The New Look and Feel of MATLAB and Simulink

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MathWorks Product Overview

**Fixed-Point Modeling**

**Event-Based Modeling**

**Physical Modeling**

**Rapid Prototyping and HIL Simulation**

**Verification, Validation, and Test**

**Simulation Graphics and Reporting**

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**Applications**

- Control Systems
- Signal Processing and Communications
- Image Processing and Computer Vision
- Test and Measurement
- Computational Finance
- Computational Biology

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**SIMULINK**
Simulation and Model-Based Design

**Parallel Computing**

**Code Generation**

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**MATLAB**
The Language of Technical Computing

**Math, Statistics, and Optimization**

**Application Deployment**

**Database Access and Reporting**
Core MathWorks Products

MATLAB®
The leading environment for technical computing

- The industry-standard, high-level programming language for algorithm development
- Numeric computation
- Parallel computing, with multicore and multiprocessor support
- Data analysis and visualization
- Toolboxes for signal and image processing, statistics, optimization, symbolic math, and other areas
- Tools for application development and deployment
- Foundation of MathWorks products
Technical Computing Workflow

Access
- Files
- Software
  - Code and Applications
- Hardware

Explore and Discover
- Data Analysis and Modeling
- Algorithm Development
- Application Development

Share
- Reporting and Documentation
- Outputs for Design
- Deployment

Automate

MATLAB, Excel, .NET, C/C++, Java, .dll
Core MathWorks Products

**Simulink**

The leading environment for system-level modeling, simulation, and verification

- Block-diagram environment
- Model, simulate, and analyze multi-domain systems
- Design, implement, and test:
  - Control systems
  - Signal processing systems
  - Communications systems
  - Other dynamic systems
- Platform for Model-Based Design
Model-Based Design: Benefits

- **Cost**
  - Minimize prototypes and rework
  - Facilitates design reuse

- **Schedule**
  - Shortens time-to-market
  - Enhances team communication

- **Performance**
  - Fosters innovation
  - Improves quality
Release 2012b Highlights

MATLAB
Introducing the new MATLAB Desktop: making it easier to find what you need.

Simulink
Introducing the new Simulink Editor: making it easier to build, manage, navigate and simulate your models.
MATLAB
Introducing the New MATLAB Desktop
What’s New in MATLAB?

- MATLAB Toolstrip
- MATLAB apps
- Import Tool
- Command line suggestions
- Help System
MATLAB Toolstrip
Find what you need

- Tabs organize commonly used functionality
  - Key features placed up front
  - Design optimized for common tasks

- Functionality only appears when needed
Quick Access Toolbar

- Place to put commonly used commands

- Any item from a tab or shortcuts can be added to the toolbar

- Remains visible when the toolstrip is minimized
Action Menus

- Contain docking commands and relevant actions for the window
- Undock windows by using the action menu or by dragging the window out
What’s New in MATLAB?

- MATLAB Toolstrip
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- Help System
What are MATLAB Apps?

- Interactive MATLAB programs that include a GUI
- Apps are included in many MATLAB products
- There are also many user-written apps
MATLAB Apps Gallery

- Tab within the MATLAB Toolstrip
- Prominently displays both user-written apps and apps included in MATLAB products
- Makes it easy to find and launch MATLAB apps
Packaging and Sharing MATLAB Apps

- Automatically includes all necessary files
- Documents required products
- Creates single installation file for easy distribution and installation into the MATLAB apps gallery
### Getting More Apps

#### Math, Statistics, and Optimization Apps

<table>
<thead>
<tr>
<th>APP</th>
<th>AVAILABLE IN</th>
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</thead>
<tbody>
<tr>
<td>Curve Fitting</td>
<td>Curve Fitting Toolbox</td>
</tr>
<tr>
<td>Distribution Fitting</td>
<td>Statistics Toolbox</td>
</tr>
<tr>
<td>MBC Model Fitting</td>
<td>Model-Based Calibration Toolbox</td>
</tr>
<tr>
<td>MBC Optimization</td>
<td>Model-Based Calibration Toolbox</td>
</tr>
<tr>
<td>MuPad Notebook</td>
<td>Symbolic Math Toolbox</td>
</tr>
<tr>
<td>Neural Net Clustering</td>
<td>Neural Network Toolbox</td>
</tr>
<tr>
<td>Neural Net Fitting</td>
<td>Neural Network Toolbox</td>
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</table>

