MATLAB EXPO
2021

MATLAB/Simulink 最新情報

山本　順久

MathWorks®

MATLAB® & SIMULINK®

R2019b

R2020a

R2020b

R2021a


Focus
Collaboration
Production

Focus

Collaboration

Production

Live Editor - C:\Demos\WeatherEventAnalysis\PreprocessData.mlx *

LIVE EDITOR | INSERT | VIEW

Demo_StormEventDataScience.mlx | AccessStormEventData.mlx * | PreprocessData.mlx *

Explore data

Plot some of the events on a map and use the size of the bubble as the damage cost.

```
threshold =   7640  ;
plotEventCostsMap(data,threshold);
```

Event frequency by location

Calculate damage costs by group.

```
damageByEvent = groupsummary(data,"weathercats",["mean","std"],"damage_total")
```

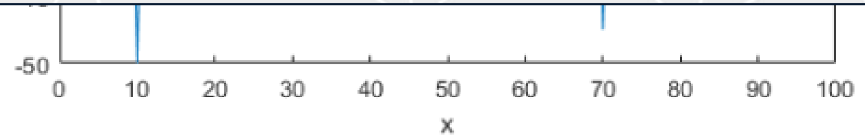
damageByEvent = 32×4 table

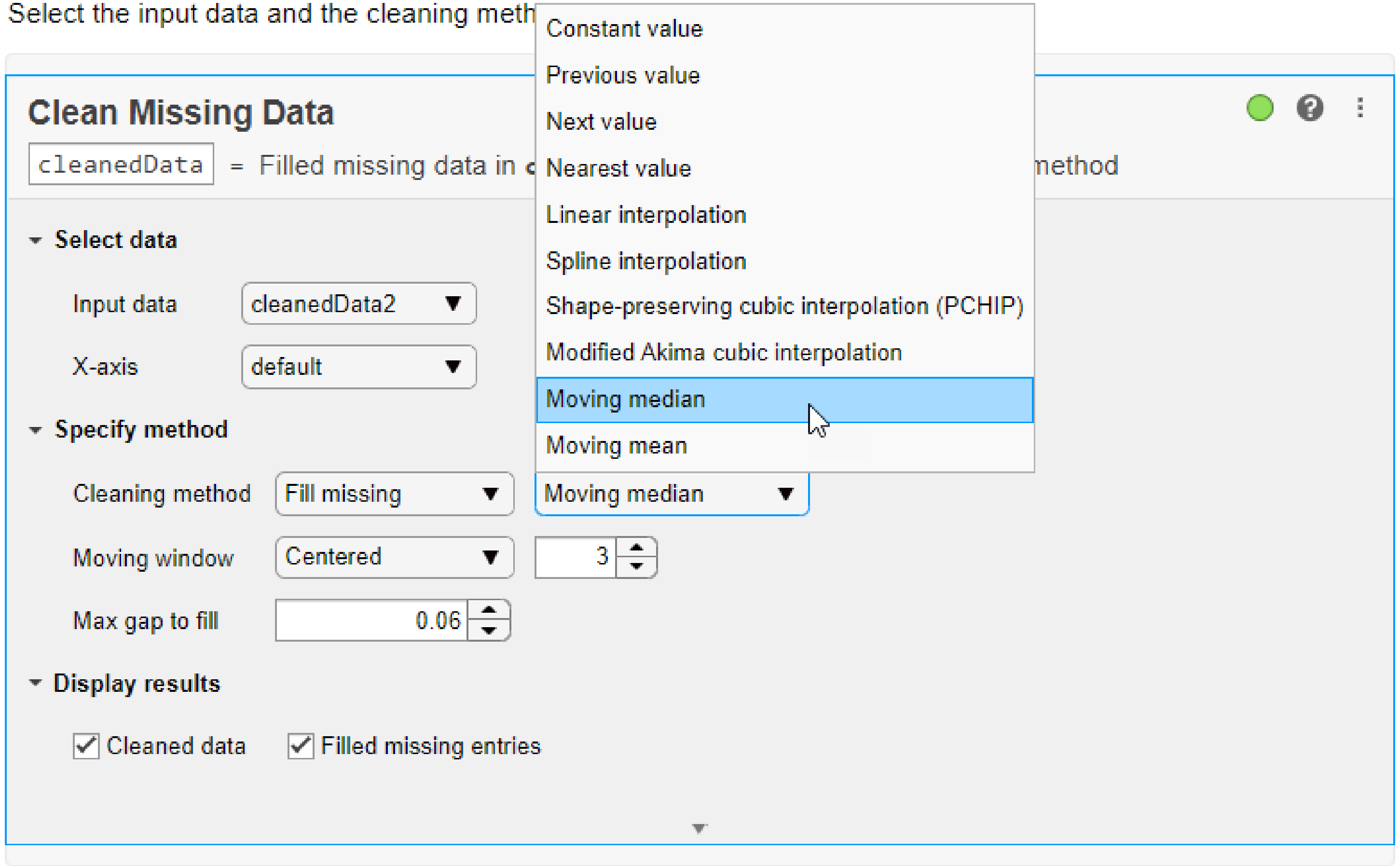
	weathercats	GroupCount	mean_damage_total	std_damage_total
1	Avalanche	39	1.2500	5.5160
2	Blizzard	961	4.8792	38.3841
3	Coastal Weather	6053	356.5849	1.1948e+04
4	Debris Flow	318	111.1654	736.8761
5	Dense Fog	1115	0.8292	9.3457
6	Dense Smoke	61	0	0
7	Drought	3584	0.1853	2.4966
8	Dust Devil	14	41.5714	132.2025
9	Dust Storm	151	8.8298	48.1969

