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

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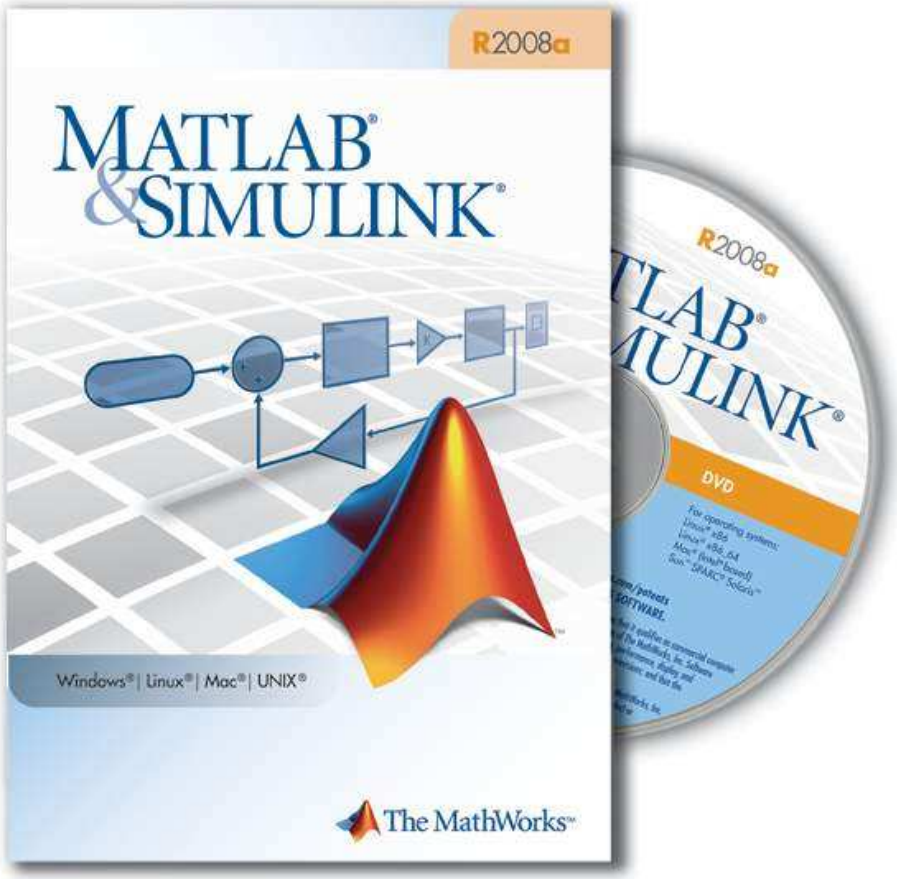
Area	Release 2007b	Release 2008a
MATLAB		
Math, Statistics, and Optimization		
Application Deployment		
Parallel Computing		
Simulink and Stateflow®		
Discrete Event Simulation		
Physical Modeling		
Rapid Prototyping and HIL HW and SW		
Model Verification and Validation		
HDL Code Generation and Verification		
Embedded Code Generation and Verification		
Control Systems		
Signal Processing and Communications		
Image and Video Processing		
Test & Measurement		
Computational Biology		
Financial Modeling and Analysis		
PolySpace™ Products		

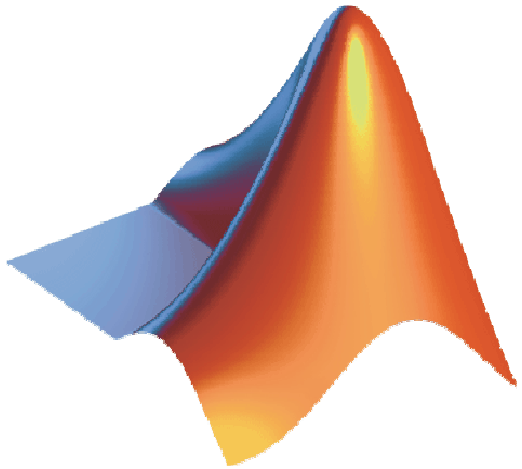
R2008a Overview

- 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



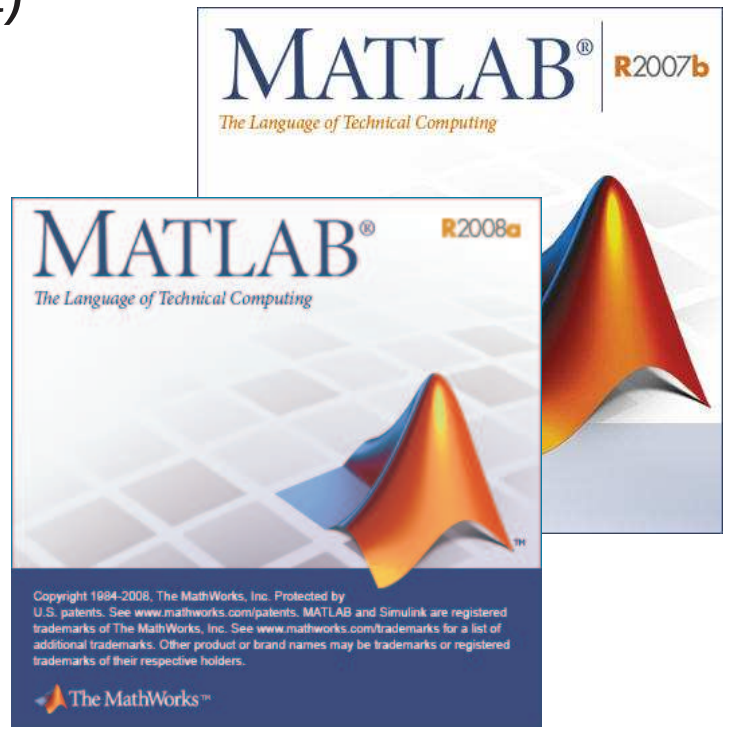
R2007b and R2008a Product Highlights
MATLAB Product Family

- 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

R2008a

- 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

```
classdef AWGN < handl
    properties ...
    methods
        function obj=
        function awgn
        function obj=
    end
end
```

Parallel Computing
R2008a Product Name Changes

R2008a

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

R2008a

No code changes

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

Trivial code changes

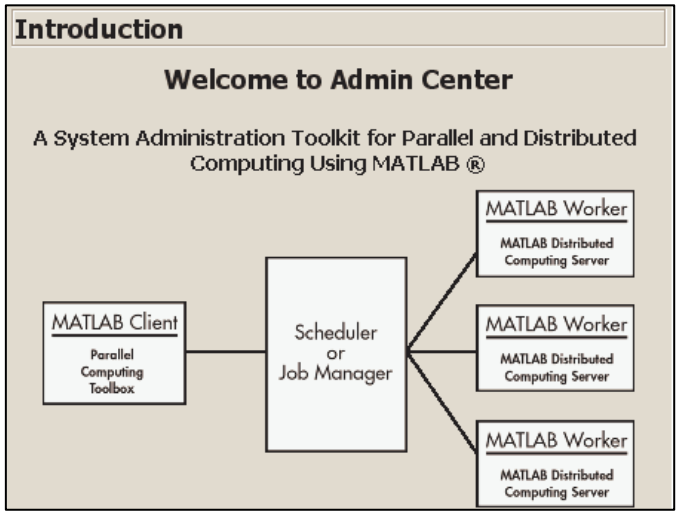
- `parfor`
- jobs and tasks
- distributed arrays

- MATLAB® MPI (Message Passing Interface)

Parallel Computing – New Features

R2007b R2008a

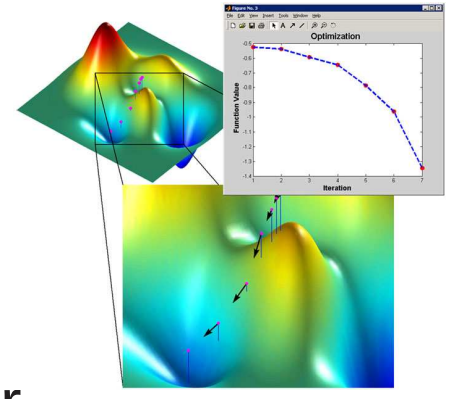
- Updated `parfor` command
  - Interleaving of parallel and serial code
- New batch command to run MATLAB® scripts
- Administrative features
  - Graphical user interface for defining user configurations
  - Parallel profiler
  - Admin Center
- Extended support for 3rd-party schedulers
  - PBS Pro™ and TORQUE schedulers



