What’s New with the MATLAB® and Simulink® Product Families

Marta Wilczkowiak & Coorous Mohtadi
Application Engineering Group
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R2008a Overview

- **Available on March 1**
  - First release of 2008
  - Updates to 87 products, including MATLAB 7.6 and Simulink 7.1

- **New capabilities for:**
  - Object-oriented programming
  - Parallel Computing
  - Verification and Validation
  - Code Generation

- **Activation and License Center**
R2007b and R2008a Product Highlights

MATLAB Product Family

- MATLAB
- Parallel computing
- Math and analysis
- Application deployment
- Image and video processing
MATLAB®

- Major enhancements to object-oriented programming capabilities (2008a)

- Broad range of improvements in the following areas:
  - Performance and large data set handling
  - Development environment
  - Language and programming
  - Mathematics
  - Graphics and GUI building
Major Enhancements to Object-Oriented Programming Capabilities

- Class definition files
  - Definition of properties, methods, and events
- Handle classes with reference behavior
- Events and listeners
- JIT-Accelerator support
- Development environment support for the creation and use of classes
Parallel Computing
R2008a Product Name Changes

Distributed Computing Toolbox™ → Parallel Computing Toolbox™

MATLAB® Distributed Computing Engine™ → MATLAB® Distributed Computing Server™

New names better match the capabilities the products now provide
Writing Parallel Code

- Other toolboxes:
  - Optimization Toolbox™
  - Genetic Algorithm and Direct Search Toolbox™
  - SystemTest™

- `parfor`
- jobs and tasks
- distributed arrays

- MATLAB® MPI (Message Passing Interface)
Parallel Computing – New Features

- Updated `parfor` command
  - Interleaving of parallel and serial code

- New batch command to run MATLAB® scripts

- Administrative features
  - Graphical user interface for defining user configurations
  - Parallel profiler
  - Admin Center

- Extended support for 3rd-party schedulers
  - PBS Pro™ and TORQUE schedulers
Math and Analysis

Optimization

- Interior-point algorithm – for solving large problems

- Parallel computing options directly in:
  - Optimization Toolbox™
  - Genetic Algorithm and Direct Search Toolbox™

- Multi-objective genetic algorithm (MOGA) for solving problems with competing objectives

- Unified graphical-user interface for all optimization solvers
Math and Analysis

Statistics

- New capabilities for identifying the best model
  - Feature selection – Identifies variables of importance
  - Partial least squares – Dimension reduction
  - Cross validation – Uses simulation to statistically quantify differences between models

- Quasi-random number generator
  - Trade-off between simulation time and accuracy
    - Decrease run time
    - Improve accuracy
Application Deployment

MATLAB® Builder for Java™ 2.0

- New features for enterprise Web deployment
  - Interactive Web figures (zoom, pan, and rotate)
  - Ability to easily run on multiple servers (RMI)
Video Processing

- MATLAB
  - Improved support for AVI files
  - New support for MPEG, MPEG-2, MPEG-4, WMV, and other codecs
  - NOTE: Only on Windows platforms

  >> mmreader

- Image Processing Toolbox
  - New video viewer

  >> implay

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Image and Video Processing

*Improvements to Graphical User Interfaces*

- Image Processing Toolbox
  - Improved GUIs for cropping, histograms, …
  - New ROI tools

- Image Acquisition Toolbox
  - Image Acquisition Tool
R2007b and R2008a Product Highlights

MATLAB Product Family

- MATLAB
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R2007b and R2008a Product Highlights

Simulink Product Family

- Simulink
- Stateflow
- Embedded MATLAB™ functionality
- Model verification and validation
- Code generation and verification
- New products and major updates
Simulink

- New multiplatform library browser
- Improved simulation performance
- Enhanced component-based modelling
Simulink Library Browser

Problem
- Simulink library browser was a Windows-only feature
- Browsing or searching libraries could be slow
- Searching was incremental → hard to find blocks with common names

Solution
- Implement new browser using platform-independent technology
- Browse and search libraries without loading
- Find ALL matches and organize search results by blockset
- Added new compact grid view option

Benefit
- Library Browser now available on all Simulink supported platforms
- Improved usability as browsing libraries and searching is much faster
- Search results are easier to review and navigate

Matches for “filter”: 10 blocksets, 8 subsystems, 69 blocks
New Simulation Modes in Simulink

Problem
- Increased simulation performance needed as models grow in size
- Simulation acceleration and profiling need to be core capabilities of Simulink
- Simulink should use a second processing core if available

Solution
- Make Simulink Accelerator product part of Simulink
- Add additional Rapid Accelerator mode that creates a separate process to Simulink and communicates with Simulink via External mode

Benefit
- Faster simulation in Simulink using code generation
- Profile Simulink Models to find bottlenecks
Model Reference Normal Mode

Problem
- Model reference can have slow turnaround time
  - Required code to be generated
- Many analysis and debugging tools did not work with referenced models

Solution
- Reference model in normal mode
  - No code generation needed

Benefit
- Much faster turnaround when creating/changing referenced model
- Many tools now work in referenced model
  - Stateflow animation
  - Scopes
  - Model coverage
  - Linearization
  - Debugging...

