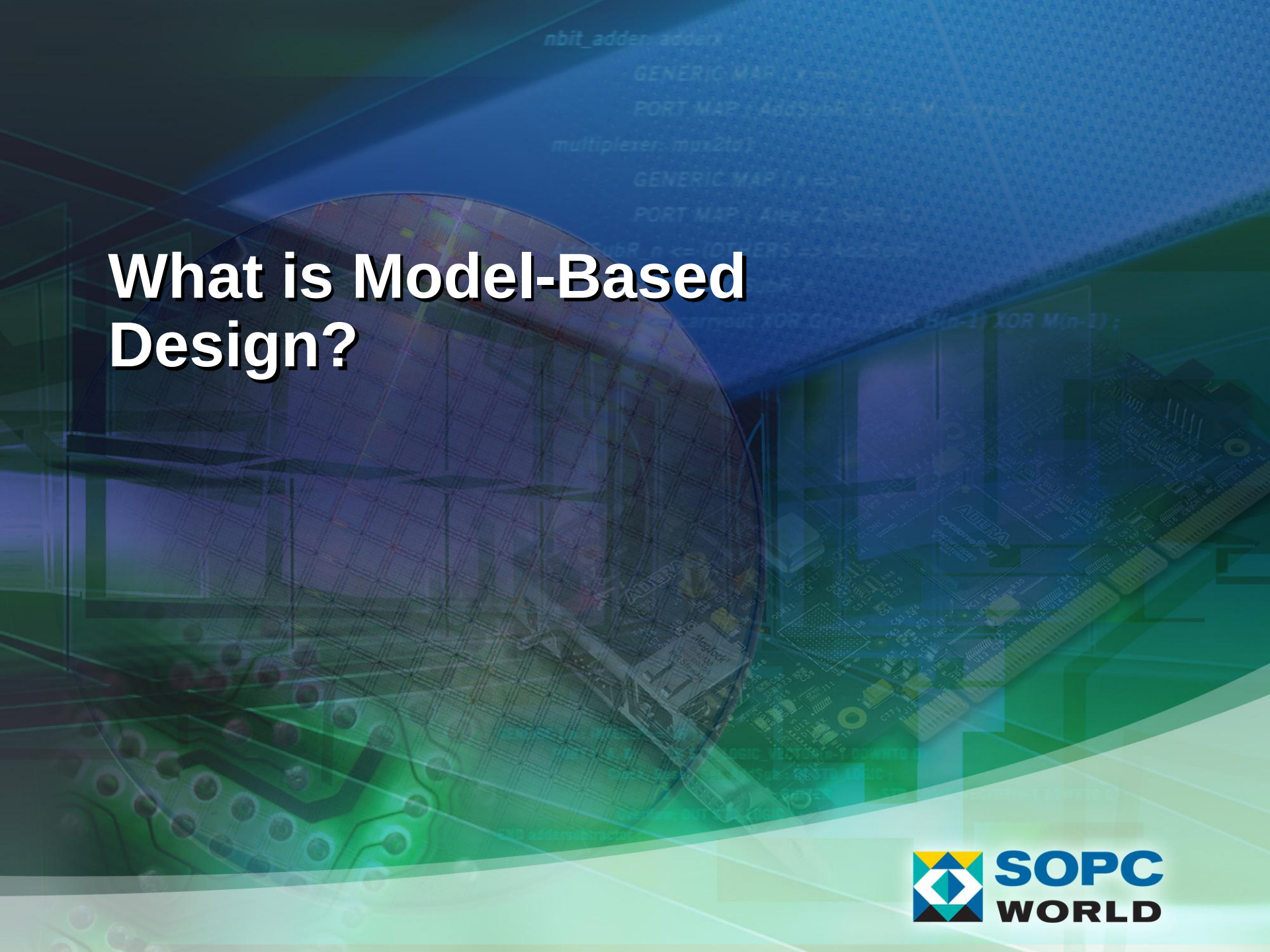
What is Model-Based Design?



