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

Applications

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

SIMULINK
Simulation and Model-Based Design

MATLAB
The Language of Technical Computing

- Math, Statistics, and Optimization
- Application Deployment
- Database Access and Reporting
- Parallel Computing
- Code Generation
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
  - Code:
    ```
    for k=1:max
    x = fft(dat)
    y = 20*log1
    ```
- Application Development

Share
- Reporting and Documentation
- Outputs for Design
- Deployment
  - MATLAB
  - .NET
  - Excel
  - 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
- MATLAB apps
- Import Tool
- Command line suggestions
- 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

- **Curve Fitting**
  Fits curves and surfaces to data.
  Available in Curve Fitting Toolbox

- **Distribution Fitting**
  Fit probability distributions to data.
  Available in Statistics Toolbox

- **MBC Model Fitting**
  Create experimental designs and statistical models for model-based calibration.
  Available in Model-Based Calibration Toolbox

- **MBC Optimization**
  Generate optimal lookup tables for model-based calibration.
  Available in Model-Based Calibration Toolbox

- **MuPad Notebook**
  Perform and document symbolic calculations.
  Available in Symbolic Math Toolbox

- **Neural Net Clustering**
  Solve clustering problems using self-organizing map (SOM) networks.
  Available in Neural Network Toolbox

- **Neural Net Fitting**
  Solve fitting problems using two-layer feed-forward networks.
  Available in Neural Network Toolbox
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
- MATLAB apps
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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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- MATLAB apps
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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>
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<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>
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<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>
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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
Explorer Bar
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Navigate model hierarchy
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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Tabbed Windows
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

Generate diagram
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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Simulation Stepper with Breakpoints
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
RASPBERRY PI
GUMSTIX OVERO HARDWARE
BEAGLE BOARD
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

### 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
Q&A