- **Curve Fitting**: Fits curves and surfaces to data.
- **Distribution Fitting**: Fit probability distributions to data.
- **MBC Model Fitting**: Create experimental designs and statistical models for model-based calibration.
- **MBC Optimization**: Generate optimal lookup tables for model-based calibration.
- **MuPad Notebook**: Perform and document symbolic calculations.
- **Neural Net Clustering**: Solve clustering problems using self-organizing map (SOM) networks.
- **Neural Net Fitting**: Solve fitting problems using two-layer feed-forward networks.
What’s New in MATLAB?

- MATLAB Toolstrip
- MATLAB apps
- Import Tool
- Command line suggestions
- Help System
Import Tool

- Interactive import of delimited and fixed-width text files
- Improved handling of:
  - Mixed numeric and text data
  - Dates
- Define rules for handling nonnumeric values
- Automatically generate MATLAB code (scripts and functions) to automate the process
What’s New in MATLAB?

- MATLAB Toolstrip
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- Command line suggestions
- Help System
Command Line Suggestions

- Suggested corrections for mistyped functions and variables in the Command Window
- Press Enter to execute the suggested command, or Esc to delete it
What’s New in MATLAB?

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- Help System
Documentation Center and Redesigned Help

- Content organized by topic rather than content type
- Browser-like interface, with improved search
  - Facets allow users to filter search results
  - Multiple tabs
- Documentation installed locally
  - Option to use the online Documentation Center

Demos are now “Examples”
**Release 2012b Highlights**

**MATLAB**
Introducing the new MATLAB Desktop: making it easier to find what you need.

**Simulink**
Introducing the new Simulink Editor: making it easier to build, manage, navigate and simulate your models.
Introducing the New Simulink Editor
Simulink R2012b is the most significant upgrade to Simulink Ever!

<table>
<thead>
<tr>
<th>Model-Based Design Industry Trends</th>
<th>Simulink R2012b Capabilities</th>
</tr>
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<tbody>
<tr>
<td>Huge models to capture complex behavior across systems and in components</td>
<td>Tabbed windows and Explorer bar to navigate model hierarchy and access key sections of the design.</td>
</tr>
<tr>
<td>Models to communicate designs and specifications, not just to create them</td>
<td>Smart signal routing and new Stateflow Editor to help create clean-looking models.</td>
</tr>
<tr>
<td>Simulation to understand, design, verify and analyze systems</td>
<td>Ability to add signal breakpoints and step back and forth through a simulation.</td>
</tr>
</tbody>
</table>
What’s New in Simulink?

- Simulink Editor
- Smart Signal Routing
- Simulation & Analysis Tools
- Rapid Prototyping
Brand New Design Environment

- Build readable models efficiently
  - NEW LOOK AND FEEL, SMART GUIDES, ACCESSIBILITY
- Understand parts of a design file easily
  - TABS, EXPLORER BAR
- Exclude parts of a design
  - COMMENT OUT
- Use rich modeling semantics
  - CONTROL LOGIC (STATEFLOW),
  - DISCRETE EVENT (SIMEVENTS),
  - PHYSICAL MODELING (SIMSCAPE)
Explorer Bar
Navigate model hierarchy
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Explorer Bar
Navigate model hierarchy
Tabbed Windows
Key sections of the model at your fingertips
Tabbed Windows
Key sections of the model at your fingertips
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Key sections of the model at your fingertips
Comment Out Blocks
Test variations of the model
What’s New in Simulink?

- Simulink Editor
- Smart Signal Routing
- Simulation & Analysis Tools
- Rapid Prototyping
Smart Signal Routing
Determine the optimal signal path
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Determine the optimal signal path
New Stateflow Editor
Organize the logic
New Stateflow Editor
Organize the logic
State Transition Tables

Build state machines quickly using tabular interface

- Structured interface to guide diagram construction
- Automatically complete state machine syntax
- Diagnostics identify syntax errors and incomplete transitions

`sf_cdplayer_STT`
MATLAB as the Action Language
Define state and transition labels with MATLAB language

- Call built-in and custom MATLAB functions directly in state diagram
- Automatic placement of brackets for transition labels
- Automatic inference of data size, type and complexity
What’s New in Simulink?