Math and Analysis
Optimization

R2007b R2008a

- Interior-point algorithm – for solving large problems
- Parallel computing options directly in:
  - Optimization Toolbox™
  - Genetic Algorithm and Direct Search Toolbox™

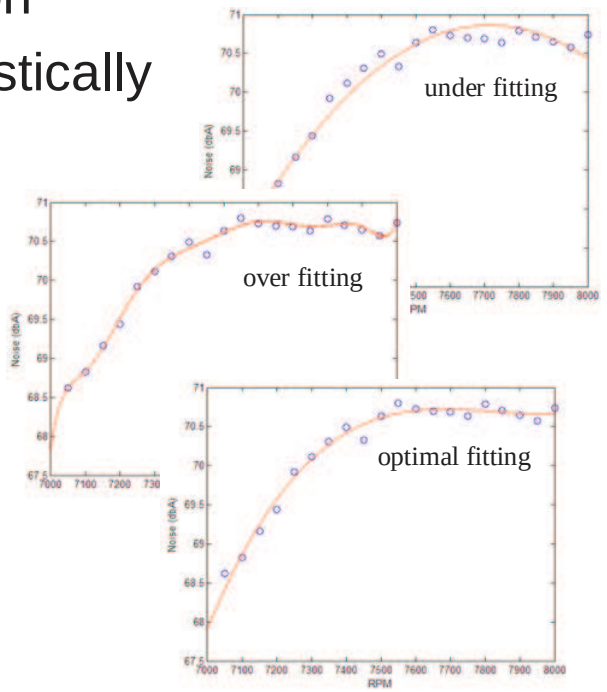


- Multi-objective genetic algorithm (MOGA) for solving problems with competing objectives
- Unified graphical-user interface for all optimization solvers

Math and Analysis
Statistics

R2008a

- 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

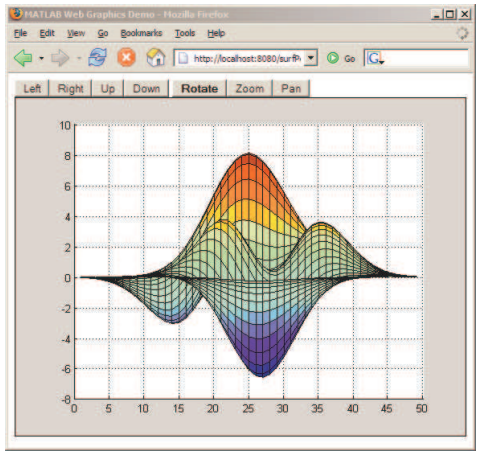


- Quasi-random number generator
  - Trade-off between simulation time and accuracy
    - Decrease run time
    - Improve accuracy