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Stateflow®

- Asynchronous modelling
- Enhanced language constructs
- Continuous-time with zero crossing support
Asynchronous modelling

Problem
- Asynchronous modelling in Stateflow required overhead through the use of local event broadcasting or extra transitions

Solution
- Provide super step semantics within Chart Options

Benefit
- Take all state transitions that evaluate `true` in each simulation time step
- No overhead necessary
- Cleaner code for asynchronous models
- Easy to switch back and forth from synchronous to asynchronous modelling

With super step enabled, logic transitions from A to B to C in one time step
Enhanced Language Constructs

- Embedded MATLAB functions, graphical functions, and truth tables can now have multiple outputs
- Absolute-time temporal logic
- Complex data support for inputs, outputs, locals, parameters and functions
- New temporalCount operator counts occurrences of events
Enhanced Continuous Time Support

Problem
- It was not possible to use Stateflow to model logic coupled with instantaneous changes in dynamics (e.g., a clutch)

Solution
- Enhance the continuous-time support of Stateflow to include detection of zero-crossings for continuous variables
- Add semantics for defining simple plant models directly within Stateflow

Benefit
- Use Stateflow to define mode logic for continuous systems

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Embedded MATLAB™ Functionality

- Support in M-Lint Code Analyzer
- Generate code from MATLAB® command line
- Include M-files in your Embedded MATLAB functions
M-Lint Supports Embedded MATLAB

Problem
- How do I know my MATLAB function is compatible with the Embedded MATLAB subset?

Solution
- Use M-Lint code analyzer to check your Embedded MATLAB functions

Benefit
- Improved workflow in bringing MATLAB to C
Embedded MATLAB Command-Line Code Generation

Problem

- How can I generate C code from standalone Embedded MATLAB code?

Solution

- Use the new function in Real-Time Workshop®:
  - `emlc` from the MATLAB command-line

Benefit

- Simplified command-line workflow
Embedded MATLAB Compiles M-Files

Problem
- How can I incorporate M-files into my simulation and still generate code?

Solution
- Embedded MATLAB now compiles M-files that are on your MATLAB path

Benefit
- Sharing of algorithms between blocks without copy-paste eases maintainability
- Simpler workflow

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Model Verification and Validation

- Modelling standards checks
- Automatic test vector generation and property proving
Simulink® Verification and Validation™

Problem
- Customers want support for:
  - Safety-critical development using DO-178B or IEC 61508
  - MAAB modelling Style Guidelines.

Solution
- DO-178B checks added in R2007b
- IEC 61508 checks in R2008a
- MathWorks Automotive Advisory Board checks in R2006b (18 more in R2008a)
Simulink® Design Verifier™
Generate tests and prove model properties using formal methods

- Automatically generate tests for models
- Prove functional requirements
- Meet coverage goals
- Supports Simulink, Stateflow and Embedded MATLAB functions
Code Generation and Verification

- Bi-directional traceability between model and code
- PolySpace
- Floating-point to fixed-point automated conversion
Bidirectional Traceability Between Model and Code

Problem
- No automated way to trace Simulink blocks, Stateflow chart and Embedded MATLAB functions to generated code

Solution
- Generate comments that automatically link Simulink blocks, Stateflow objects and Embedded MATLAB functions to the generated code
- Allow model-to-code and code-to-model bidirectional navigation

Benefit
- Bidirectional traceability helps code reviews, code verification, and software certification
PolySpace™ Code Verification
Detect run-time errors and prove code correctness

- Designed-in quality
  - Prove the absence of errors
  - Increase the confidence in the code
  - Measure – improve – control code correctness

- Usage
  - Simple coloured source code
  - No compilation, no execution, no test cases
  - For C/C++/Ada

- Process
  - Early in the development cycle
  - Generated & hand-written code
Floating-Point to Fixed-Point Automated Conversion

Problem
- Obtain an initial floating-point to fixed-point conversion with least effort

Solution
- Fixed-Point Advisor helps to:
  - Set model parameters
  - Set block parameters
  - Perform fixed-point conversion
  - Validate conversion using floating point results
  - Prepare for code generation
- Complement Fixed-Point Tool, which optimizes fixed-point scaling
New Products and Major Updates

New Since R2007b (Web release)
- Embedded IDE Link™ MU (for Green Hills® MULTI®)

New in R2008a
- EDA Simulator Link™ DS (for Synopsys® Discovery™)

New since R2008a (web release)
- SimElectronics™

Major Updates
- Aerospace Toolbox 2
- Aerospace Blockset™ 3
- Communications Toolbox™ 4
- Simscape™ 2
- SystemTest™ 2
- Communications Blockset 4
- Embedded IDE Link™ VS 2 (for Analog Devices™ VisualDSP++®)
- Target Support Package™ TC2 3 (for TI's C2000™ DSP)

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