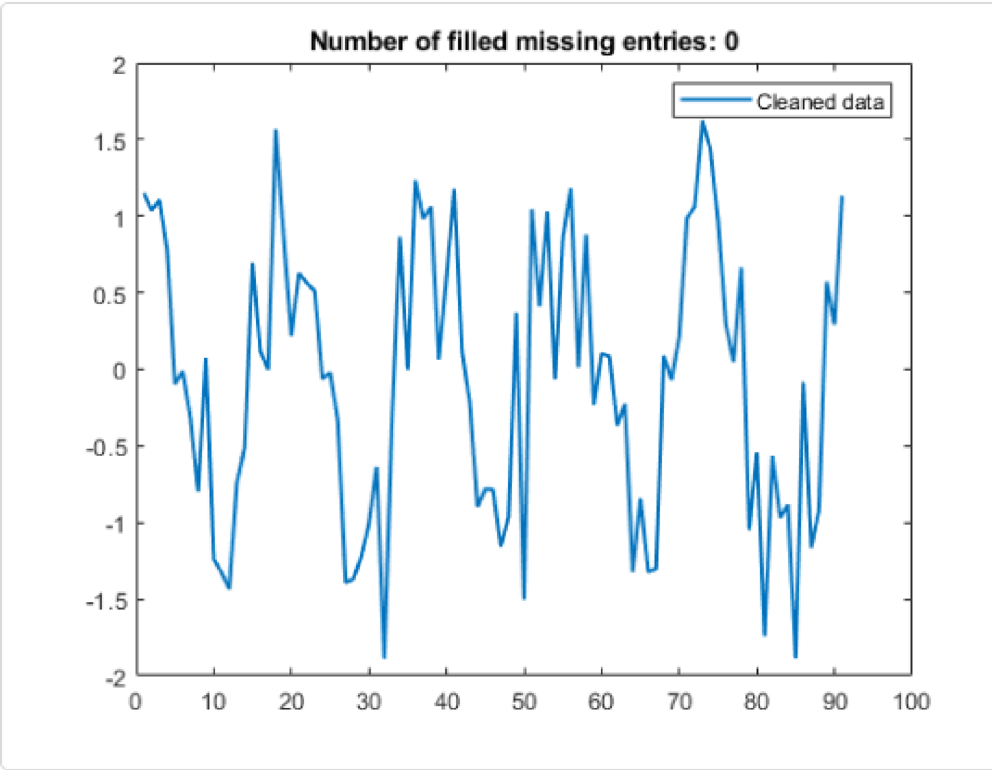
UTF-8 | LF | script | Ln 25 | Col 1

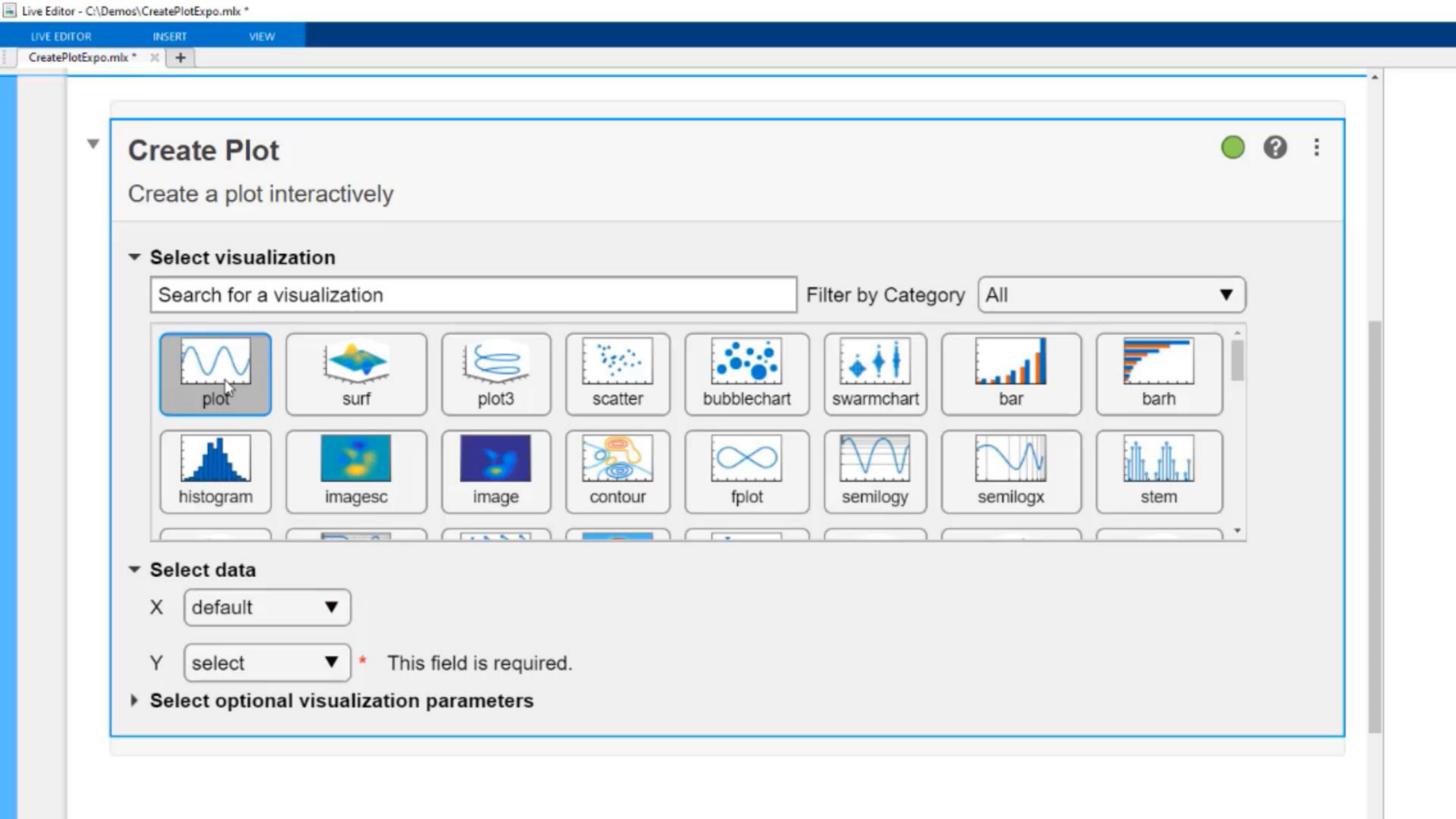
Fill Missing Data

To replace `NaN` values in the data and visualize the results, open the **Clean Missing Data** task. Start by typing the keyword `missing` in a code block, and then click `Clean Missing Data` when it appears in the menu. Select the input data and the cleaning meth








Live Editor - C:\Demos\CreatePlotExpo.mlx *
LIVE EDITOR
INSERT
VIEW
CreatePlotExpo.mlx *
Create Plot
Create a plot interactively
Select visualization
Search for a visualization
Filter by Category
All
plot
surf
plot3
scatter
bubblechart
swarmchart
bar
barh
histogram
imagesc
image
contour
fplot
semilogy
semilogx
stem
Select data
X
default
Y
select
This field is required.
Select optional visualization parameters

Live Editor Tasks make coding **optional**

DATA AND VISUALIZATION
- Create Plot

DATA PREPROCESSING
- Clean Missing Data
- Clean Outlier Data
- Find Change Points
- Find Local Extrema
- Remove Trends
- Smooth Data

TABLES AND TIMETABLES
- Join Tables
- Retime Timetable
- Stack Table Variables
- Synchronize Timetables
- Unstack Table Variables

OPTIMIZATION
- Optimize

CONTROL SYSTEM DESIGN AND ANALYSIS
- Convert Model Rate
- Reduce Model Order
- Tune PID Controller

PREDICTIVE MAINTENANCE
- Estimate Approximate Entropy
- Estimate Correlation Dimension
- Estimate Lyapunov Exponent
- Extract Spectral Features
- Reconstruct Phase Space