Application Deployment
MATLAB® Builder for Java™ 2.0

R2007b

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



Video Processing

R2007b

- 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
```

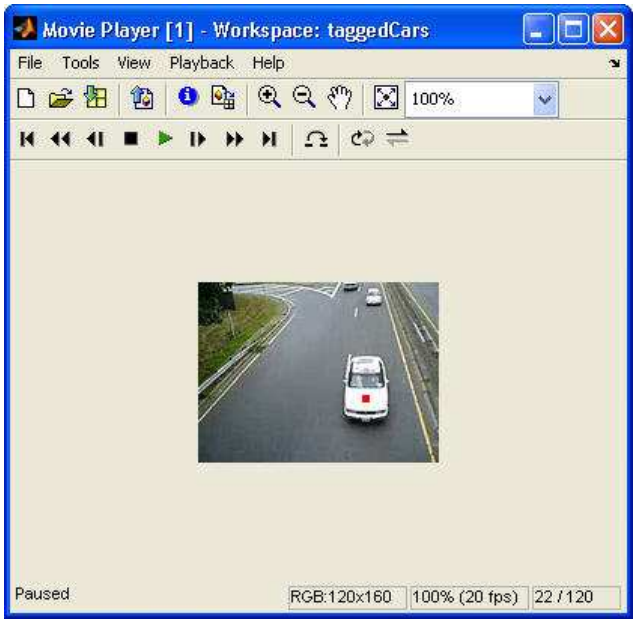
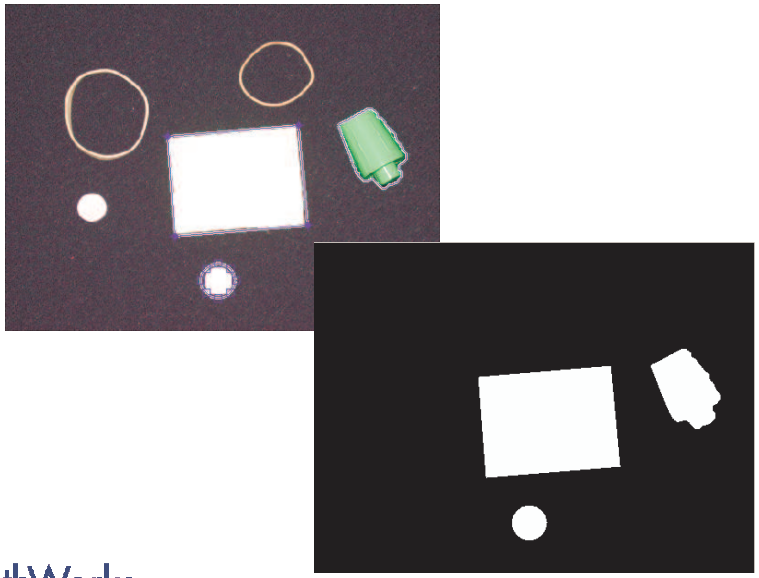


Image and Video Processing

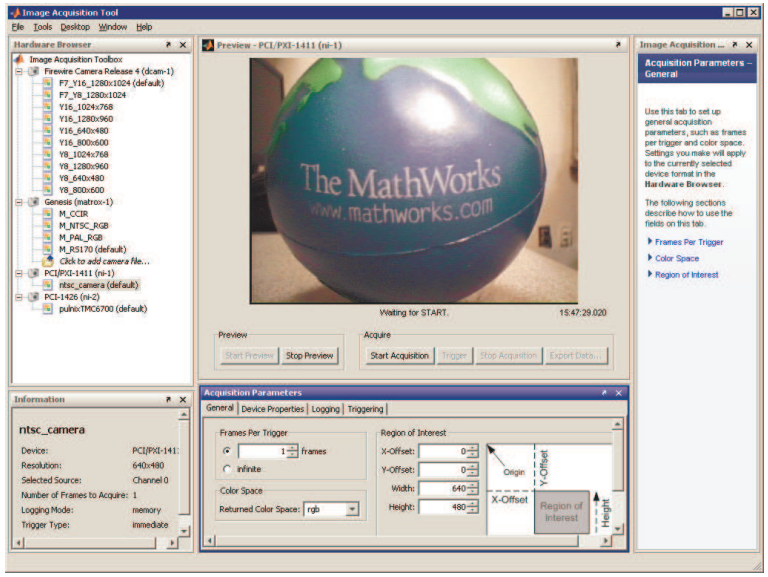
Improvements to Graphical User Interfaces

R2007b

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



- Image Acquisition Toolbox
  - Image Acquisition Tool



R2007b and R2008a Product Highlights
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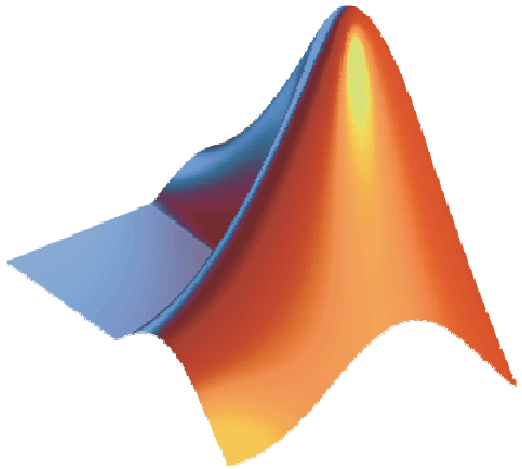
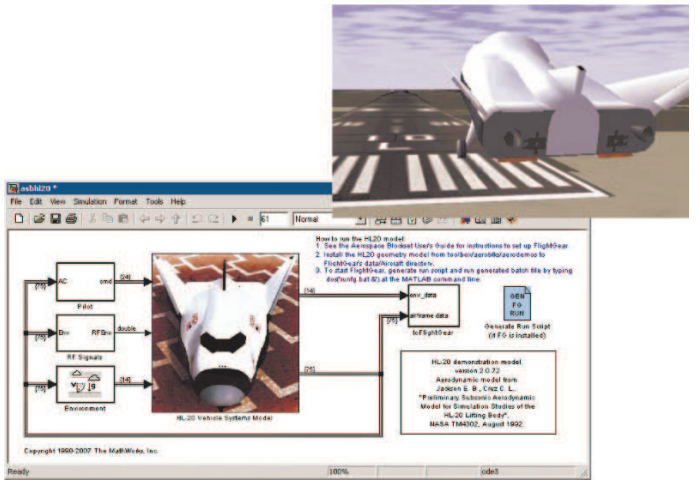
- Application deployment
- Image and video processing

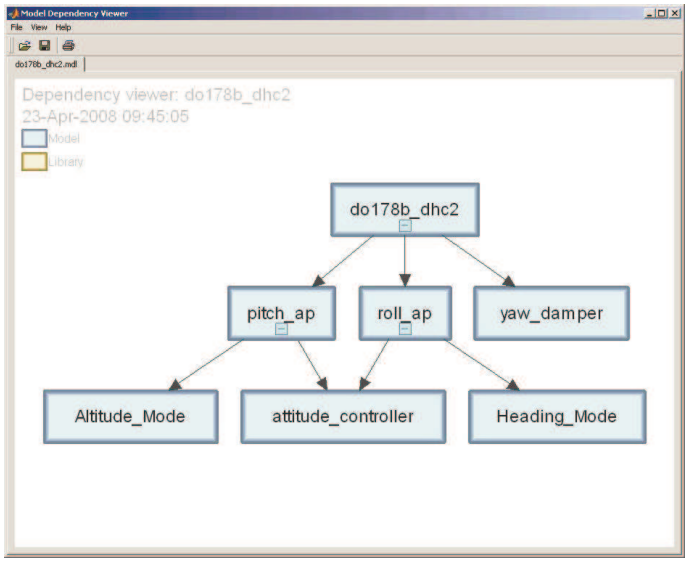


R2007b and R2008a Product Highlights

Simulink Product Family

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

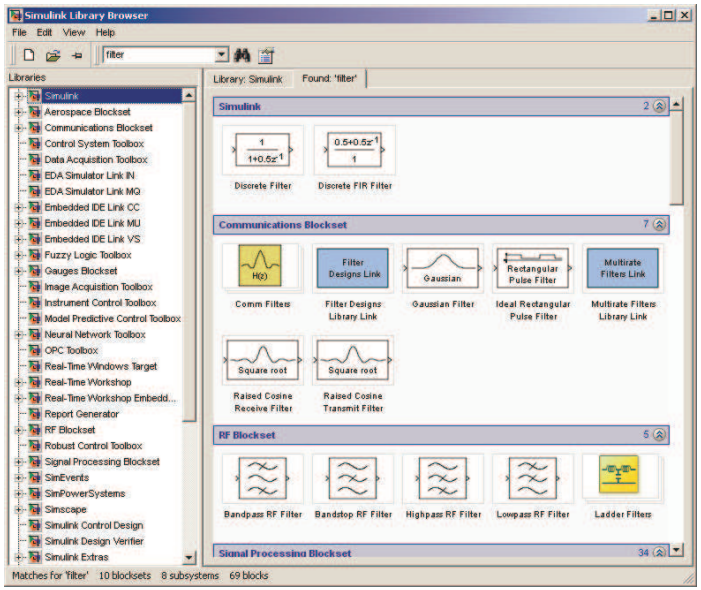




Simulink

R2007b R2008a

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