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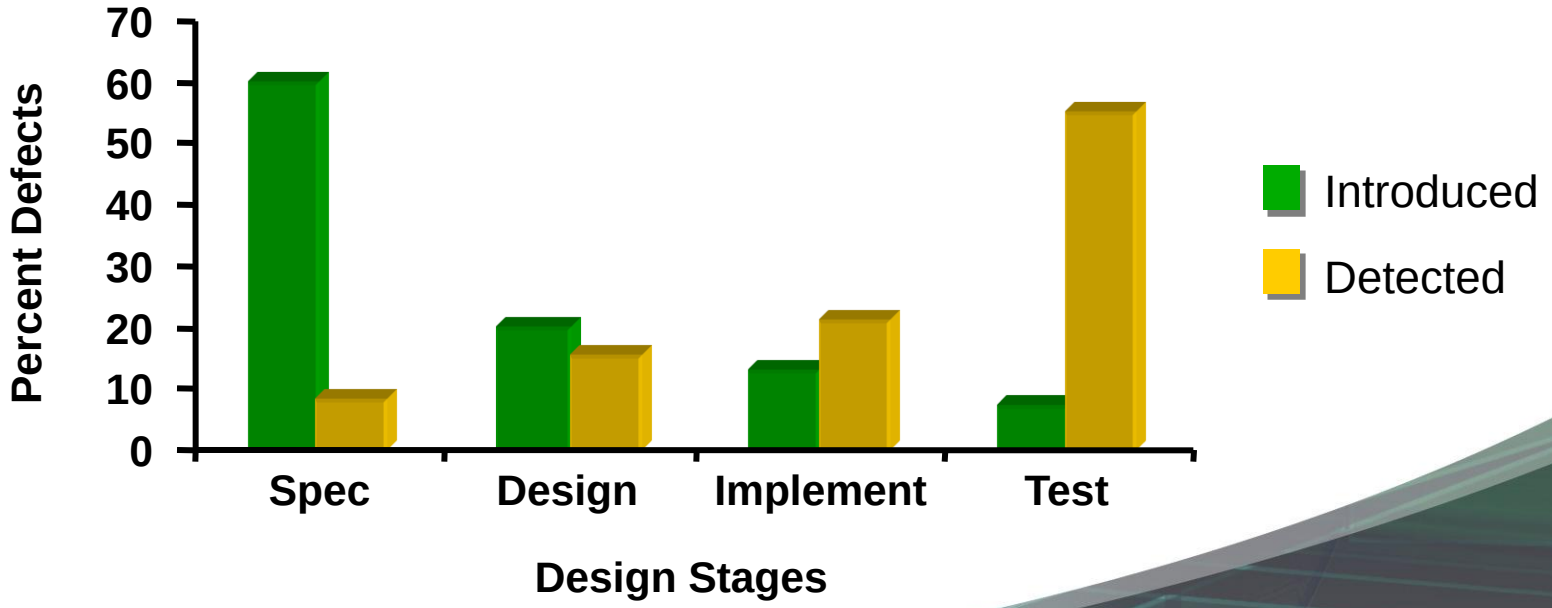
Design Failure and Time-to-Market in Embedded Systems

- Across industries:
  - 50% of projects behind schedule
  - 1/3 fail to meet 50% of performance/feature requirements



Source: Embedded Market Forecasters

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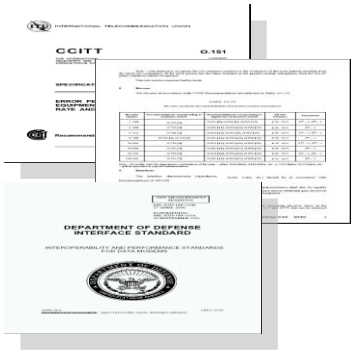
Traditional Development

Requirements and Specifications



Design

Implementation

Test and Verification

Text-based
- Prevents rapid iteration

Simulation prototypes
- Incomplete and expensive

Manual coding
- Introduces human errors

Traditional testing
- Errors found too late

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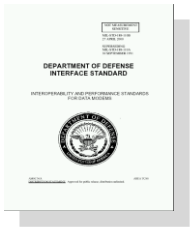
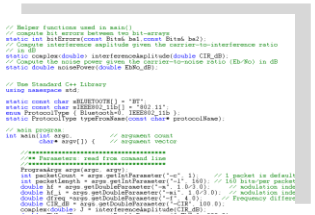
Advantages of Model-Based Design