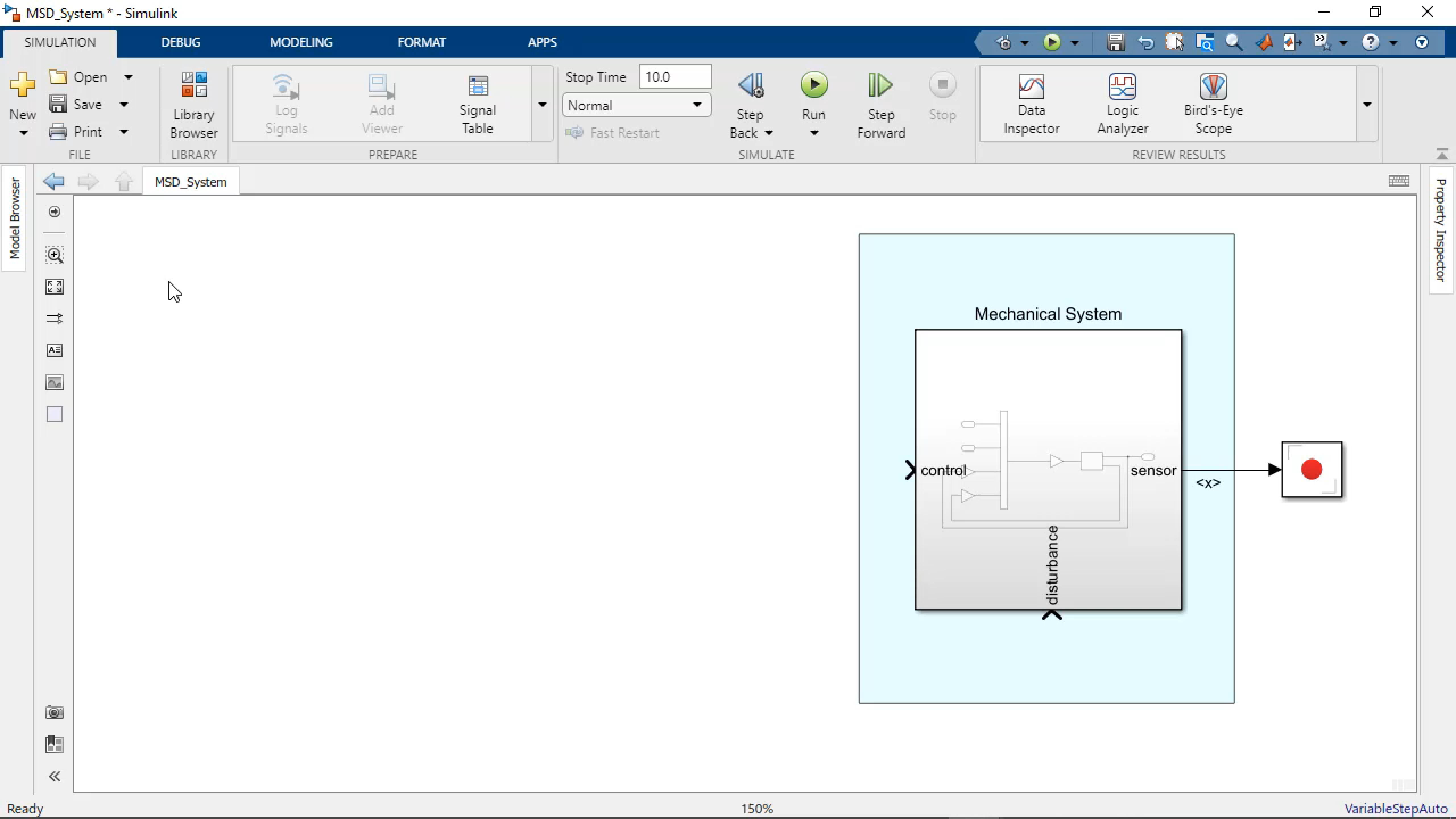
SYSTEM IDENTIFICATION
- Estimate Process Model
- Estimate State-Space Model