Simulink Library Browser

R2008a

Problem

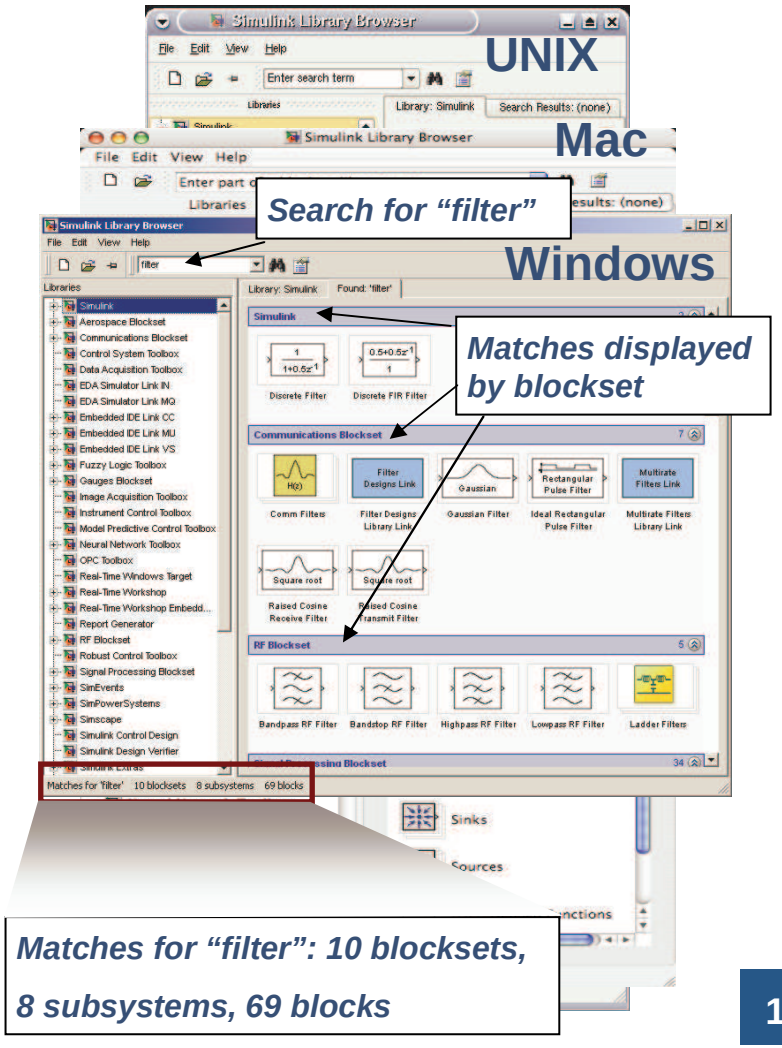
- Simulink library browser was a Windows-only feature
- Browsing or searching libraries could be slow
- Searching was incremental ➔ hard to find blocks with common names

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



New Simulation Modes in Simulink

R2007b

Problem

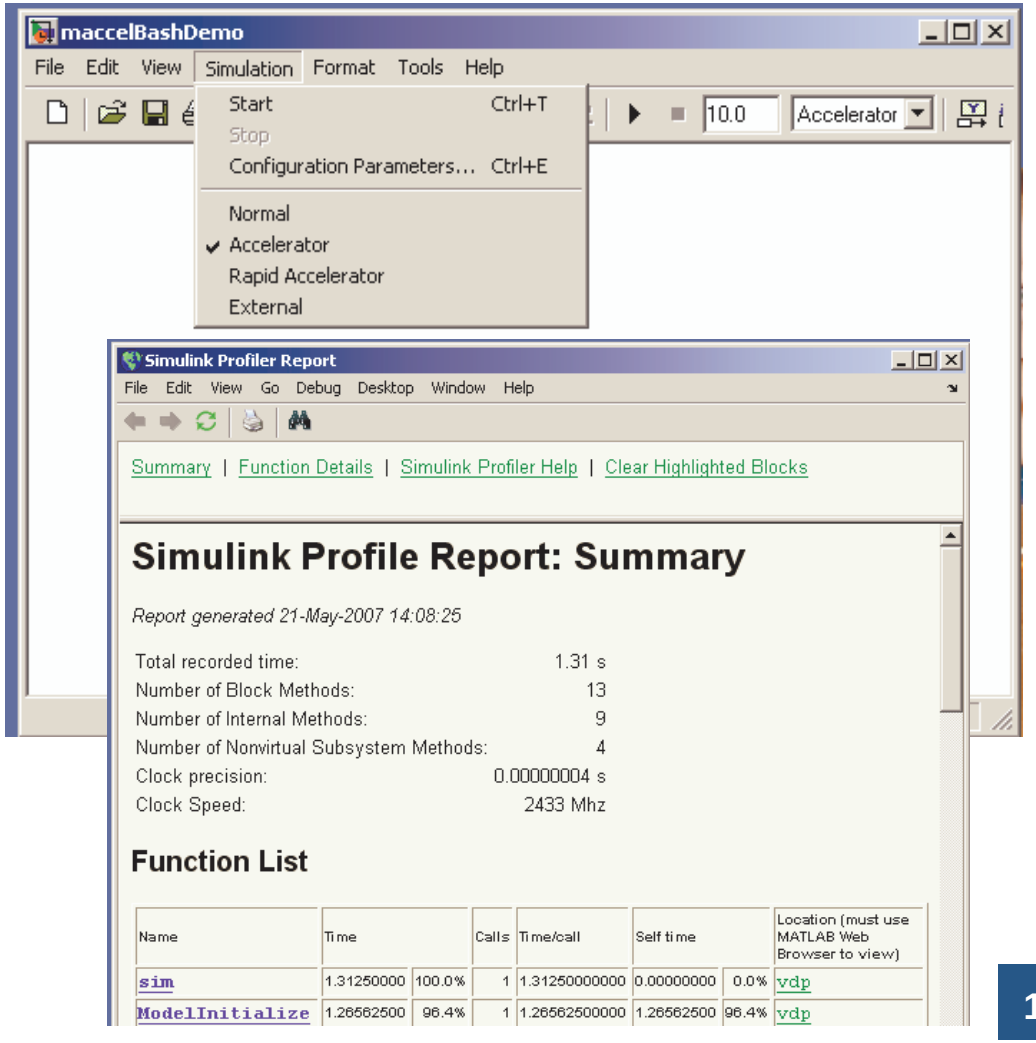
- Increased simulation performance needed as models grow in size
- Simulation acceleration and profiling need to be core capabilities of Simulink
- Simulink should use a second processing core if available

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



MathWorks
Aerospace and Defence Conference '08

Model Reference Normal Mode

R2007b

Problem

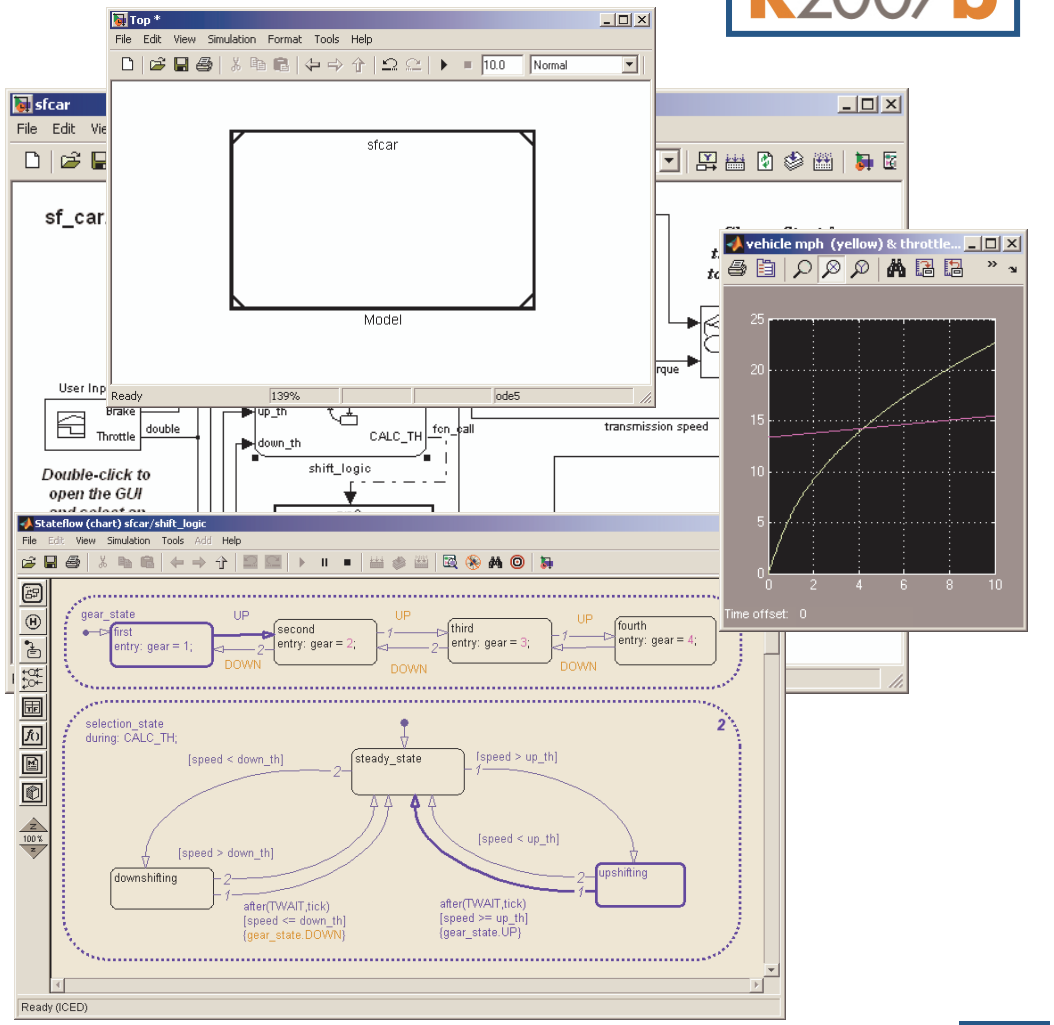
- Model reference can have slow turnaround time
  - Required code to be generated
- Many analysis and debugging tools did not work with referenced models

Solution

- Reference model in normal mode
  - no code generation needed

