What’s New in MATLAB and Simulink

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Principal Application Engineer
Engineers and scientists...
Engineers and scientists...

Develop algorithms

write MATLAB code.

Analyze data
Engineers and scientists…

deploy algorithms and applications within web, enterprise, and production systems.
Engineers and scientists... build Simulink models.
Engineers and scientists... combine MATLAB code and Simulink models together.
Engineers and scientists...

generate code.
Engineers and scientists...

connect software to hardware.
And it’s all easier to do in the latest releases.
Analysis and Visualization

Modeling and Simulation

Testing and Verification

Sharing and Collaboration

Performance
MATLAB Live Editor

Change the way you work in MATLAB

- See results together with the code that produced them, accelerating exploratory programming and analysis
- Add equations, images, hyperlinks, and formatted text to create interactive narratives
- Create lectures that combine explanatory text, mathematical equations, code and results
MATLAB Graphics

New look makes data easier to interpret and graphics objects are easier to customize

- New default line colors, fonts, and styles with anti-aliased graphics and fonts improve the clarity and aesthetics of MATLAB visualizations

- Steady stream of new features released
  - R2014b – rotatable tick labels, automatic updating of `datetime` tick labels, and new visualization functions (`histogram`, `animatedline`)
  - R2015b – increased control for customizing plot axes
  - R2016a – new functions for polar plots, multiple y-axis plots, and for plotting mathematical expressions and equations
One-Click Display

Click a signal line when the simulation is running to view the current value

- Display port value for a signal by clicking it during simulation for easy debugging
- For bus signals, select the signals of interest before simulation
New Interface for Scopes

View and debug signals with cursors and measurements

- Scope, Floating Scope, and Viewers all upgraded with new UI
- Includes simulation data analysis and debugging tools
  - Cursors
  - Measurements
  - Triggers
Analysis and Visualization

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Performance
Deep Learning

Perform fast, accurate image classification

- Enables recognition workflows in autonomous robotics and ADAS
- Convolutional neural network (CNN) algorithm added to Neural Network Toolbox
- Uses cuDNN (a GPU-accelerated library from NVIDIA) (requires Parallel Computing Toolbox)
3D Vision

Enables autonomous systems to map and measure the world

- Supports workflows for ADAS, autonomous driving, and robotics
- New functionality to support:
  - 3D point cloud processing
  - Structure from motion
Pause Button

Troubleshoot problems without specifying breakpoints in advance

- Pause the execution of a program from the Editor and enter debug mode
- Check on the progress of long running programs to ensure they are running as expected
- Resume program execution
Get started or resume work faster by accessing templates, recent models, and featured examples

- Create new Simulink models using templates as starting points to common modeling approaches
- Use fully developed example models as a reference as you set out to build your own models
- Access most recent Simulink models right from the start page
Automatic Solver Option

Set up and simulate your model more quickly with automatically selected solver settings

- Simulink will select a solver and step size that is optimized for your specific model
- Considers factors such as model stiffness and simulation performance
- All new Simulink models use the automatic solver option
- Can optionally lock down solver so that it does not change from one simulation to another

Modeling and Simulation
Always-On Tunability

Tune all block parameters and workspace variables during a simulation

- All tunable block parameters can be tuned during simulation while retaining the simulation speed
- Choose between tunable and inline for default parameter behavior during code generation
- Simscape block parameters now tunable as well
Simulink Units

Specify, visualize, and check consistency of units on interfaces

- Specify physical units for Simulink signals and bus elements at the interfaces of components such as subsystems, model references, Stateflow charts and MATLAB function blocks.

- Identify unit mismatches at the component interfaces.

- Enforce consistency is by restricting the unit systems for certain components using the configuration parameter, ‘Allowed unit systems’.