Requirements and Specifications



Design

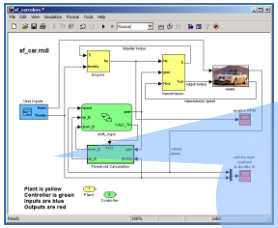


Implementation

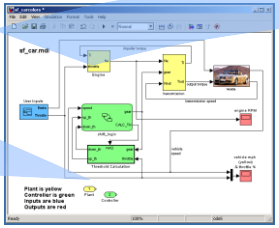
Test and Verification

Model Elaboration

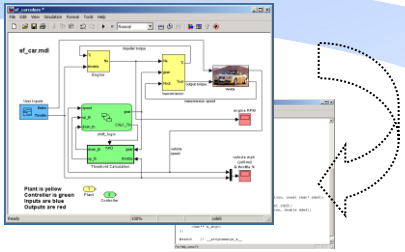
Continuous Verification



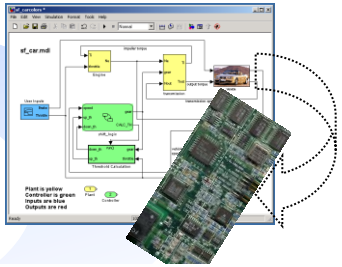
Executable Models



Simulation



Automatic Code Generation

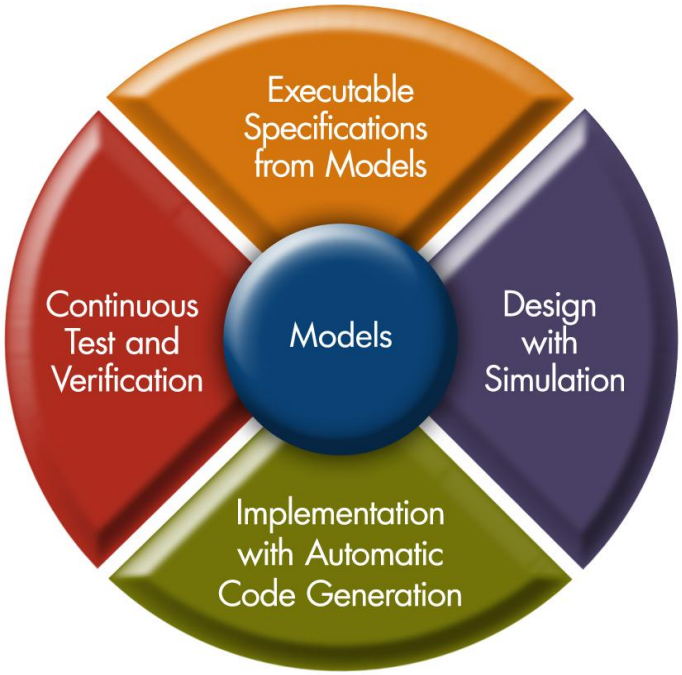


Test and Design

Model-Based Design with MATLAB and Simulink

Validate Behavior by Model Execution

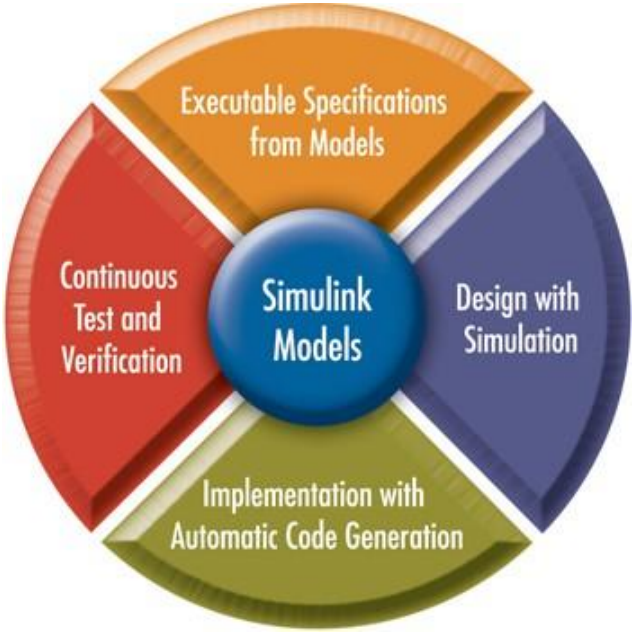
System-Level Verification by Reuse of the Model's Test Environment



Model Elaboration: Fixed-Point and RF/Analog Effects

Faster Implementation and Fewer Coding Errors

Model-Based Design with MATLAB and Simulink



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Model-Based Design With MATLAB, Simulink, and Altera DSP Builder

-Step by Step design and implementation of an edge detection algorithm

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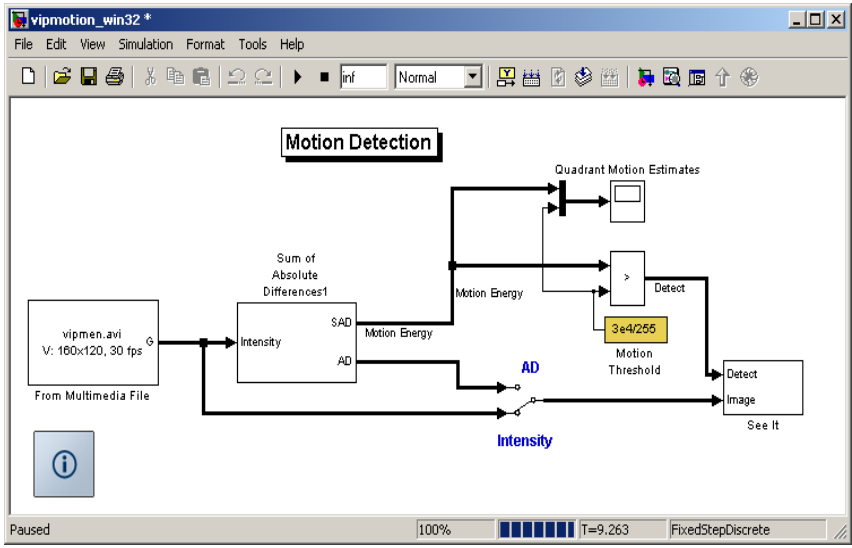
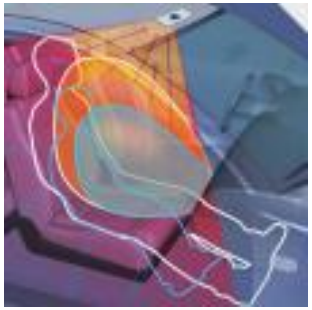
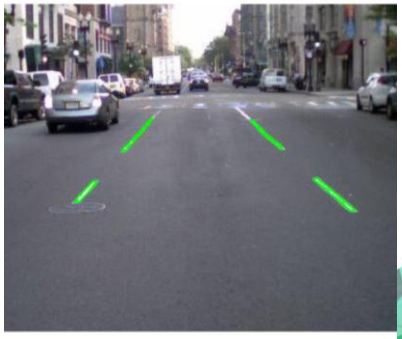
What is Simulink?

- Simulation, modeling, and design tool
- Block diagram environment
- Platform for Model-Based Design







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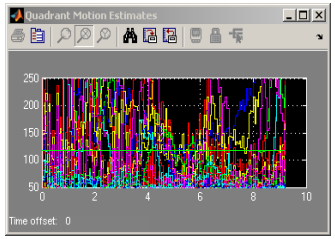
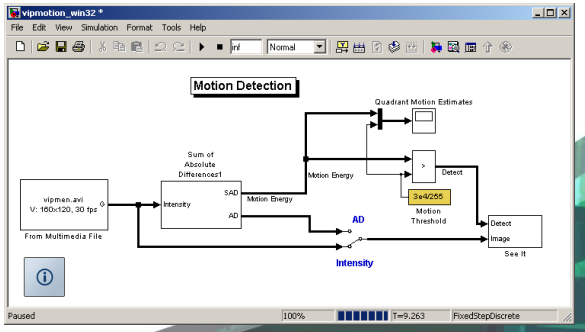
Simulink Key Features