Benefit

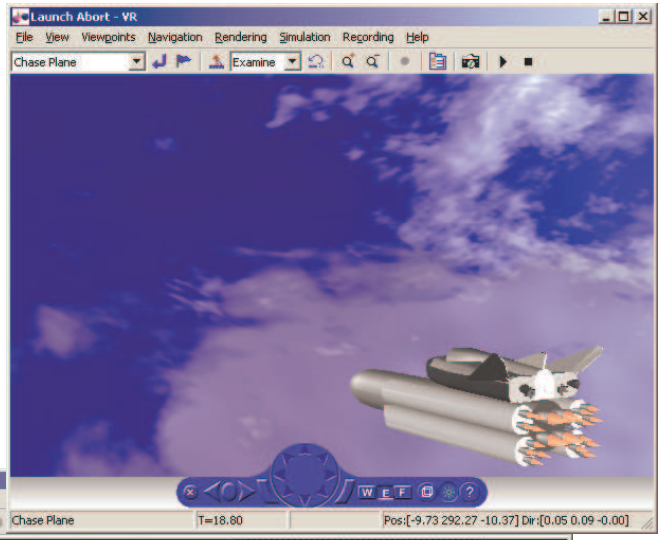
- Much faster turnaround when creating/changing referenced model
- Many tools now work in referenced model
  - Stateflow animation
  - Scopes
  - Model coverage
  - Linearization
  - Debugging…

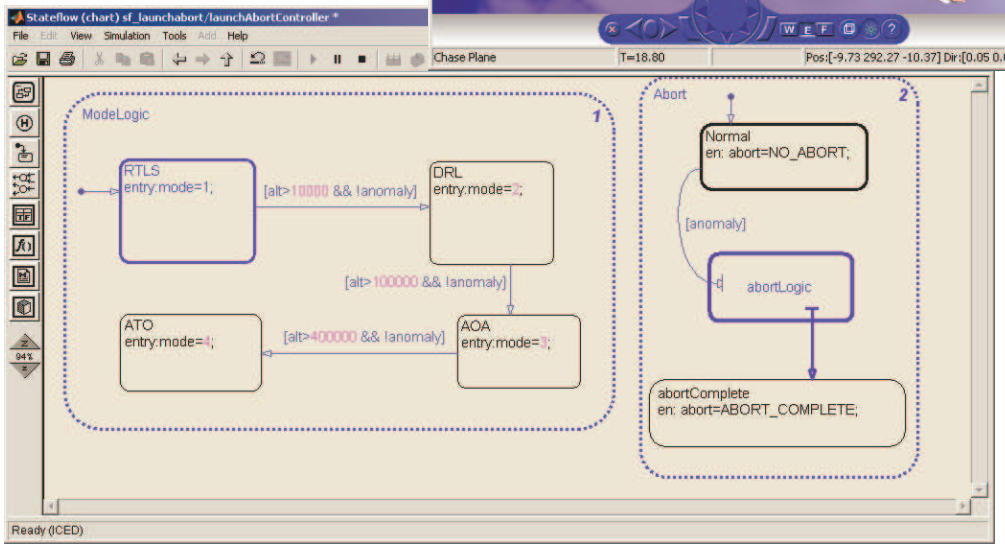


Stateflow®

R2007b R2008a

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





Asynchronous modelling

R2007b

Problem

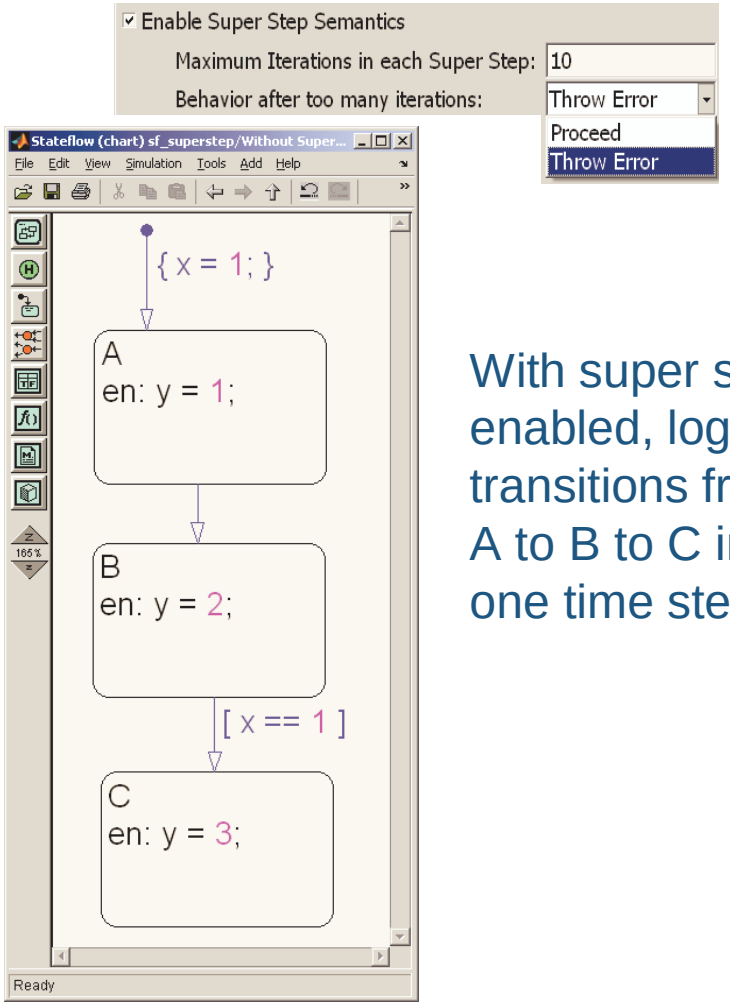
- Asynchronous modelling in Stateflow required overhead through the use of local event broadcasting or extra transitions

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

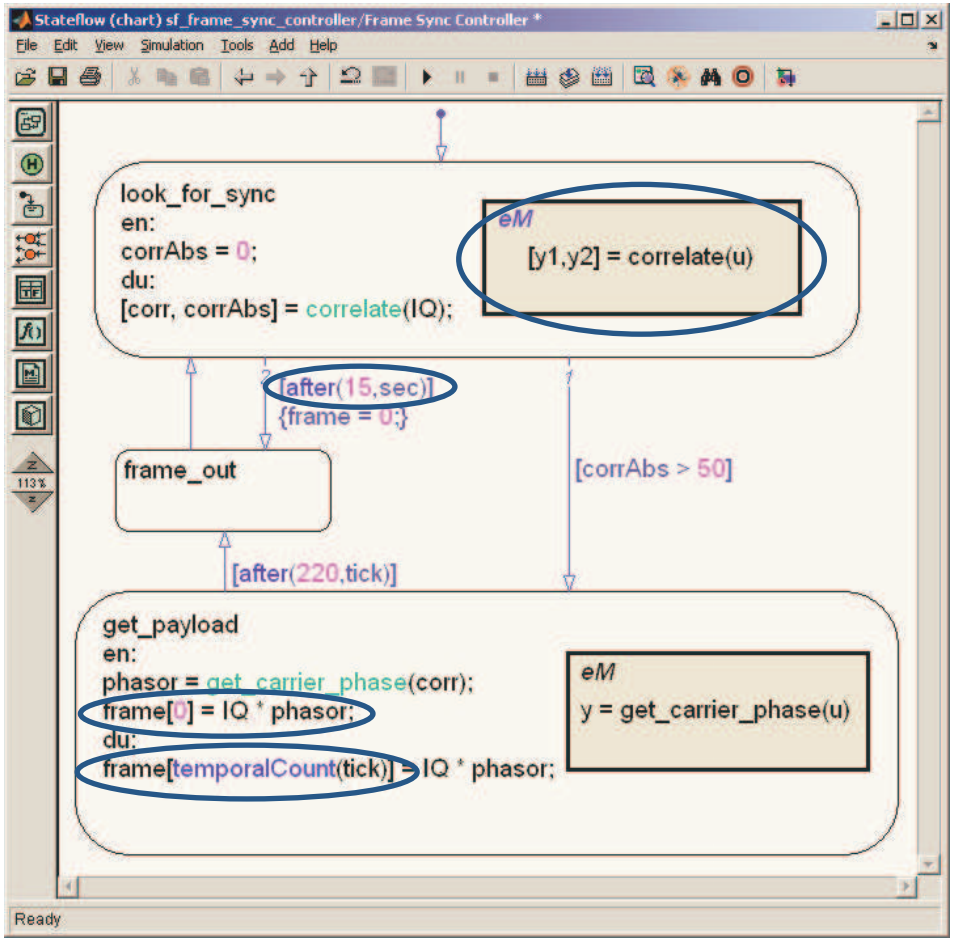


With super step enabled, logic transitions from A to B to C in one time step

Enhanced Language Constructs

R2007b R2008a

- 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

R2007b

Problem

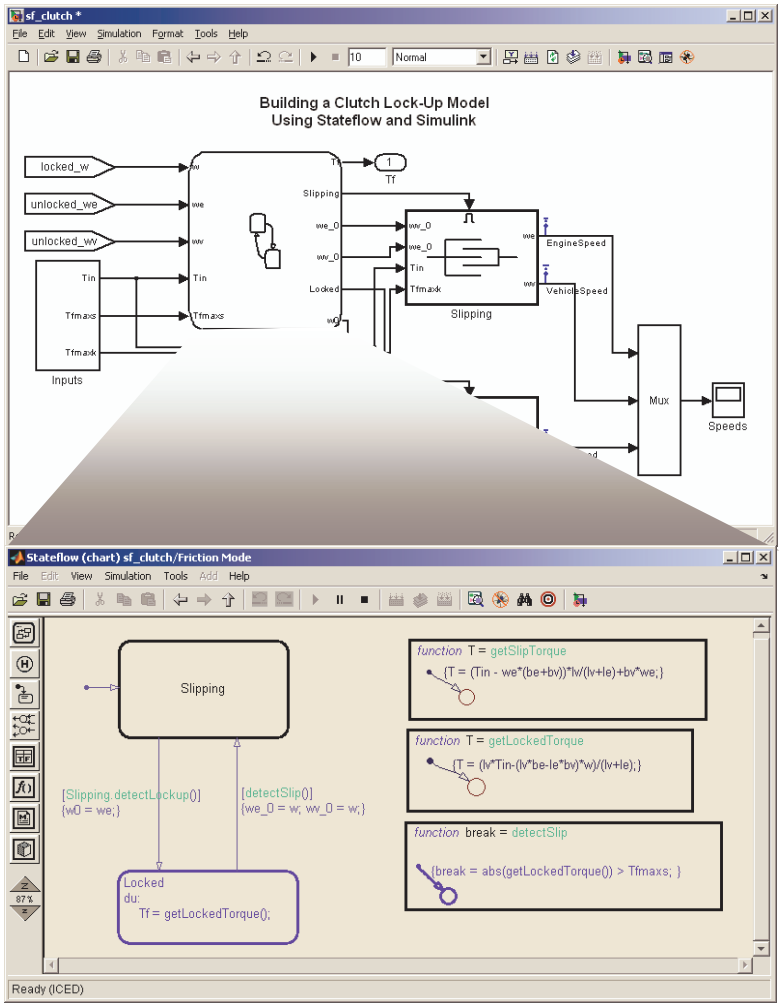
- It was not possible to use Stateflow to model logic coupled with instantaneous changes in dynamics (e.g., a clutch)