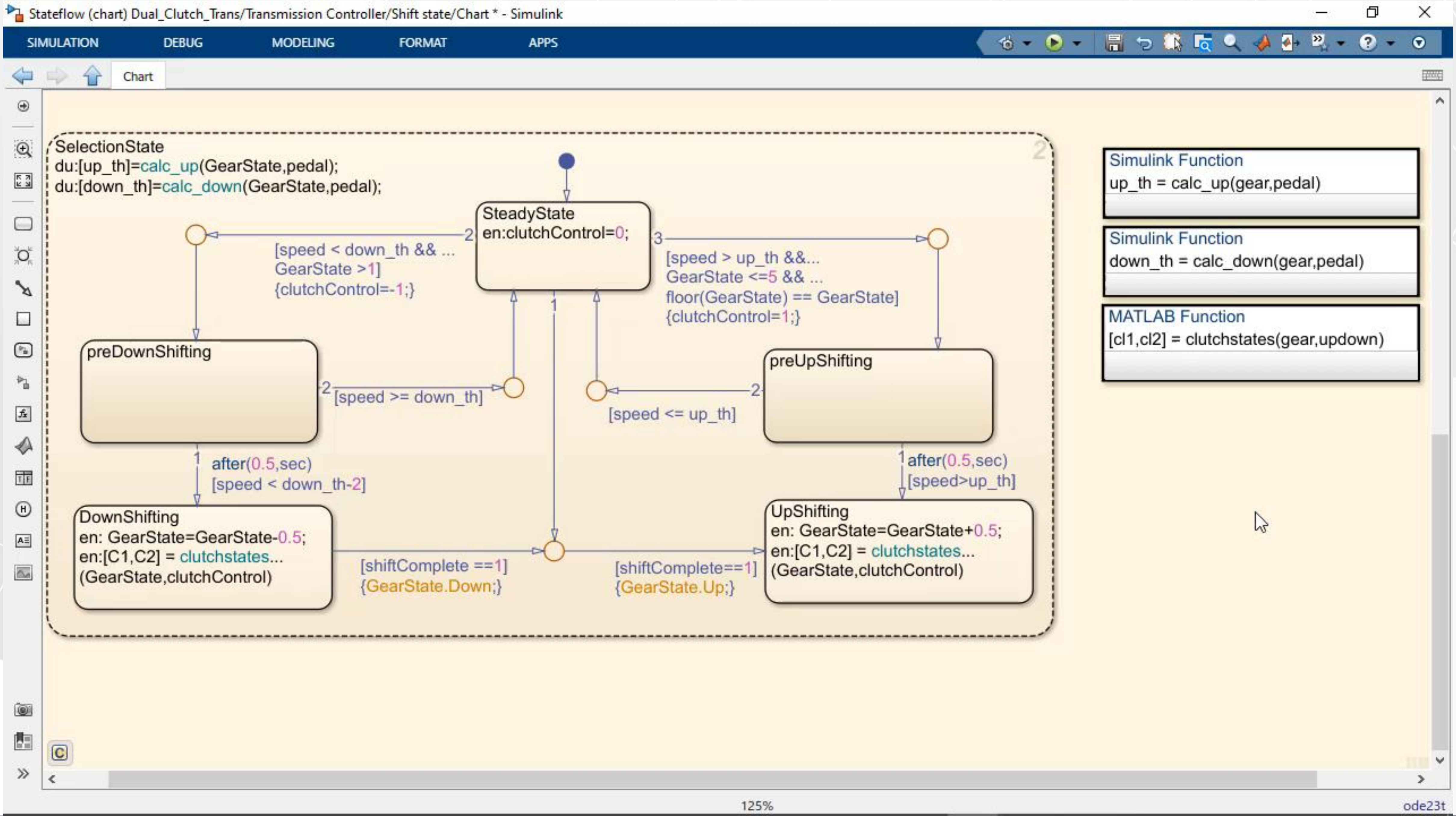
SIGNAL PROCESSING AND COMMUNICATIONS
- Extract Audio Features