- Hierarchical, component-based modeling
- MATLAB® integration
- Extensive library of predefined blocks
- Application-specific libraries available
- Open Application Program Interface (API)





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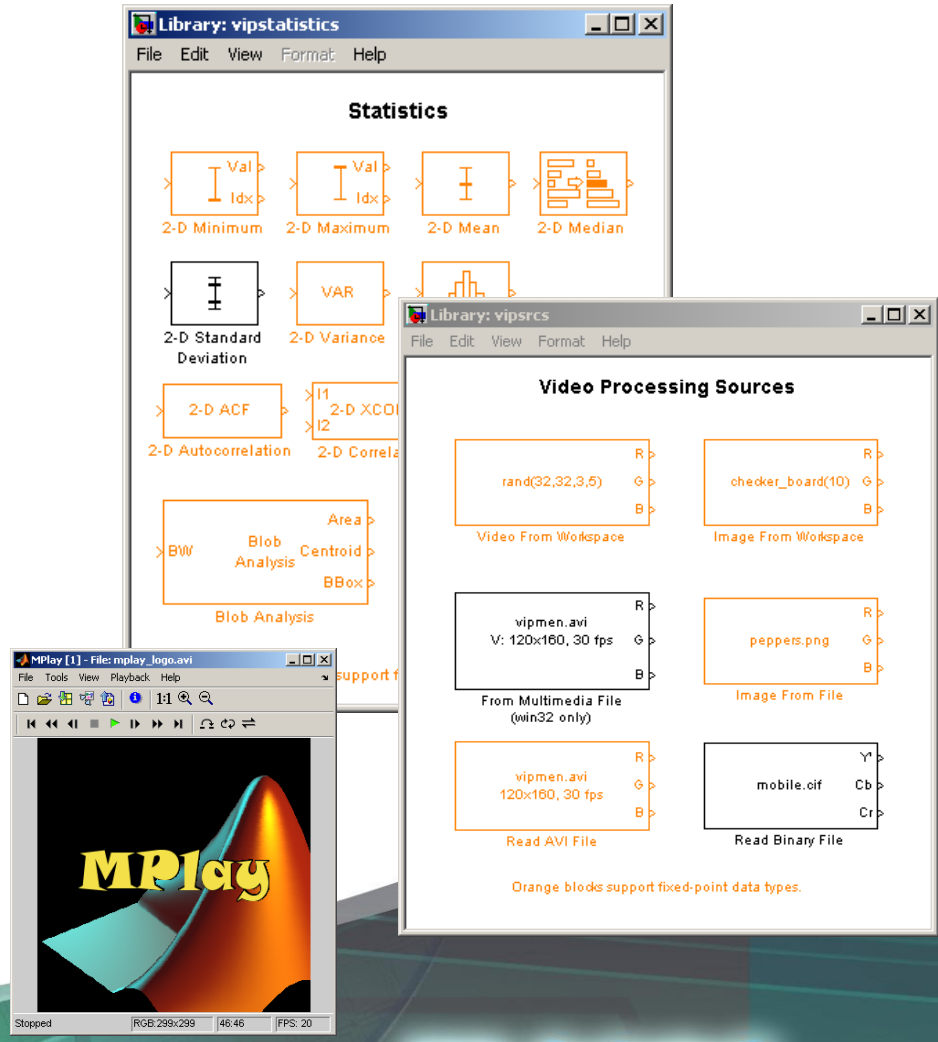
Simulink Libraries and Blocksets

Example: Video and Image Processing Blockset

- Analysis and enhancement
- Conversions
- Filtering
- Geometric transforms
- Morphological operations
- Sinks
- Sources
- Statistics
- Text and graphics
- Transforms
- Utilities