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

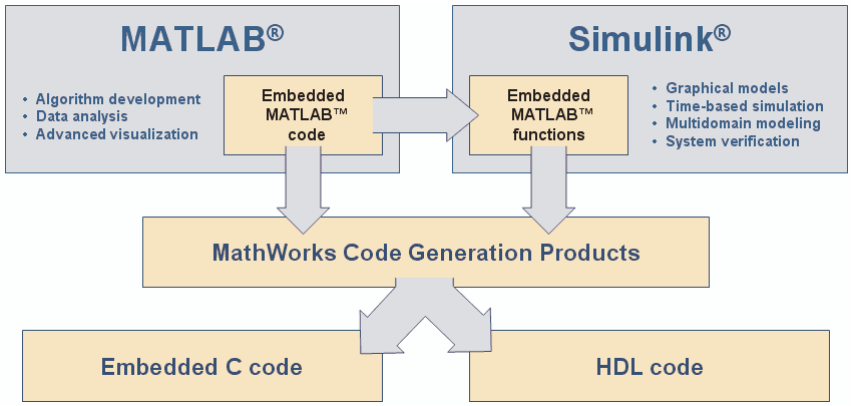
- Use Stateflow to define mode logic for continuous systems



Embedded MATLAB™ Functionality

R2007b R2008a

- 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

R2008a

Problem

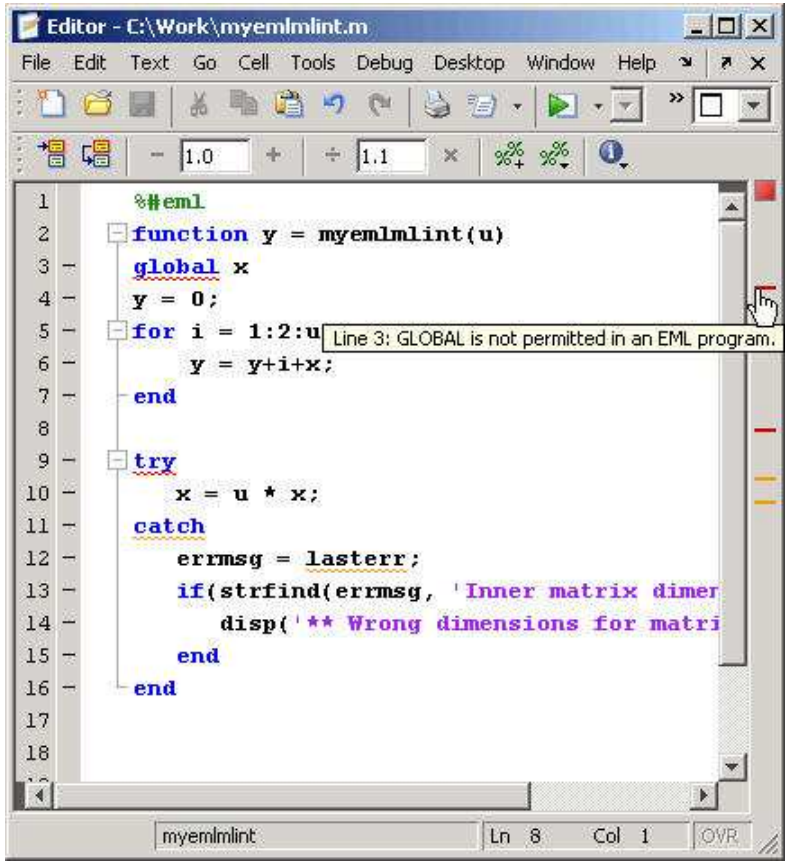
- How do I know my MATLAB function is compatible with the Embedded MATLAB subset?

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

R2007b

Problem

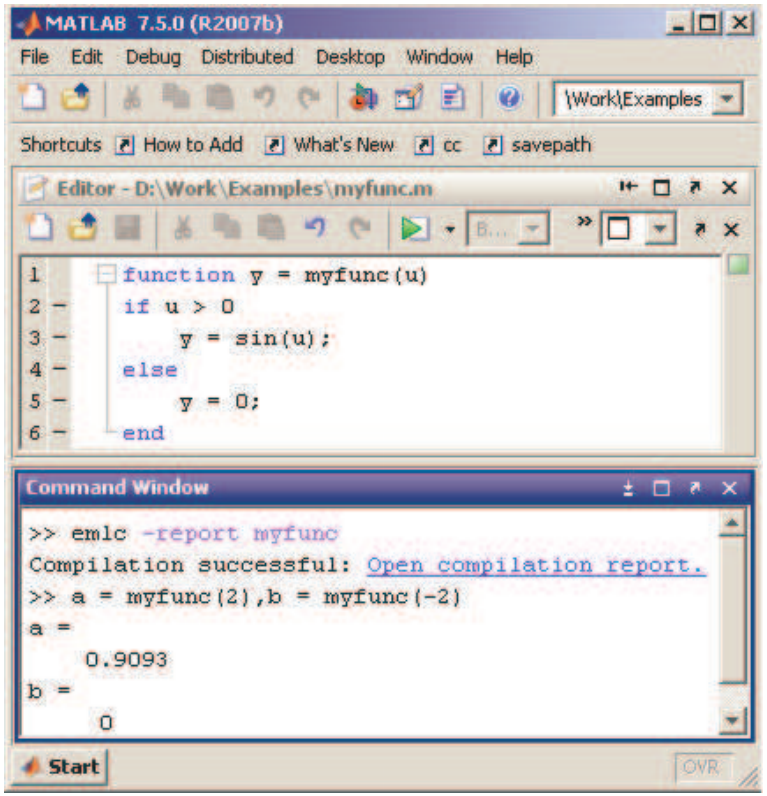
- How can I generate C code from standalone Embedded MATLAB code?

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

R2007b

Problem

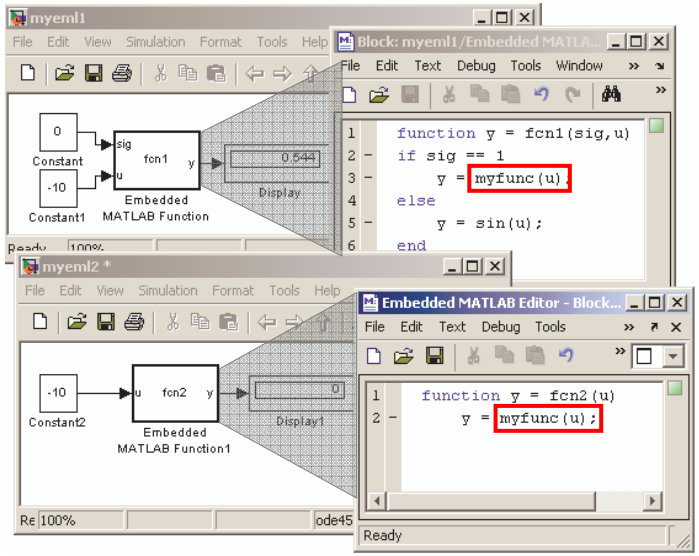
- How can I incorporate M-files into my simulation and still generate code?

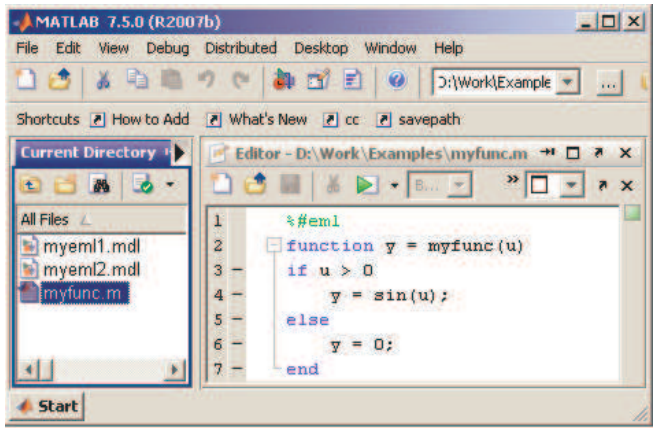
Solution

- 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

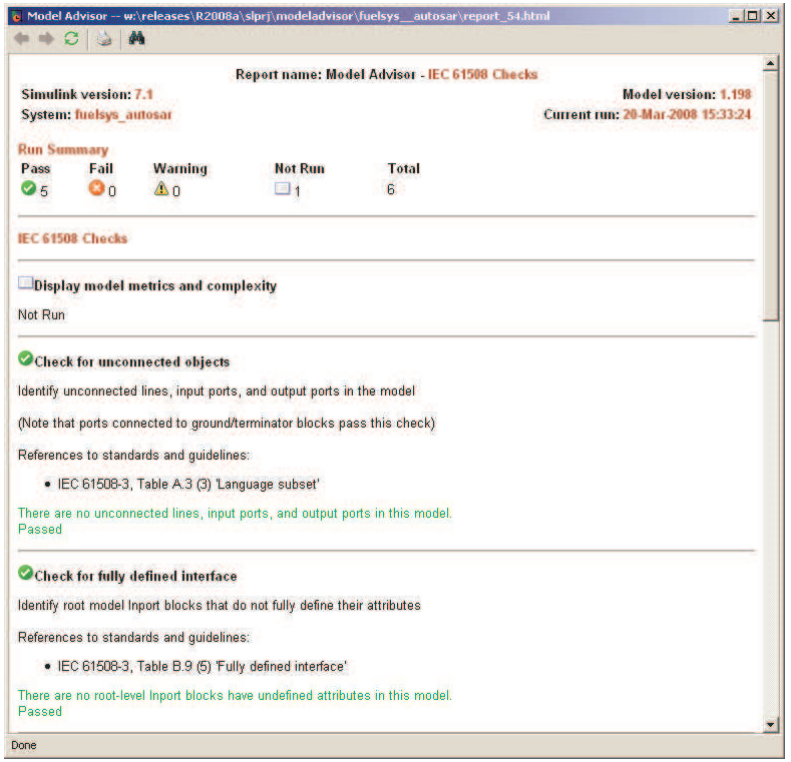




Model Verification and Validation

R2007b R2008a

- Modelling standards checks