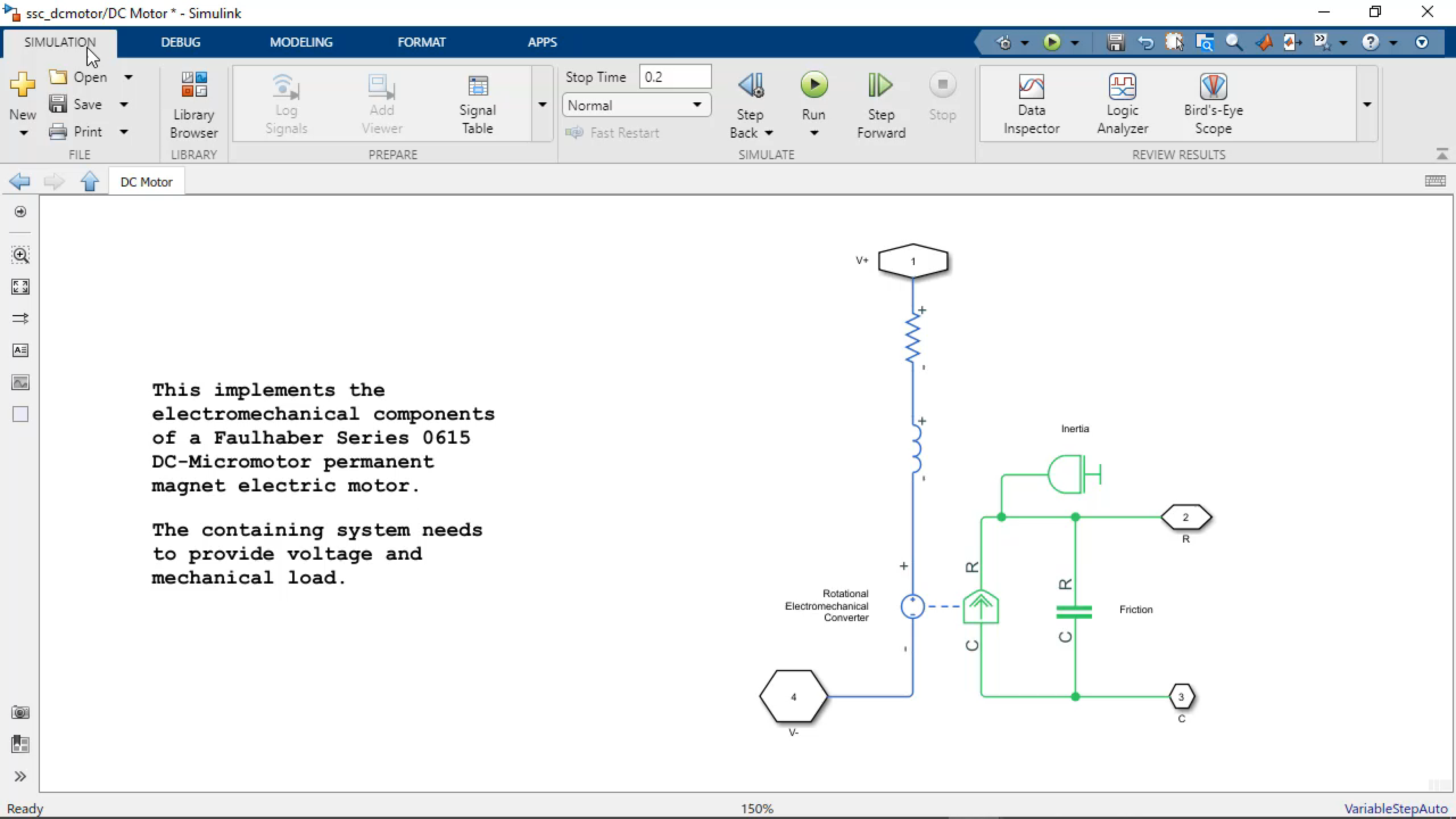
SYMBOLIC MATH
- Simplify Symbolic Expressio
- Solve Symbolic Equation