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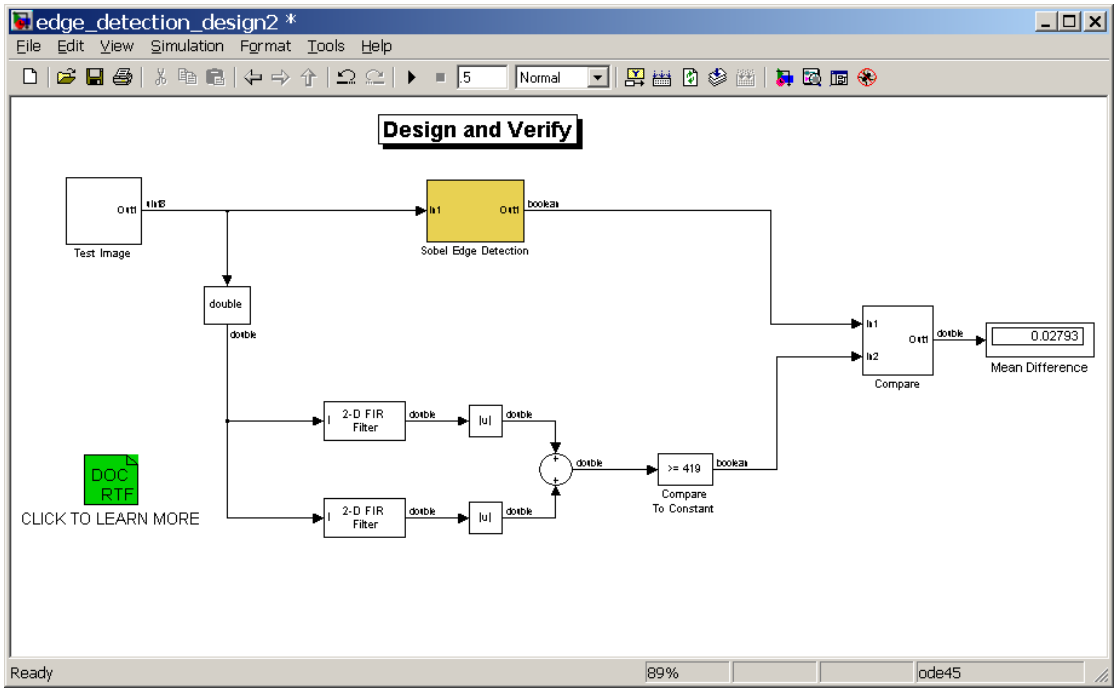
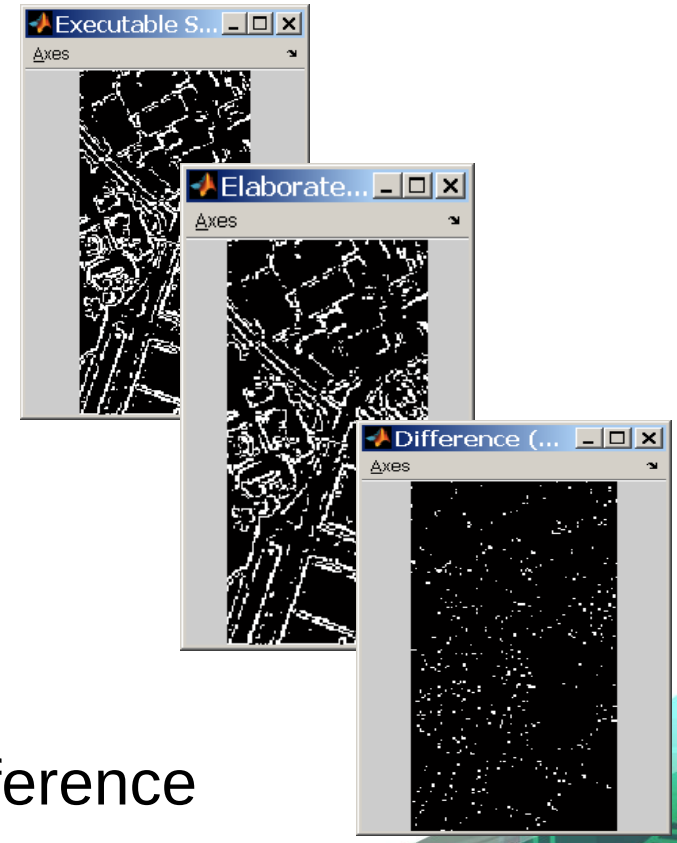
Modeling and Simulation w/Simulink





- Executable Specification / Golden Reference
- Design and Verify
- Fixed-Point Design and Verification
- Elaborate and Verify

Live Demo

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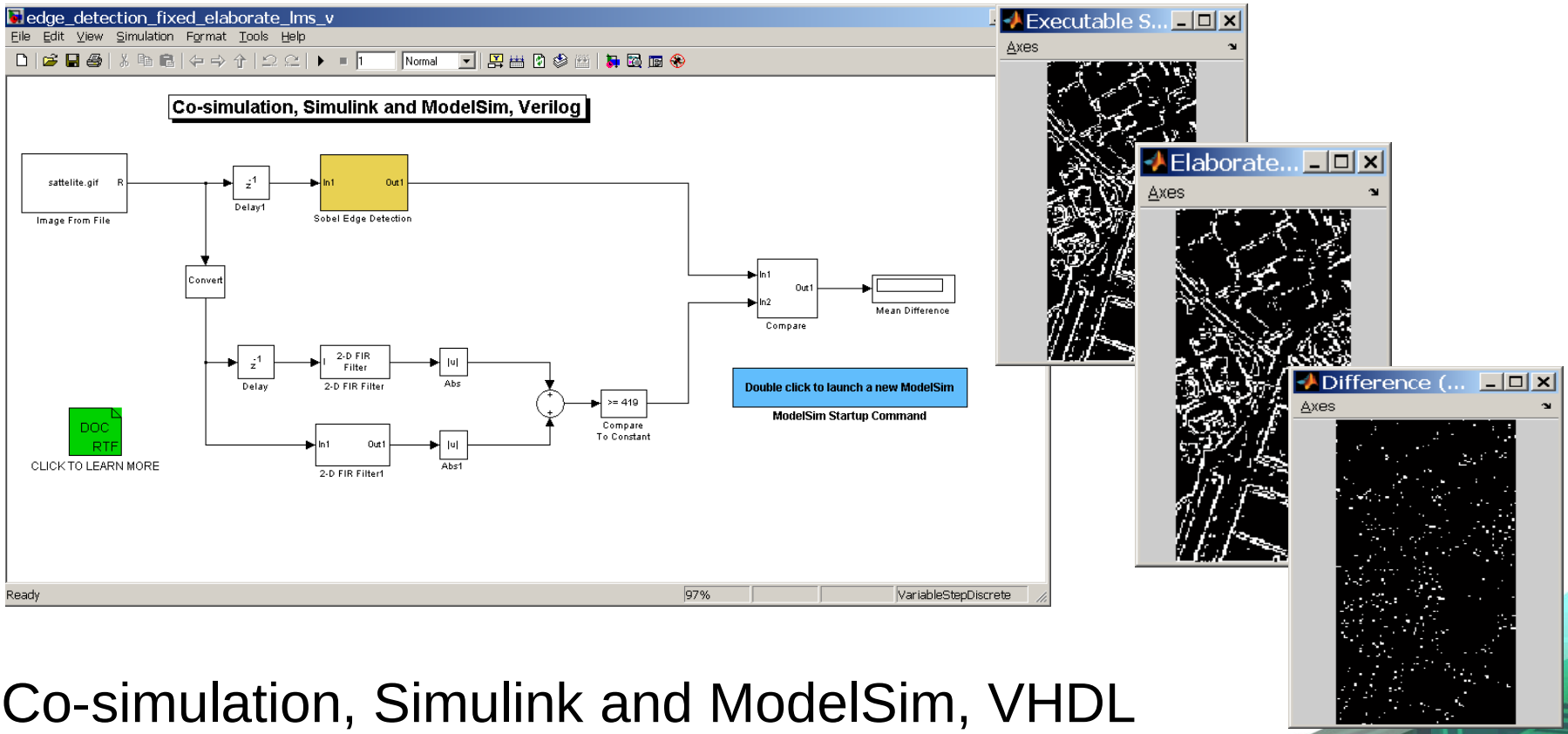
Co-Simulation (HDL code written manually)