- Simulink Editor
- Smart Signal Routing
- Simulation & Analysis Tools
- Rapid Prototyping
New Simulation and Analysis Tools

- Control simulation step “rewind” and “forward”
  - SIMULATION STEPPER
- Compare simulation data across simulation runs
  - SIMULATION DATA INSPECTOR
- Scan and Speed-up Simulink models
  - PERFORMANCE ADVISOR
- Access simulation data visually
  - SCOPE ENHANCEMENTS
  - PORT VALUE DISPLAYS
  - 3D VISUALIZATION (SIMULINK 3D ANIMATION)
Simulation Stepper with Breakpoints
Understand the system, debug the design
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Understand the system, debug the design
Simulation Data Inspector
Quickly compare results for multiple simulation runs

- View and compare data from multiple simulations
- Validate the generated code against simulation
- Import external data for comparison with simulation data
Performance Advisor
Speed up your simulation and update diagram performance

- Performance Advisor analyzes your model for common performance bottlenecks
- Option to automatically apply the advice you receive
- Tool verifies whether its advice does indeed speed up your model
What’s New in Simulink?

- Simulink Editor
- Smart Signal Routing
- Simulation & Analysis Tools
- Rapid Prototyping
Simulink Support for Low Cost Hardware

- Prototype on low cost hardware
- Avoid writing driver blocks
- Avoid installation issues
- Deploy smoothly

ARDUINO
PANDABOARD
BEAGLE BOARD
GUMSTIX OVERO
RASPBERRY PI
LEGO MINDSTORMS NXT
Simulink Support for Low Cost Hardware

- Prototype on low cost hardware
  - BUILT-IN SUPPORT IN SIMULINK
  - ARDUINO, LEGO MINDSTORMS NXT, RASPBERRY PI
- Avoid writing driver blocks
  - HARDWARE SUPPORT PACKAGES
- Avoid installation issues
  - SUPPORT PACKAGE INSTALLER
- Deploy smoothly
  - 1-CLICK DEPLOYMENT
Other Updates
MATLAB Product Family

- MATLAB – xUnit-style testing framework *(R2013a)*
  - For writing and running unit tests, and analyzing test results

- MATLAB Production Server *(New product – R2012b)*
  - Run MATLAB programs as a part of web, database, and enterprise applications

- Phased Array System Toolbox
  - FMCW generation and processing, MATLAB Compiler support *(R2012b)*
  - Polarization support, three new MATLAB apps *(R2013a)*

- GPU computing *(R2012b)*
  - Performance improvements to GPU-enabled MATLAB functions
  - More GPU-enabled functions (e.g., `convn`, `cov`, and `normest`)
  - Additional support for toolboxes
    (Neural Networks Toolbox, Signal Processing Toolbox, Phased Array System Toolbox, Statistics Toolbox)
Other Updates
Simulink Product Family

- Verification and Validation *(R2013a)*
  - Improved Design Error Detection in Simulink Design Verifier

- RF modeling *(R2013a)*
  - SimRF has improved circuit envelope solver

- SimMechanics *(R2012b)*
  - Generate code and import CAD models with SimMechanics 2G technology

- Industry Standards Support *(R2012b)*
  - DO Qualification Kit and IEC Certification Kit support latest standards: DO-178C, ISO-26262, IEC 61508, EN-51028

- Fixed Point Designer *(New product – R2013a)*
  - Unified Fixed-Point Toolbox and Simulink Fixed Point
Learn More

Learn More

Introducing the New Simulink Editor
See how the new Simulink Editor makes modeling easier.

New Features By Release
R2013a (Version 8.1) - Released 7 Mar 2013

New Simulink Editor
- Reordering of tabs in tabbed windows
- Scalable vector graphics for mask icons

Component-Based Modeling

Project and File Management
- Simplified scripting interface for automating Simulink Project tasks
- Option to use elements from multiple templates when creating a new project