MATLAB EXPO 2015
KOREA
2015년 5월 21일 목요일
인터컨티넨탈 코엑스, 서울
What’s New in Release 2015a and 2014b

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Principal Application Engineer
Agenda

- New Features
  - Graphics and Data
  - Design
  - Performance
  - Design Management

- New Products
  - Application Deployment/Statistics and Machine Learning Toolbox
  - Antenna Toolbox
  - Signal Processing and Communications
  - Vision HDL Toolbox
  - Simulink Test
  - Robotics System Toolbox

MATLAB EXPO 2015
Graphics and Data
New Graphics System

Overview

- **New look**
  - New default colormap and line colors
  - Anti-aliased fonts and lines
  - Subtler grid lines

- **Easier to customize**
  - Graphics objects now behave like other MATLAB objects
  - Support dot-notation to access and change properties

Data easier to interpret

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New Graphics System

Features

- Rotatable tick labels
- Automatic updating of datetime tick labels
- New visualization functions
  - histogram
  - animatedline
- Multiple colormaps per figure
- Multilingual text and symbols
- User interfaces with tab panels

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Graphics & Data

Simulink – New graphical controls and displays
Simulink – Better Simulation Data Analysis

New Simulation Data Inspector

- View live signal data
- Visualize and compare simulation output including Simscape
- Data cursors
Graphics & Data

Stateflow – Watch Data
MATLAB Data Types

Graphics & Data

Heterogeneous data
- structure
- cell
- char
- categorical

Time
- datetime
- duration
- calendarDuration

Text

Numeric
- int8, uint8, single, double
- int16, uint16, int32, uint32, int64, uint64

Function handle
- **table** – new fundamental data type
- For mixed-type tabular data
  - Holds both data and metadata
- Supports flexible indexing
- Built-in functionality (merge, sort, etc.)
MATLAB

Categorical Arrays

- **categorical** – new fundamental data type
- For discrete non-numeric data
  - Values drawn from a finite set of possible values ("categories")
- More memory efficient than a cell array of strings
- Can be compared using logical operators
  - Similar to numeric arrays
Design
Design

Simulink – Accelerate Model Building

Smart Editing Cues
Simulink – Comment Out / Through

Comment a block so that the output equals the input

- Signal passes through the block during simulation
- Comment out option remains available
- Works on blocks with the same number of inputs and outputs
Design

Simulink – Model Templates

Build models using design patterns that serve as starting points to solve common problems

- Use shipped templates to get started with building models or create custom templates to from a Simulink model
- Avoid repetitive tasks when starting out to build a new model
- Enforce a standard process for building models for the entire team or organization
Performance
Performance

Simulink – Faster Consecutive Simulations

Fast Restart
Performance

Stateflow – Start Simulation Faster

Just-In-Time Compilation
MATLAB – Access Big Data

datastore

- Easily specify data set
  - Single text file or collection of text files
  - Database (using Database Toolbox)
  - Data stored on HDFS

- Preview data structure and format

- Select data to import using column names

- Incrementally read subsets of the data
Use the powerful MapReduce programming technique to analyze big data
- **mapreduce** uses a **datastore** to process data in small chunks that individually fit into memory
- Useful for problems with complex grouping, or when intermediate results do not fit in memory

**mapreduce** on the desktop
- Increase compute capacity (Parallel Computing Toolbox)
- Analyze big database tables (Database Toolbox)
- Access data on HDFS to develop algorithms for use on Hadoop

**mapreduce** on a cluster
- Run on cluster or Hadoop using MATLAB Distributed Computing Server
- Deploy applications and libraries for Hadoop using MATLAB Compiler
MATLAB – Big Data Capabilities

Memory and Data Access
- 64-bit processors
- MemoryMapped Variables
- Disk Variables
- Databases
- Datastores R2014b

Programming Constructs
- Streaming
- Block Processing
- Parallel-for loops
- GPU Arrays
- SPMD and Distributed Arrays
- MapReduce R2014b

Platforms
- Desktop (Multicore, GPU)
- Clusters
- Cloud Computing (MDCS on EC2)
- Hadoop R2014b
Design Management
Design Management

MATLAB and Simulink – Managing Code and Models

Source Control Integration

- Manage your code from within the MATLAB Desktop and your models from within Simulink Projects
- Leverage modern source control capabilities
  - GIT and Subversion integration in Current Folder browser
- Use Comparison Tool to view and merge changes between revisions
Toolbox Packaging

- Package your toolbox as a single installer file
  - Contains all of the code, data, apps, documentation, and examples
  - Checks for dependent files and automatically includes them
  - Documents required products

- Included folders and files automatically appear on path when installed

- View details and uninstall toolboxes with Manage Custom Toolboxes dialog box
Simulink – Sharing Projects

