What’s new in MATLAB and Simulink

Mandar Gujrathi
Mandar.Gujrathi@mathworks.com.au
Platform
Productivity

Getting your work
done faster

Workflow
Depth

Support for your
entire workflow

Application
Breadth

Products for the
work you do
- Simulate Faster
- Create Your Designs Faster
- Simplify Analysis
- Scale Your Work
- Collaborate
Simulate Faster

Redesigned execution engine runs MATLAB code faster

- All MATLAB code can now be JIT compiled
- MATLAB runs your code over twice as fast as it did just three years ago
- No need to change a single line of your code
- Increased speed of MATLAB startup in R2018a

Average Speedup in Customer Workflows
Create Your Designs Faster

MATLAB
Live Editor
Create Your Designs Faster

MATLAB
App Designer
Create Your Designs Faster

MATLAB

Simulink
Create Your Designs Faster

MATLAB

Simulink

Stateflow
Simplify Analysis with Apps

These interactive applications automate common technical computing tasks

- **Econometric Modeler app**
  - Perform time series analysis, specification testing, modeling, and diagnostics

- **Analog Input Recorder app**
  - Acquire and visualize analog input signals

- **Wavelet Signal Denoiser app**
  - Visualize and denoise time series data
Scale Your Work

Use parallel computing to run multiple simulations faster

- Run multiple parallel simulations with `parsim`
- Monitor simulation status and progress in the Simulation Manager

Parallel Computing Toolbox
MATLAB Distributed Computing Server
Scale Your Work

Use tall arrays to manipulate and analyze data that is too big to fit in memory

- Use familiar MATLAB functions and syntax
- Support for hundreds of functions
- Works with Spark + Hadoop clusters
Team Collaboration

Use advanced software development features to manage, test, and integrate MATLAB code

MATLAB® Test Report

Timestamp: 04-Jan-2017 13:28:06
Host: AH-SDE
Platform: win64
MATLAB Version: 9.1.0.441655 (R2016b)

Number of Tests: 17
Testing Time: 0.4516 seconds
Overall Result: PASSED

Overview

Details

Identify differences between model elements, Stateflow charts, and MATLAB Function blocks
Platform Productivity

Workflow Depth

Application Breadth

- Create Your Designs Faster
- Simplify Analysis
- Simulate Faster and Scale Your Work
- Collaborate
- Deployment of MATLAB Algorithms and Applications
- Code Generation from Simulink Models
- Verification and Validation
Deploy MATLAB Algorithms and Applications

### Access Data
- Sensors
- Files
- Databases

### Analyze Data
- Data exploration
- Preprocessing
- Domain-specific algorithms

### Develop
- AI model
- Algorithm development
- Modeling & simulation

### Deploy
- Desktop apps
- Enterprise systems
- Embedded devices
Deploy MATLAB Algorithms and Applications

Share your work outside of MATLAB without having to recode your algorithms

- Standalone desktop applications
- Add-ins for Microsoft Excel
- Software components to integrate with other languages (C/C++, .NET, Python, Java)
- Software components for web and enterprise applications
Deploy MATLAB Algorithms and Applications

Share your work outside of MATLAB without having to recode your algorithms

- Standalone desktop applications
- Add-ins for Microsoft Excel
- Software components to integrate with other languages (C/C++, .NET, Python, Java)
- Software components for web and enterprise applications
Deploy MATLAB Algorithms

Deploy machine learning and deep learning models using automatically generated code

- Generate C code for predictive machine learning and deep learning models
- Generate optimized CUDA code for deep learning, embedded vision, and autonomous systems
PID Control Tuning

Implement an embedded PID auto-tuning algorithm

- Automatically tune PID controller gains in real time against a physical plant
- No model of plant dynamics required
- Deploy the auto-tuning algorithm to embedded software using automatic code generation
Connecting Your Design to Hardware

Connect directly to hardware with support packages

- Live streaming to and from hardware
- Run Simulink models on low-cost hardware, such as Arduino, Raspberry Pi, and LEGO
- Automatically generate code and run it on microprocessors, FPGAs, and more.