IMAGE ACQUISITION
- Acquire Webcam Image

Edit at the **Speed of Thought**


MSD_System * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
New
Open
Save
Print
FILE
Library Browser
LIBRARY
Log Signals
Add Viewer
Signal Table
PREPARE
Stop Time
10.0
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
SIMULATE
Data Inspector
Logic Analyzer
Bird's-Eye Scope
REVIEW RESULTS
Model Browser
MSD_System
Property Inspector
Mechanical System
control
sensor
disturbance
<x>
Ready
150%
VariableStepAuto

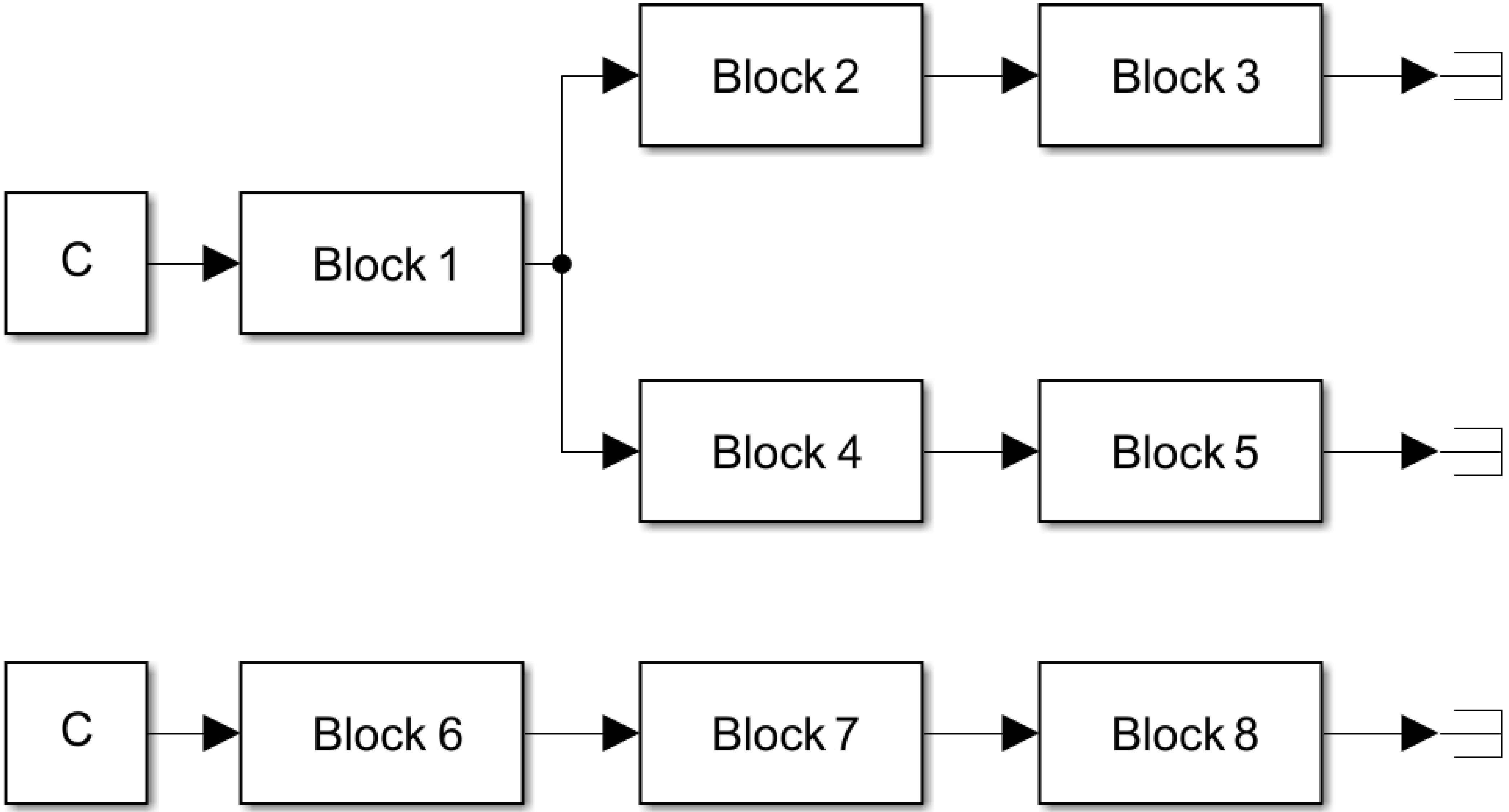

Stateflow (chart) Dual_Clutch_Trans/Transmission Controller/Shift state/Chart * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Chart
SelectionState
du:[up_th]=calc_up(GearState,pedal);
du:[down_th]=calc_down(GearState,pedal);
SteadyState
en:clutchControl=0;
[speed < down_th && ...
GearState >1]
{clutchControl=-1;}
[speed > up_th &&...
GearState <=5 && ...
floor(GearState) == GearState]
{clutchControl=1;}
preDownShifting
preUpShifting
[speed >= down_th]
[speed <= up_th]
after(0.5,sec)
[speed < down_th-2]
after(0.5,sec)
[speed>up_th]
DownShifting
en: GearState=GearState-0.5;
en:[C1,C2] = clutchstates...
(GearState,clutchControl)
UpShifting
en: GearState=GearState+0.5;
en:[C1,C2] = clutchstates...
(GearState,clutchControl)
[shiftComplete ==1]
{GearState.Down;}
[shiftComplete==1]
{GearState.Up;}
Simulink Function
up_th = calc_up(gear,pedal)
Simulink Function
down_th = calc_down(gear,pedal)
MATLAB Function
[cl1,cl2] = clutchstates(gear,updown)
125%
ode23t



ssc_dcmotor/DC Motor * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
New
Open
Save
Print
FILE
Library Browser
LIBRARY
Log Signals
Add Viewer
Signal Table
PREPARE
Stop Time
0.2
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
SIMULATE
Data Inspector
Logic Analyzer
Bird's-Eye Scope
REVIEW RESULTS
DC Motor
This implements the electromechanical components of a Faulhaber Series 0615 DC-Micromotor permanent magnet electric motor.
The containing system needs to provide voltage and mechanical load.
V+
1
Inertia
2
R
Rotational Electromechanical Converter
Friction
4
V-
3
C
Ready
150%
VariableStepAuto