- Co-simulation, Simulink and ModelSim, VHDL
- Co-simulation, Simulink and ModelSim, Verilog

Live Demo

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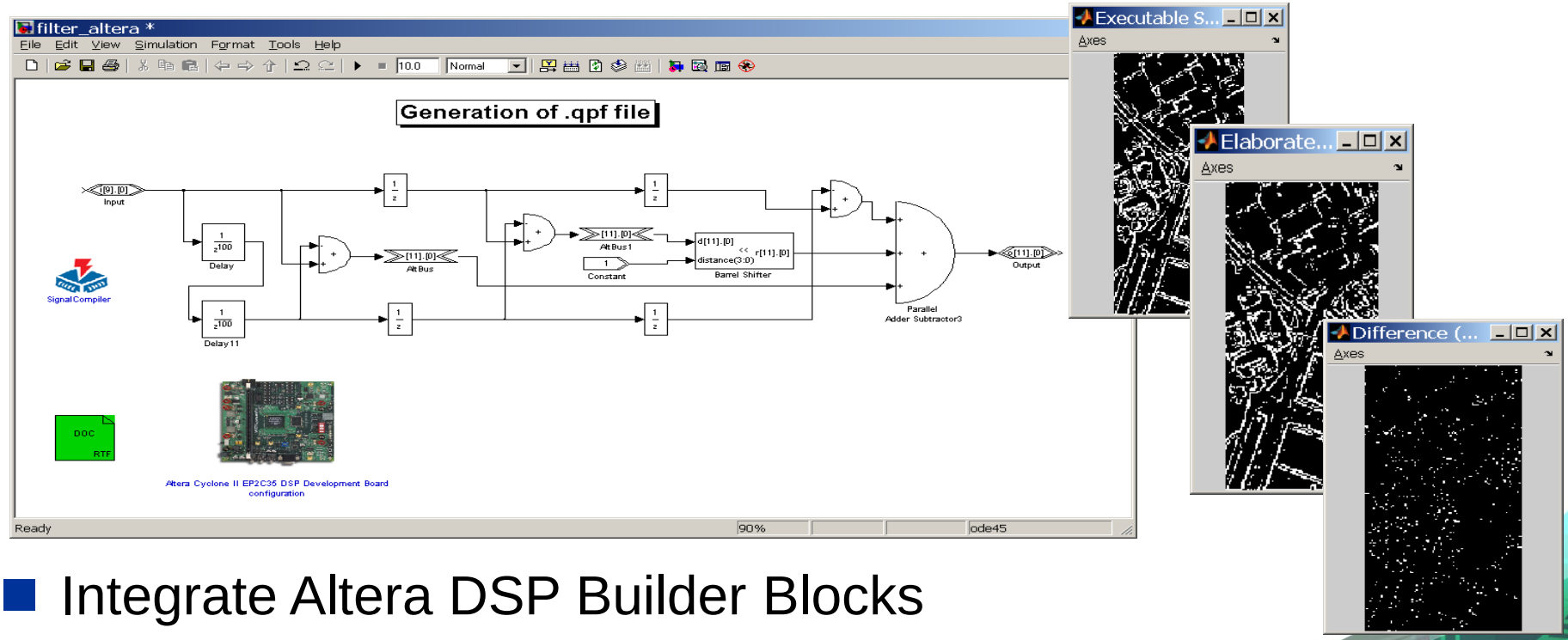
Automatic Code Generation and Continues Verification



- Integrate Altera DSP Builder Blocks
- Automatically generating HDL code
- Elaborate and Verify with Altera DSP Builder
- Implement on FPGA

