Introducing Simulink R2012b for Signal Processing & Communications

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Simulink R2012b

the most significant upgrade to Simulink ever

Who does Simulink R2012b affect?
Every single Simulink user

Why?
Because Simulink R2012b features the new Simulink Editor, which makes it easier to develop, navigate, and use models.

In short …
Simulink R2012b simplifies modelling
Three Themes

Helping Simulink users

- **Understand** large models more quickly
- **Build** models more easily
- **Explore** model behaviour through simulation
Understand Models Quickly

Motivation:
- Large teams work on large models
- Models are shared across departments, organisations and supply chains
- Models aid communication as an executable specification

In R2012b
- New Simulink editor helps you quickly understand a large model
- Simulink Projects supports the model development process
Introducing the New Simulink Editor
Simulink Projects: Aims

- Create an environment that supports adopting best practices
  - Component-based modeling
  - Peer review workflow
  - Simplified configuration management
  - Integration with external data management tools

- Make it easy for everyone on the team to work in the same way
  - Standard way to access to company standard tools and libraries

- Improved consistency of results; efficient team-working
Team Collaboration with Simulink Projects

Integrate with Source Control

MATLAB API to help automate common, uncommon & repetitive tasks

Source Control

Place to build, store & share best-practice

Simulink Projects

Support for peer-review of changes

Understand structure of your design

Create & standardize team environment

R2012b

+ YourLib v1.3
+ Microsoft® Visual C++ 2010
+ ...

[Diagram of Simulink Projects]

[Image of MATLAB interface]
Build Models Easily

- **Motivation:**
  - Models capture expression of design
  - Maximise time spent on design, rather than construction

- **In R2012b**
  - New Simulink editor helps develop neat, professional models that communicate well
  - Additional aids are provided to guide the user during model construction
In Diagram Notifications

- Non modal
- Useful for short messages/alerts
- Often comes with an associated action
Stateflow Editor Assistance

Edit and arrange state diagram with guidance from editor.

- Move objects with their children using drag margins and arrange them using smart guides.
- Detect object placement conflicts with just-in-time error highlighting.
- Identify labels for transitions clearly using transition indicator lines.
R2012b Stateflow Enhancements

- **MATLAB as an Action Language**
  - Call MATLAB functions directly in state diagram, as alternative to C

- **State Transition Tables**
  - Build state machines quickly using tabular interface
Explore Model Behaviour Quickly

- **Motivation:**
  - Simulation reveals dynamic behaviour, and drives iterative design development
  - Provide easy access to simulation data that is used to make design decisions

- **In R2012b:**
  - New debugger for Simulink and Stateflow
  - Ability to step forward and backwards through simulation
Simulation Stepper

Ability to step simulation forward or backward

- Specify time breakpoints
- Specify conditional breakpoints on scalar signals
- Specify watchpoints using port value display
Simulink Data Inspector R2012b Features

- Simulink Data Inspector is on the toolbar
  - Dedicated record button:

- Integration with Next/Previous Step
Time Scope for Signal Processing Applications

- Integrated Simulation Control
- Configurable Display
- Interactive Markers
- Measures and Statistics
Highlights of the new Simulink Editor

- **Explorer bar** to navigate model hierarchy
- **Tabbed windows** to minimize window clutter
- **Reorganized menu** to fit workflow of Model-Based Design
- **Smart signal routing** that determines the optimal signal line path
- **Badges** to get signal and block information at a glance
- **Simulation stepper** with breakpoints to debug the simulation
- **Comment out** blocks to test variations of the model
Highlights of the new Stateflow Editor

- **Tighter integration** with Simulink (tabbed windows, Explorer bar)
- **Smart guides** to align states, junctions, functions for cleaner charts
- **Drag margins** to move containers and their contents
- **Transition indicator lines** to identify labels for transitions
- **Just-in-time error notifications** to highlight object placement conflicts
- **Debug buttons** located within main menu for easy access
- **Visual breakpoints** and data value displays during debug mode
Model-Based Design: From Concept to Production

- Model multi-domain systems
- Explore and optimize system behavior
- Collaborate across teams and continents

- Generate efficient code
- Explore and optimize implementation tradeoffs
- Model concurrent systems

- Automate testing
- Detect design errors
- Support certification and standards
Bringing more to MATLAB

- **System Simulation**
  - System Toolboxes provide an architecture for streaming algorithm simulation in MATLAB
  - Partitioning runtime algorithm code and initialisation code

- **Generation of C and HDL from MATLAB**
  - When MATLAB code is developed in a structured way, a workflow from MATLAB code to C or HDL is achievable

- For more information, see this afternoon’s Masterclass

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Signal Processing with MATLAB: System Simulation and Real-Time Implementation
Bringing more to Simulink

- Hardware platform support
Hardware Platform Support

- **USRP® from Ettus Research**
  - ‘Radio-in-the-loop’ design and modelling
  - Simulink blocks and MATLAB System Objects
  - R2012b examples provided (802.11 beacon receiver)

- **Run on Target Hardware**
  - Execute Simulink models on selected hardware in real-time
  - Range of low-cost platforms e.g. Beagleboard, Pandaboard

>> targetinstaller

MathWorks Website: Academia->Hardware for Project Based Learning
Hardware Platform Support

- Prototyping on FPGA Development boards with HDL Coder
  - Turnkey deployment to standard platforms
  - Direct implementation with interfaces direct from Simulink

- FPGA-in-the-Loop with HDL Verifier
  - Include HDL designs executing on an FPGA with a system simulation in Simulink, using ethernet
  - Handwritten or Generated HDL

- Out-of-box support for range of Xilinx and Altera platforms
- Now support for custom boards (FPGA Board Manager)
FPGA Turnkey Example: Audio Equaliser
FPGA Turnkey Example: Audio Equaliser

HDL Workflow Advisor - eq_fpga_db/Equaliser FPGA

5.2. Program Target Device

Analysis
Program target FPGA device

Result: Passed

Passed Program target FPGA device.

Synthesis Tool Log:
Release 13.2 - iMPACT 0.61xd (nt)
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Preference Table
Name    Setting
StartupClock  Auto_Correction
AutoSignature  False
KeepSDF  False
ConcurrentMode  False
UseHighz  False
ConfigOnFailure  Stop
UserLevel  Novice
MessageLevel  Detailed
svfUseTime  false
SpiByteSwap  Auto_Correction
AutoInfer  false
SvfPlayDisplayComments  false
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Next steps

- Try out Simulink R2012b for yourself
  - R2012b is available and shipping today
  - Visit the EXPO demo booths to explore more during the breaks

- If you are interested in specific capabilities
  - Ask MathWorks staff here today
  - Make a note on your feedback form
Questions?