- Automatic test vector generation and property proving



Simulink® Verification and Validation™

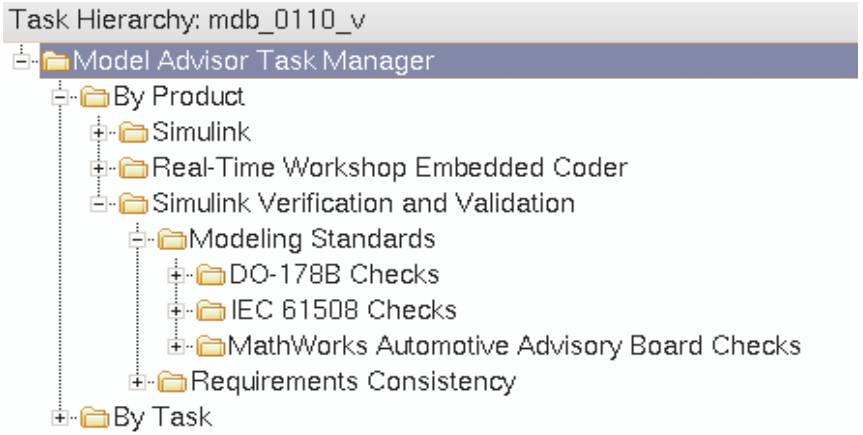
R2008a

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)

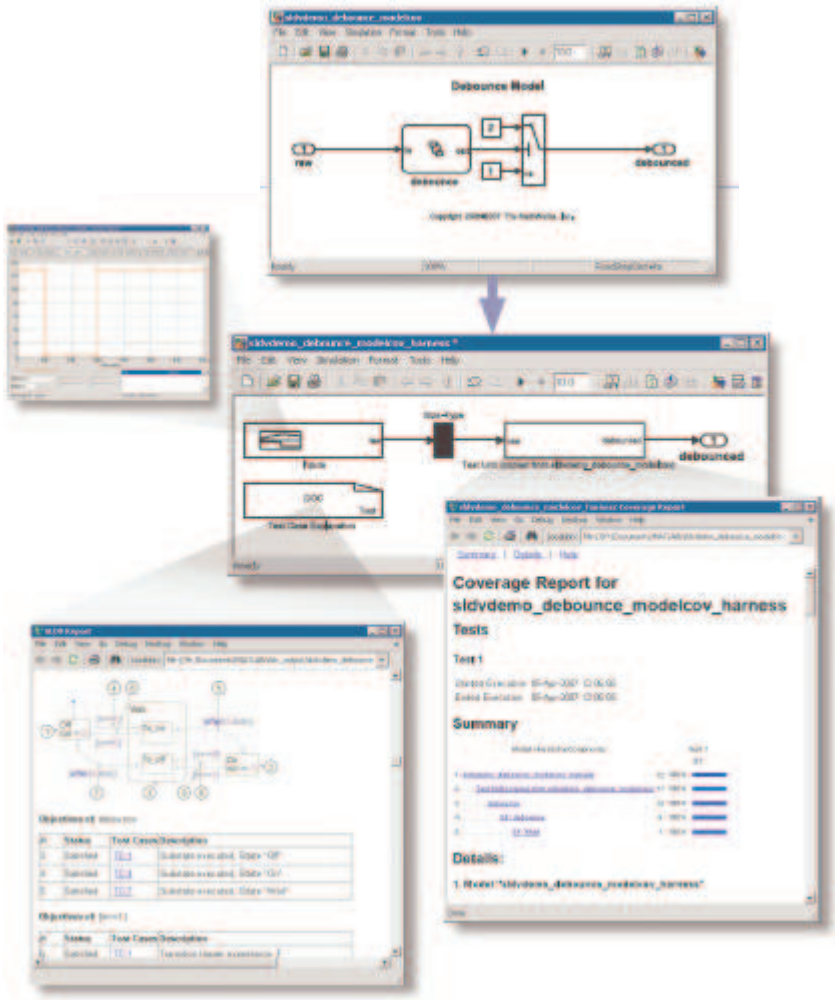


Simulink® Design Verifier™

Generate tests and prove model properties using formal methods

- Automatically generate tests for models
- Prove functional requirements
- Meet coverage goals

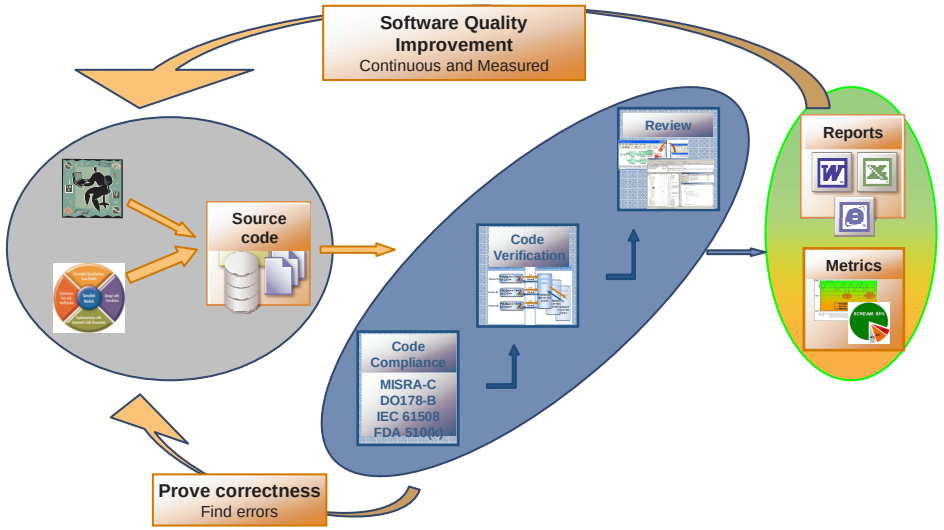
- Supports Simulink, Stateflow and Embedded MATLAB functions



Code Generation and Verification

R2007b R2008a

- Bi-directional traceability between model and code
- PolySpace
- Floating-point to fixed-point automated conversion



Bidirectional Traceability Between Model and Code

R2007b R2008a

Problem

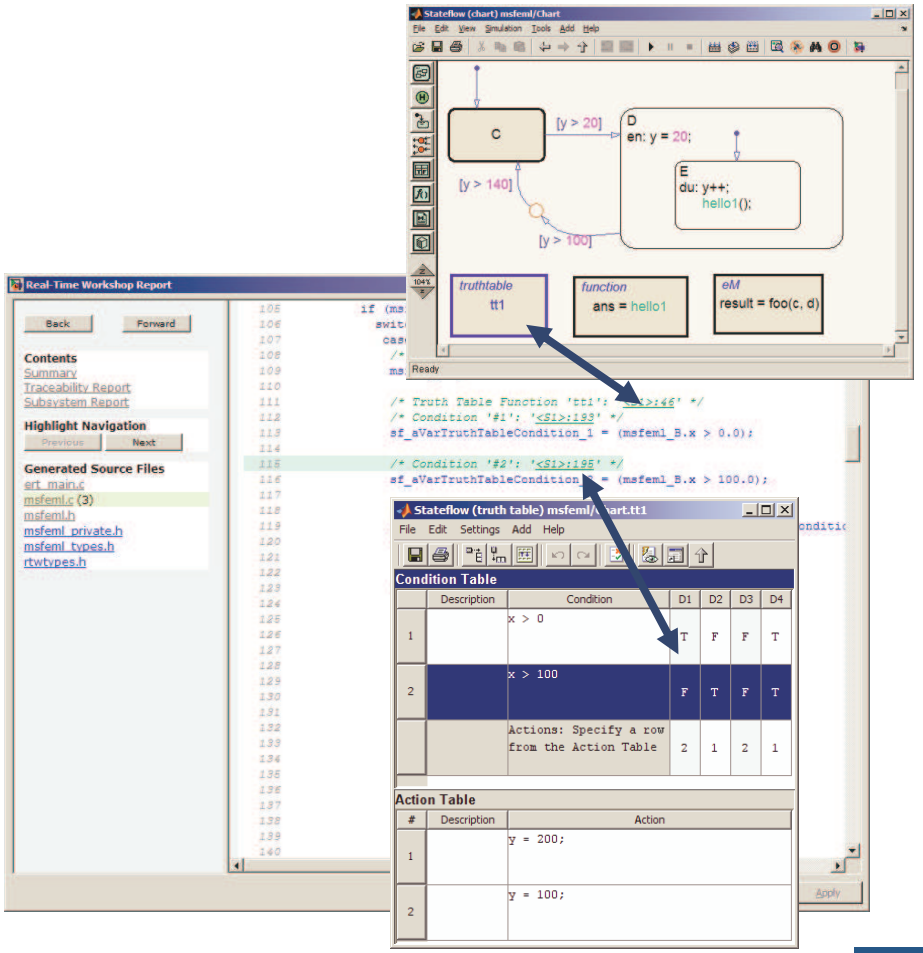
- No automated way to trace Simulink blocks, Stateflow chart and Embedded MATLAB functions to generated code

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

R2007b

- 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