Live Demo

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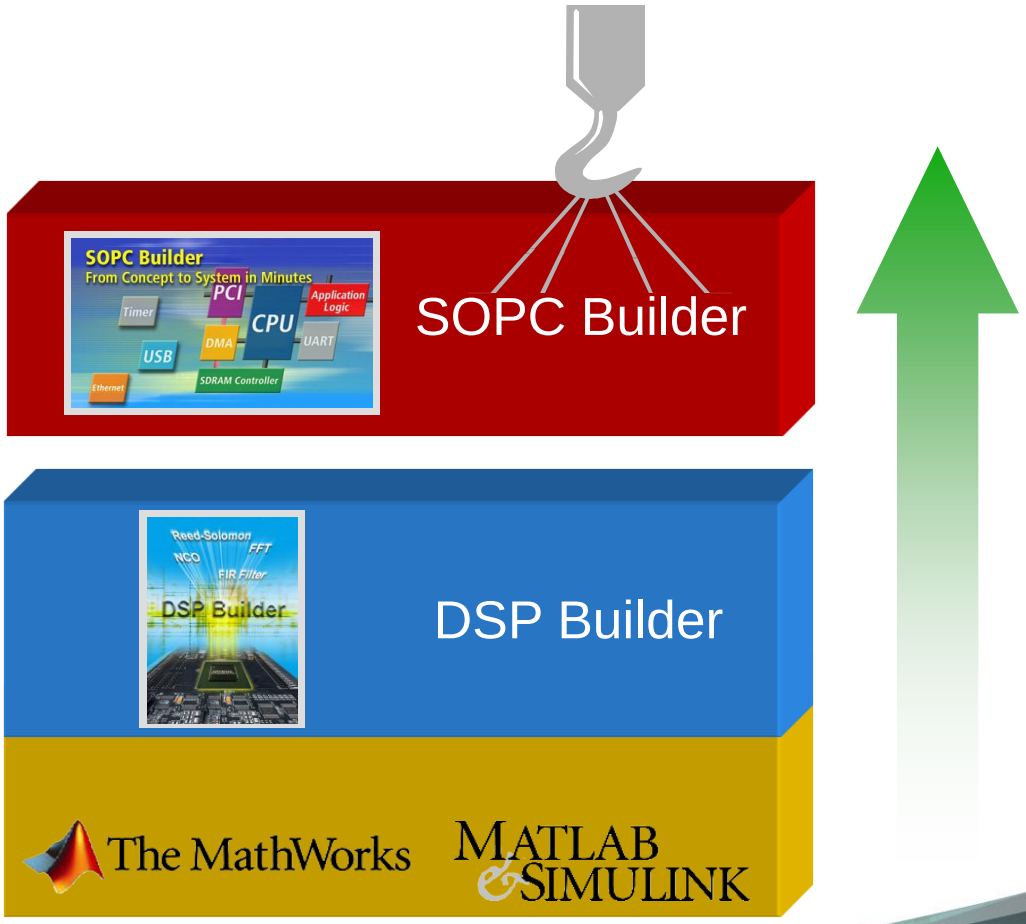
Model-Based Design Flow from Simulink to Altera FPGAs



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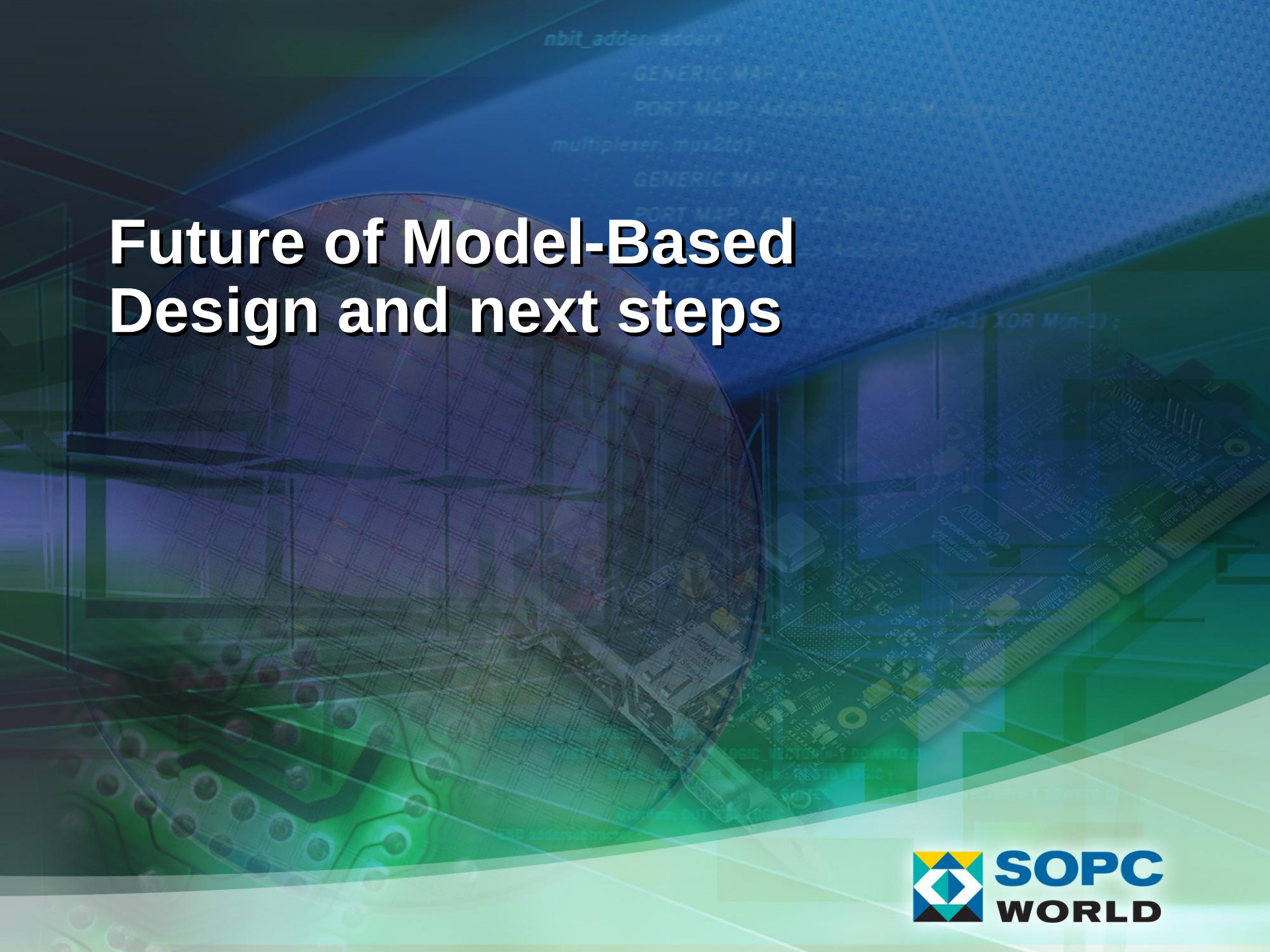
Future of Model-Based Design and next steps