Share a project on GitHub® via e-mail or as a MATLAB Toolbox

- Make your project publicly available on GitHub.
- Share your project via email.
- Package your project as a MATLAB toolbox
Agenda

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  - Performance
  - Design Management

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  - Simulink Test
  - Robotics System Toolbox

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**MATLAB Compiler** for sharing MATLAB programs without integration programming

**MATLAB Compiler SDK** provides implementation and platform flexibility for software developers

**MATLAB Production Server** provides the most efficient development path for secure and scalable web and enterprise applications
Statistics and Machine Learning Toolbox

- Import and interactively explore data
- Specify validation schemes
- Perform feature selection
- Train SVM, kNN, bagged trees and other algorithms
- Assess results using classification accuracy, ROC curves and Confusion Matrices
- Export models to the MATLAB, or generate MATLAB code to integrate models into applications.

New **Classification Learner** app
Wireless System Design: What’s new in 2015?

- End-to-end simulation
  - Antenna-to-Bits Simulation
  - Smart RF Design

- Design verification
  - Standard-compliant (LTE, LTE-A)
  - RADAR systems

- Over-the-air testing
  - Connectivity to SDR and RF instruments

- **New product:**
  - Antenna Toolbox

- **Major releases:**
  - Communications System Toolbox
  - LTE System Toolbox
  - Phased Array System Toolbox

- **New Hardware Support Package**
  - Zynq ® Software-Defined Radio
Antenna Toolbox

- Easy design
  - Library of 22 parameterized antenna elements
  - Functionality for the design of linear and rectangular antenna arrays
  - No need for full CAD design

- Rapid simulation setup
  - Method of Moments field solver for port, field, and surface analysis
  - No need to be an EM expert

- Seamless integration
  - Model the antenna together with signal processing algorithms
  - Rapid iteration of different antenna scenarios for radar and communication systems design
% txBits=bitStream(1:end-6);
txBits=[bitStream;zeros(634,1)];
% Modulate
tx = modulateBitstream(txBits, constParams, tunedParams);

- Antenna Toolbox
- Phased Array System Toolbox
- Communications System Toolbox
Phased Array Design with Simulink

- 7 Libraries
  - Beamforming
  - Detection
  - Direction of Arrival
  - Environment and Target
  - STAP
  - Transmitters and Receivers
  - Waveforms
- 47 blocks
- Supports code generation
Process original data bits and generate custom digital baseband waveforms in transmitter.

Over-the-air Testing with Radio Hardware

- RF Signal Generator
- Spectrum Analyzer
- RF Signal Generation Instruments
- RF Signal Capture Instruments
- Baseband Waveform Generation
- Baseband Waveform Analysis
- Supported SDR Transmitters
- Supported SDR Receivers

Zynq SDR
RTL SDR
USRP SDR

Process received samples in receiver. Decode/recover original data.
Supported SDRs & RF instruments

- RF Signal Generator
- Zynq Radio SDR
- USRP SDR
- RF Spectrum Analyzer
- Zynq Radio SDR
- USRP SDR
- RTL SDR

Transmitter

Receiver

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Vision HDL Toolbox

A Complete Solution for Embedded Vision

Concept Development  Algorithm Development  Prototyping  Architecture design  Prototyping  Chip design

Frame based  Pixel based

Computer Vision System Toolbox  Image Processing Toolbox  Vision HDL Toolbox

HDL Coder  MATLAB Coder  Fixed Pt Designer  HDL Verifier

[Track 4] 14:30  HDL 타겟을 위한 컴퓨터 비전 모델링
## Simulink Test

<table>
<thead>
<tr>
<th>1. Test Harnesses</th>
<th>2. Test Sequence Block</th>
<th>3. Test Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Synchronized, simulatable test environment</td>
<td>• Inputs and assessment based on logical, temporal conditions</td>
<td>• Author, execute, manage test cases • Review, export, report</td>
</tr>
</tbody>
</table>

### Test Harness

- **Component under test**

### Main Model

- **Test Sequence**

[Image of Simulink Test environment]
Robotic System Toolbox

Build Robots with Low-Cost Hardware?
- Drivers Provided
- Comprehensive Algorithms

Use Powerful Robots Running ROS?
- ROS/Gazebo Interface
- ROS Node Generation
- Comprehensive Algorithms

Hardware Support Package

Robotics System Toolbox

[Track 5] 15:30

Robotics System Toolbox 소개
Key Capabilities of Robotics System Toolbox

**MATLAB-ROS Interface**
- Create a ROS node inside MATLAB
- Design and test robotics algorithms on a robot simulator such as Gazebo
- Test robotics algorithms on a physical robot
- Import rosbag log files into MATLAB

**Simulink-ROS Interface**
- Simulink I/O with ROS networks
- ROS node generation from Simulink models

**Algorithms in Robotics System Toolbox**
- Map utilization
- Path planning
- Path following
- Read point clouds