MATLAB EXPO 2016
What’s New in MATLAB and Simulink

Mohamed Anas
Stephan van Beek
InMotion Student Team Develops the Racing Car of the Future

Punch Powertrain Develops Faster and more Accurate Control for Switched Reluctance Motors using Zynq SoC

Vintecc Develops PLC System for Multi-Axle Harvesting Machine Using Model-Based Design

ASML Develops Virtual Metrology Technology for Semiconductor Manufacturing with Machine Learning

Rabobank Develops Goal Monitor to Optimize Portfolio of their Customers

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InMotion Student Team Develops the Racing Car of the Future
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...

Model systems

build Simulink models.

Run simulations
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
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Start Page

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
- Define your own templates for standardization
- 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
Simulink Units

Specify, visualize, and check consistency of units on interfaces

- Specify physical units for Simulink signals and bus elements
- Identify unit mismatches at the component interfaces
- Automatically convert units
- Enforce consistency by restricting the unit system
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
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
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Performance
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

```matlab
function tests = solverTest
tests = functiontests(localFunctions);
end

function testRealSolution(testCase)
actSolution = quadraticSolver(1,-3,2);
expSolution = [-1; 2];
verifyEqual(testCase, actSolution, expSolution);
end

%% Test Class Definition
classdef MyComponentTest < matlab.unittest.TestCase
    % Test Method Block
    methods (Test)
        function testASolution(testCase)
            % Exercise function under test
            % act - the value from the function under test
            % exp - the expected value
            % testCase.<qualification method>(act,exp);
                % Verify using test qualification
        end
    end
end
```
Simulink Test

Author, execute and manage simulation-based testing

- Build synchronized executable test environments
- Create inputs and assessments based on logic or temporal conditions
- Integration with Real-Time Testing
Deploying to Hardware

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

- Acquire images from Raspberry Pi and Kinect V2 into MATLAB and Simulink
- Run Simulink models on Lego EV3, Raspberry Pi 3, Raspberry Pi 3, and Arduino Yun
- Adds to existing support for Arduino, Lego, and Raspberry Pi platforms
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
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
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 R2016a
  - 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]
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