Introducing Simulink Release 2012b for Control System Development

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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
Introducing the New Simulink Editor
Highlights of the new Simulink Editor

- **Explorer bar** to navigate model hierarchy
- **Tabbed windows** to minimize window clutter
- **Reorganised 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
Three Themes

Helping Simulink users

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

- Large teams work on large models
- Simulink Projects supports the development process
- Editor helps you understand a large model
Simulink Projects Overview

- Understand structure of your design
- Create & standardize team environment
- Integrate with Source Control
- Support for peer-review of changes
- Place to build, store & share best-practice
- MATLAB API to help automate common, uncommon & repetitive tasks

R2012b
- YourLib v1.3
- Microsoft® Visual C++ 2010
+ ...
Explorer Bar
Navigate model hierarchy
Tabbed Windows
Key sections of the model at your fingertips
Construct Models Quickly

- Automate construction where possible
- Provide immediate feedback
- Provide relevant advice
Smart Signal Routing
Determine the optimal signal path
New Stateflow Editor
Organize the logic
State Transition Tables
Simplified interface for state machine specification

<table>
<thead>
<tr>
<th>STATES</th>
<th>TRANSITIONS (Condition / Action / Destination)</th>
</tr>
</thead>
<tbody>
<tr>
<td>state1</td>
<td>en: t = 0; du: t = t + 1; [t &gt; 5] INPUT_EVT</td>
</tr>
<tr>
<td>state2</td>
<td>[t &gt; 10];</td>
</tr>
<tr>
<td>state3</td>
<td>[t == 0];</td>
</tr>
</tbody>
</table>

Block: untitled/State Transition Table

State Transition Table

State Flow (chart) untitled/State Transition Table

Node: state1
- en: t = 0;
- du: t = t + 1;
- [t > 5] INPUT_EVT

Node: state2
- du: t = t + 1;
- [t > 10];
- [t == 0];

Node: state3
- du: t = t - 1;
- [t == 0];

Node: INPUT_EVT
- du: t = t + 1;
MATLAB Action Language

Bring the usability of MATLAB into your Stateflow charts

- MATLAB code can now be used directly in states and transitions
- Variables automatically declared – just like in MATLAB
- Variable types and sizes on function inputs and outputs automatically inferred
In Diagram Notifications

- Non modal
- Useful for short messages/alerts
- Often comes with an associated action
Explore Model Behaviour Quickly

- The most valuable button in Simulink:
- Improve how you interact with a model

Hybrid Vehicle Modelling

- Standardised Vehicle Modelling Architecture deployed across JLR
  > Re Use Vehicle Sub Systems
  > Architecture supports offline and real-time applications
  > Run Scenarios, Adjust Parameters and Visualise Outputs
Simulation Stepper with Breakpoints
Understand the system, debug the design
Simulink Data Inspector in R2012b

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

- Integration with Next/Previous Step
A Difficult Demo?

- How stressful is it to do a hardware demo?

Heart rate monitor

- Arduino Mega 2560
- Indicator LEDs
- Interface board

Clearly a prototype!
We have seen…

- Host based simulation / debug of the monitoring algorithm
We have seen…

- Using Run on Target Hardware + External Mode to check behaviour on device
We have seen…

- Device running standalone
Model Based Design Overview

New in Simulink R2012b: Run on Target Hardware

Rapid prototyping: xPC for HIL Controller RP

Production Code Generation
Simulink Hardware Support for Project-Based Learning

Run Simulink models on low-cost target hardware

- [http://www.mathworks.com/academia/hardware-resources/](http://www.mathworks.com/academia/hardware-resources/)

- Supported target hardware
  - Arduino® Uno ($30), Mega 2560 ($65)
  - LEGO® MINDSTORMS® NXT ($280)
  - BeagleBoard ($150)
  - PandaBoard ($175)

- Available in Student Version
## Code Generation Approaches in R2012b

<table>
<thead>
<tr>
<th>Run on Target Hardware</th>
<th>Simulink Coder</th>
<th>Embedded Coder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code runs standalone</td>
<td>Code runs standalone</td>
<td>Code runs standalone</td>
</tr>
<tr>
<td>Interface to custom drivers / code</td>
<td>Interface to custom drivers / code</td>
<td>Interface to custom drivers / code</td>
</tr>
<tr>
<td>External Mode</td>
<td>External Mode</td>
<td>External Mode</td>
</tr>
<tr>
<td>No access to source code</td>
<td>Full source available</td>
<td>Full source available, optimised for readability and traceability</td>
</tr>
<tr>
<td>Fixed list of targets</td>
<td>Any target, including xPC turnkey systems</td>
<td>Any production target</td>
</tr>
<tr>
<td>No optimisation control</td>
<td>Basic control</td>
<td>Advanced control</td>
</tr>
<tr>
<td>No design feedback</td>
<td>Basic execution profiling</td>
<td>On-target profiling, SIL / PIL and code coverage</td>
</tr>
<tr>
<td>Early stage research</td>
<td>Rapid prototyping / HIL</td>
<td>Production code</td>
</tr>
</tbody>
</table>
Summary

- Simulink Release 2012b:
  - Help understand large models quickly
  - Make model construction easier
  - Help explore model behaviour through simulation
  - Run Simulink models directly on hardware
Next steps

- Try out Simulink R2012b for yourself
  - R2012b is available 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