```
static void Pointer_Arithmetic ()
{
  int tab[100];
  int i, *p = tab;

  for(i = 0; i < 100; i++, p++)
    *p = 0;

  if(get_bus_status() > 0)
  {
     if(get_oil_pressure() > 0)
       *p = 5; /* Out of bounds */
     else
       i++;
  }

  i = random_int();
  if (random_int())  *(p-i) = 10;

  if (0<i && i<=100)
  { p = p - i;
    *p = 5;     /* Safe pointer access */
  }
}
```

Floating-Point to Fixed-Point Automated Conversion

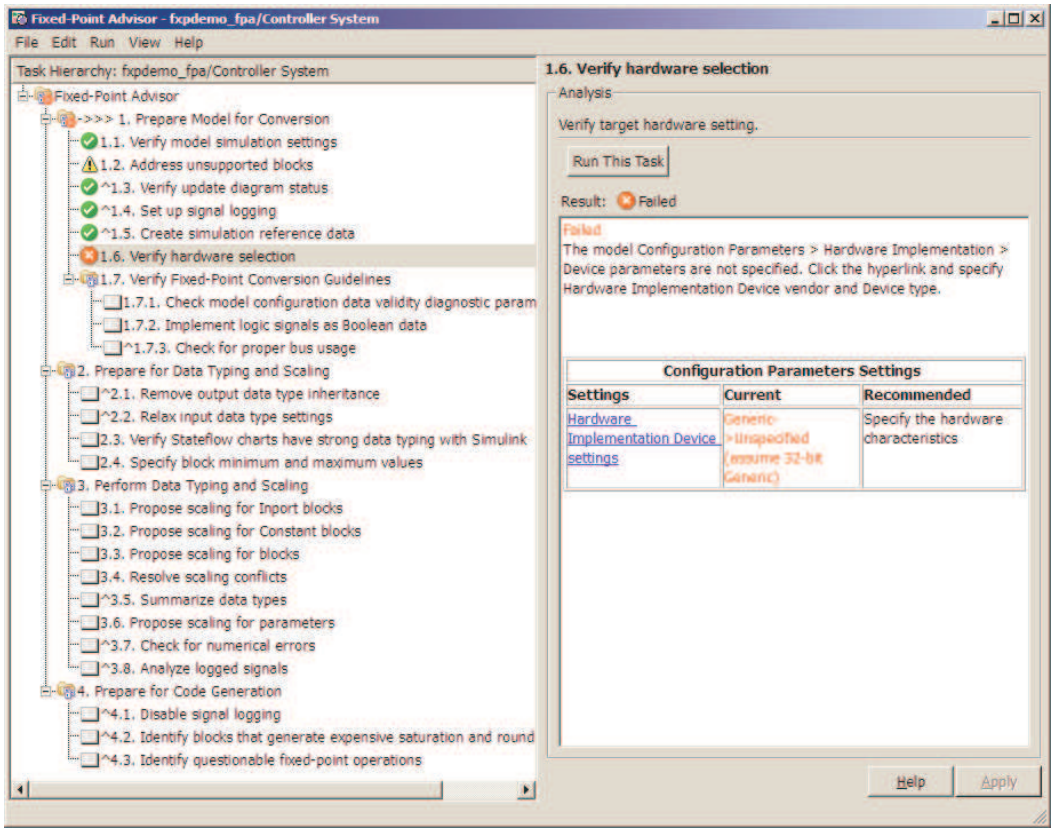
R2008a

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

R2007b

- Aerospace Toolbox 2
- Aerospace Blockset™ 3
- Communications Toolbox™ 4
- Simscape™ 2
- SystemTest™ 2

R2008a

- 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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