Modeling and Simulation
Messages

Model asynchronous operations in state charts using objects that carry data and can be queued

- New message object and queue
- Message Viewer block to visualize lifetime of a message
- Signal lines in Simulink to transfer messages between charts
New SimEvents Engine and Block Library

Model operating system task scheduling and communication

- Model interrupts, shared resources, network delays, and other characteristics of multicore and distributed systems
- Predict data races, deadlocks, and livelocks that can affect system performance before going to hardware
- Customize reactions to events using MATLAB and the Discrete Event System block
Audio System Toolbox and WLAN System Toolbox

Design and test audio processing and WLAN (WiFi) communications systems

- Audio System Toolbox enables real-time audio processing in MATLAB and Simulink
- WLAN System Toolbox enables design and verification of evolving WLAN systems and WiFi devices
- Use together with LTE System Toolbox to design and test wireless systems
MATLAB Unit Testing Framework

Write and run unit tests, and analyze test results

- xUnit-style testing framework for the MATLAB language
- Includes a set of readily available qualification methods, and supports automation, providing easy reuse of test-cases
- Includes script-based, function-based, and object-oriented interfaces
Simulink Test

Author, execute and manage simulation-based testing

- Build synchronized executable test environments
- Create inputs and assessments based on logic or temporal conditions
Test Generation for Code

Automatically generate tests for C code S-functions

- Test generation automates a difficult task
- Generated tests lets you gain insight into the simulation of your design containing S-functions
Deploying to Hardware

Run your models on low-cost hardware and stream data into MATLAB

- Acquire images from USB webcams on Raspberry Pi into MATLAB
- Run Simulink models on Lego EV3, Raspberry Pi 2, and Arduino Yun
- Adds to existing support for Arduino, Lego, and Raspberry Pi platforms
Analysis and Visualization

Modeling and Simulation

Testing and Verification

Performance

Sharing and Collaboration
App Designer

Develop MATLAB applications with an enhanced design environment and expanded UI component set

- Choose from standard components (buttons, check boxes, panels, etc.), as well as gauges, lamps, knobs and switches
- Quickly move between visual design and code development
- New object-based code format makes it easier to share data between parts of the app
Add-On Explorer

Extend the capabilities of MATLAB by providing additional functionality for specific tasks and applications

- Browse, search, and install add-ons directly from MATLAB
- Add-ons include community-authored and MathWorks toolboxes, apps, functions, models, and hardware support
Using MATLAB with Other Languages

Integrate MATLAB with other programming languages, including C/C++, Java, .NET, and Python

- Call MATLAB from another language
- Reuse legacy code written in another programming language within MATLAB
- Package MATLAB programs into language-specific software components to integrate with other programming languages
  - Python support added in R2015b
Three-Way Model Merge

Graphically resolve conflicts between revisions within a Simulink project

- Resolve conflicts in model files under source control
- Provides an interactive comparison report with the two conflicting designs along with the original base model

Sharing and Collaboration
Scalable Report Generation

Generate PDF reports as big as 10,000 pages

- Can directly generate PDF documents that can handle large-scale reports
- Generation of large PDF documents now possible on all platforms that MATLAB supports: Windows, Mac, Linux

Sharing and Collaboration
Performance
MATLAB Execution Engine

Redesigned execution engine runs MATLAB code faster

- All MATLAB code can now be JIT compiled
- Average performance improvement of 40% on 76 performance-sensitive user applications
- A platform for future improvements

- Performance testing framework
  - Measure MATLAB code performance
  - Interface leverages the unit testing framework
GPU Acceleration and Parallel Computing

Perform parallel computations using GPUs

- Accelerate applications using GPU-enabled functions
  - > 300 in MATLAB
  - > 90 in Statistics and Machine Learning Toolbox
  - > 50 in Image Processing Toolbox

- Use enhanced gpuArray functions for sparse matrices on GPUs

```
Transfer data to GPU
>> GX = gpuArray(X);

GPGPU Computation
>> GY = fft2(GX);

Gather data to CPU
>> Y = gather(GY);
```

Simple GPU code in MATLAB

![Graph showing performance improvement with grid size increase](image)

- 18x faster
- 23x faster
- 20x faster
Fast Restart

Run consecutive simulations more quickly

- Efficiently run multiple interactive simulations
- Saves simulation time eliminating recompilation between simulation runs
- Improves calibration workflows where the user is tuning block parameters between runs
- API introduced in R2015b