Support packages:
- Arduino
- ARM Cortex
- Raspberry Pi
- Microsemi FPGA
- LEGO
- ADALM-PLUTO
Deploying to FPGA or ASIC Hardware

HDL Coder

Fixed-Point HDL

FPGA/ASIC Implementation

HDL Verifier

Algorithm w/ Hardware Implementation

Algorithm

Native Floating Point

Matrix Support

Vision HDL Toolbox

LTE HDL Toolbox

HDL Checks in Model Advisor

HDL Verifier

HDL Coder

Fixed-Point Designer

Vision HDL Toolbox

LTE HDL Toolbox
- Deployment of MATLAB Algorithms and Applications
- Code Generation from Simulink Models
- Verification and Validation
Platform
Productivity

Workflow
Depth

Application
Breadth

- Autonomous Systems
- Artificial Intelligence (AI)
- Wireless Communications
Designing Autonomous Systems

- Sense
- Perceive
- Decide & Plan
- Act
Designing Autonomous Systems

Mapping of environments using sensor data

- Segment and register lidar point clouds
- Lidar-Based SLAM: Localize robots and build map environments using lidar sensors
Designing Autonomous Systems

Understanding the environment using computer vision and deep learning techniques

- Object detection and tracking
- Semantic segmentation using deep learning

Designing Autonomous Systems

Design synthetic driving scenarios to test controllers and sensor fusion algorithms

- Interactively design synthetic driving scenarios composed of roads and actors (*vehicles*, *pedestrians*, etc.)
- Generate visual and radar detections of actors
Full Vehicle Simulation

Ride & handling

Chassis controls

Automated Driving

Vehicle Dynamics Blockset  New Product
Artificial Intelligence
Text Analytics

Data

repairNotes = 517x1 string array
- "PM SERVICE, CHECK TURN SIGNAL, CLUNKING NOISE"
- "SERVICEROB,EXT,5604"
- "NEED 4 PLOW PINS"
- "INSTALL SPINNER ASSY"
- "DON'T START"
- "DOG BONE PIN BROKEN"
- "NEED SERVICE, CHECK BRAKES"
- "HYD CAP CHECK ENGINE LIGHT ON"
- "TARP VALVE STICKING RIGHT SIDE MIRROR BRACKET"
- "HANDLES IN CAB LOOSE"
- "NO PLOW LIGHTS"
- "WHEEL LAD ROLLER"

Output

Model

Text Analytics Toolbox
Text Analytics

Work with text from equipment logs and operator reports

- **Preprocess** raw text data by extracting, filtering, and splitting

- **Visualize** text using word clouds and text scatter plots

- **Develop** predictive models using built-in machine learning algorithms (LDA, LSA, word2vec)
Predictive Maintenance

Data

Sensors

Model

Remaining Useful Life (RUL) Estimation

Failure Threshold

Real Data

Prediction

Predictive Maintenance Toolbox

New Product
Predictive Maintenance

Design and test condition monitoring and predictive maintenance algorithms

- Import sensor data from local files and cloud storage (Amazon S3, Windows Azure Blob Storage, and Hadoop HDFS)
- Use simulated failure data from Simulink models
- Estimate remaining useful life (RUL)
- Get started with examples (motors, gearboxes, batteries, and other machines)
Deep Learning

- Data
- Model
- Output

Neural Network Toolbox
Computer Vision System Toolbox
GPU Coder
Deep Learning

Design, build, and visualize convolutional neural networks

- Access the latest models
- Import pretrained models and use transfer learning
- Automate ground-truth labeling using apps
- Design and build your own models
- Use NVIDIA GPUs to train your models
- Automatically generate high-performance CUDA code for embedded deployment

![Graph showing prediction performance of AlexNet, ResNet-50, and VGG-16 on a TitanXP GPU.](image_url)

Pretrained models: AlexNet, ResNet-50, VGG-16

Frameworks: TensorFlow, MATLAB, MXNet, GPU Coder

Images / sec

- **TensorFlow**
- **MATLAB**
- **MXNet**
- **GPU Coder**
FREE
Learn to Use MATLAB for Deep Learning in 2 Hours

Launch Deep Learning Onramp
Design with the Latest Wireless Standards

- LTE
- 5G
- WiFi 802.11ax
- ZigBee
- NB-IoT
RF and Antenna Design and Prototyping

Use RF and Antenna models through your entire development cycle

- RF top-down design with RF Budget Analyzer app
- Adaptive hybrid beamforming and MIMO system modeling
- RF Power Amplifier modeling and DPD linearization
- RF propagation and 3D terrain visualization
- Design and fabrication of printed (PCB) antennas

... to implementation
What’s New in MATLAB and Simulink?

**Platform Productivity**
- Design Creation
- Analysis
- Simulation, Scaling
- Collaboration

**Workflow Depth**
- Deployment
- Code Generation
- Verification and Validation

**Application Breadth**
- Autonomous Systems
- Artificial Intelligence (AI)
- Wireless Communications
Upgrade your MATLAB Code and Simulink Models