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

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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

```
>> p = plot(x, y);
>> p.Color = 'red';
```
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
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
Stateflow – Watch Data
MATLAB Data Types

Graphics & Data

- Time
  - datetime
  - duration
  - calendarDuration

- Text
  - char
  - cell

- Heterogeneous data
  - structure
  - logical
  - categorical

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

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MATLAB

Tables

- **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
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
MATLAB – Analyze Big 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
- Memory Mapped Variables
- Disk Variables
- Databases
- Datastores

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

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

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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
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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
Signal Processing & Communications

Antenna-to-Bits Simulation

- Antenna Toolbox
- Phased Array System Toolbox
- Communications System Toolbox

% txBits=bitStream(1:end-6);
txBits=[bitStream;zeros(634,1)];
% Modulate
tx = modulateBitstream(txBits, constParams, tunedParams);

% Find Amplifier gain to Normalise symbols
ps = abs(phasor(1));
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.

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

- RF Signal Generator
- RF Spectrum Analyzer
- Zynq Radio SDR
- Zynq Radio SDR
- USRP 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>
</table>
| • Synchronized, simulatable test environment | • Inputs and assessment based on logical, temporal conditions | • Author, execute, manage test cases  
• Review, export, report |

**Test Harness**

**Main Model**

**Component under test**

**Simulink Test를 활용한 테스트 관리의 새로운 접근 방법**
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
Robotic System Toolbox

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

MathWorks