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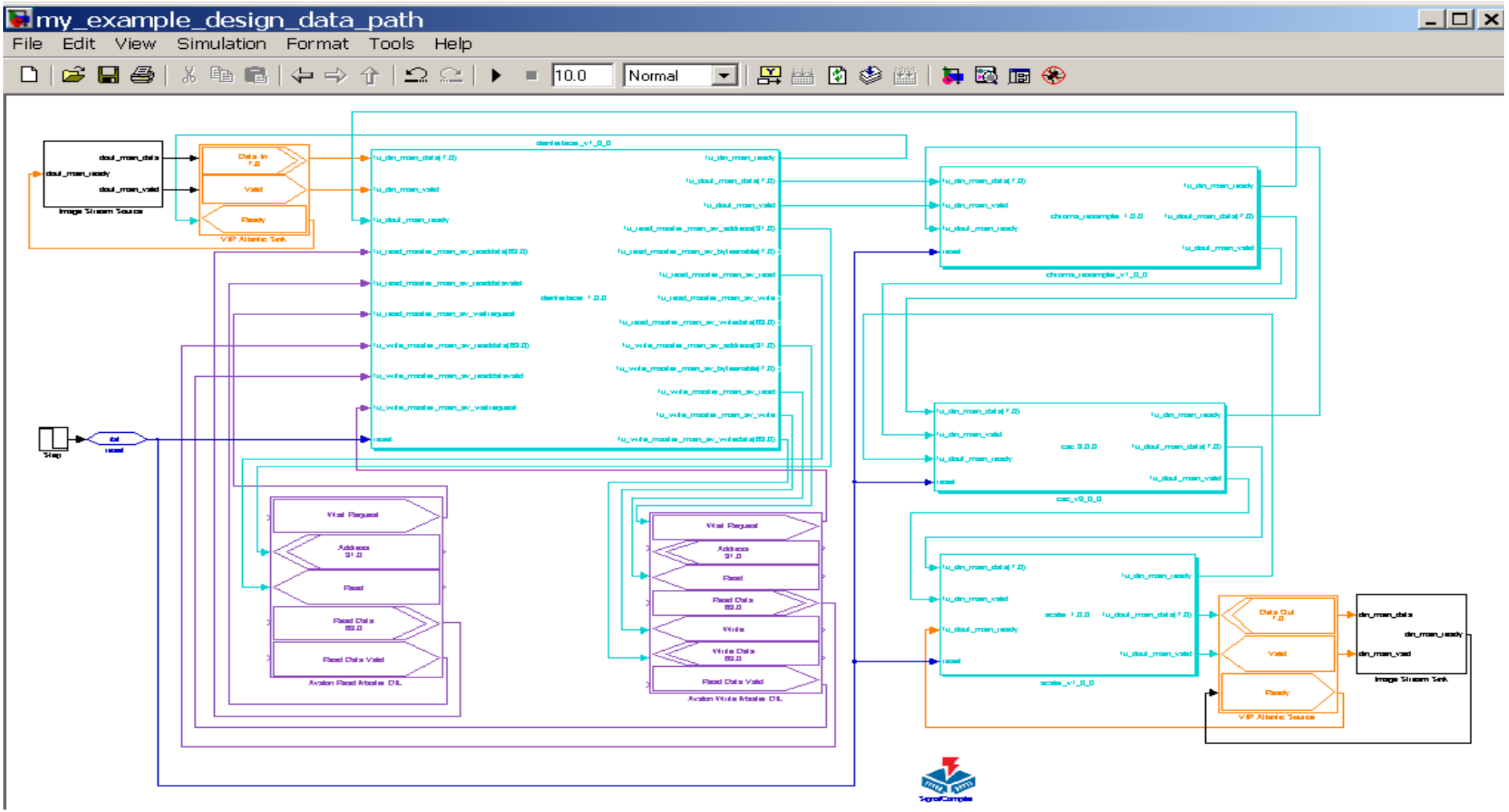
MathWorks and Altera Partnership Roadmap

- Continuing to provide rich set of IPs
  - Signal Processing
  - Video designs
  - Communications
- Seamless integration from Simulink blocks to Altera FPGAs

Latest Designs from Altera: Up Conversion and Wireless IPs



In Summary

- Integrated environment to simulate, implement, test, and verify complex systems
- Automatic code generation for FPGA and DSPs
- MATLAB and Simulink for model-based design
  - Altera DSP builder for FPGA implementation
  - MathWorks provides similar design flow for embedded software implementation

Deliver Better Products in Less Time !

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Next Steps

1. Attend DSP Builder sessions this afternoon

2. Visit the MathWorks booth and talk to our engineers
   - Check out designs and demos
   - Ask for a trial, or schedule a meeting for your company

Thank You!

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