Simulink runs faster

out-of-the box


C
Block 1
Block 2
Block 3
Block 4
Block 5
C
Block 6
Block 7
Block 8

Serial Execution

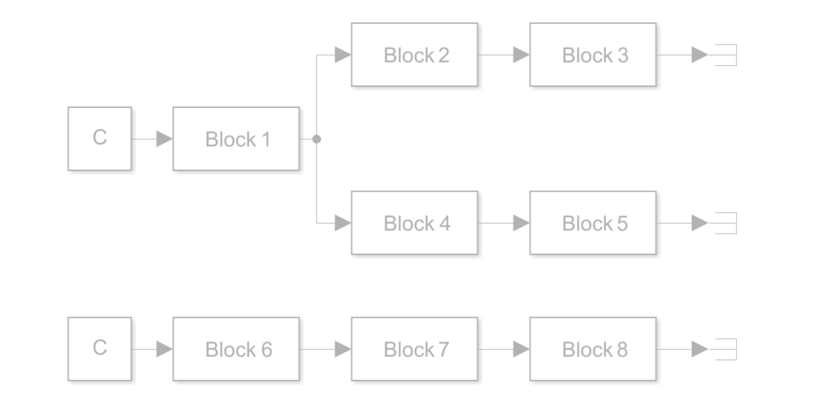
27 seconds

Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8

Parallel Execution

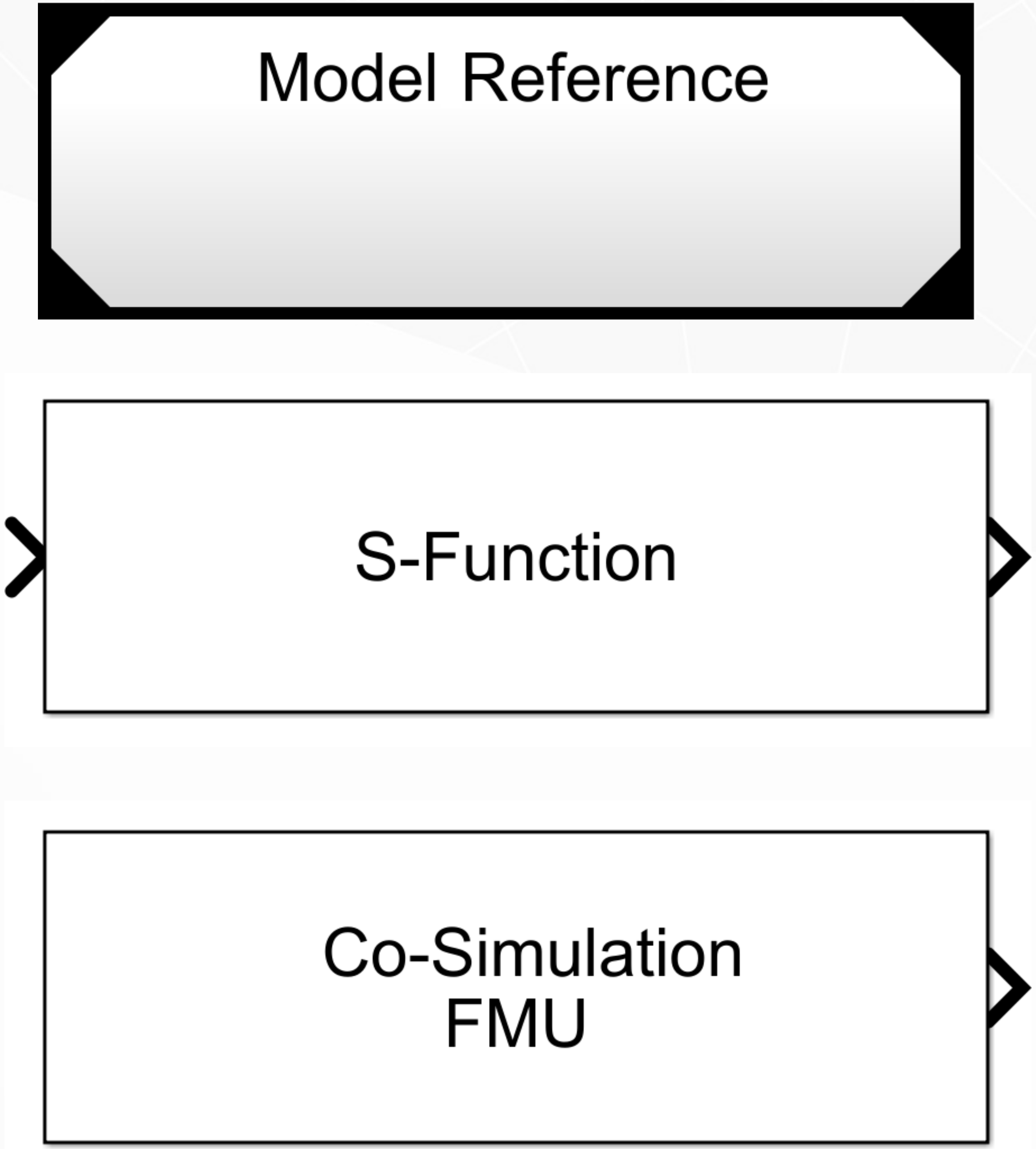
10 seconds

Thread 1	Block 1	Block 2	Block 3
Thread 2	Block 4	Block 5	
Thread 3	Block 6	Block 7	Block 8

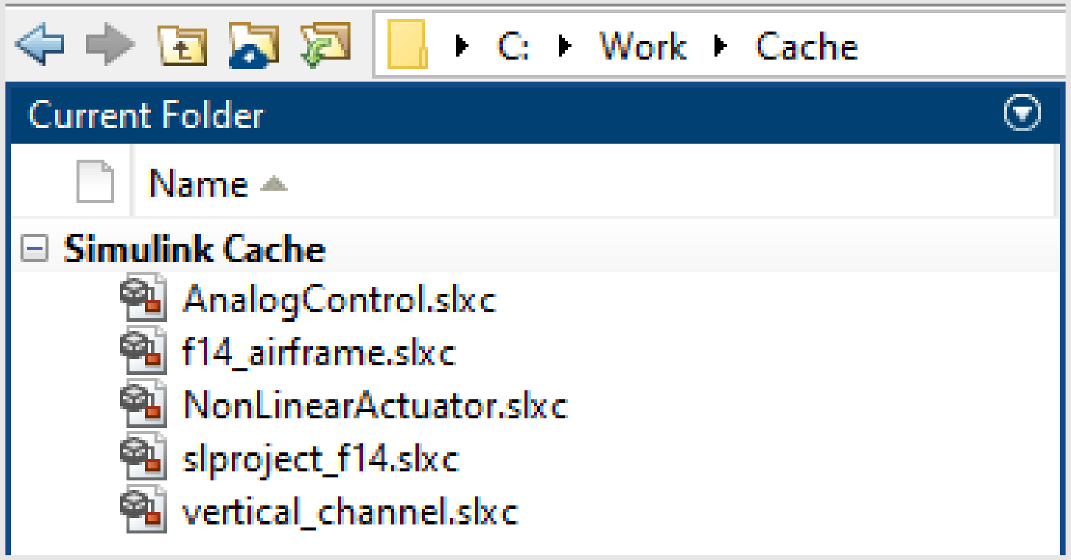


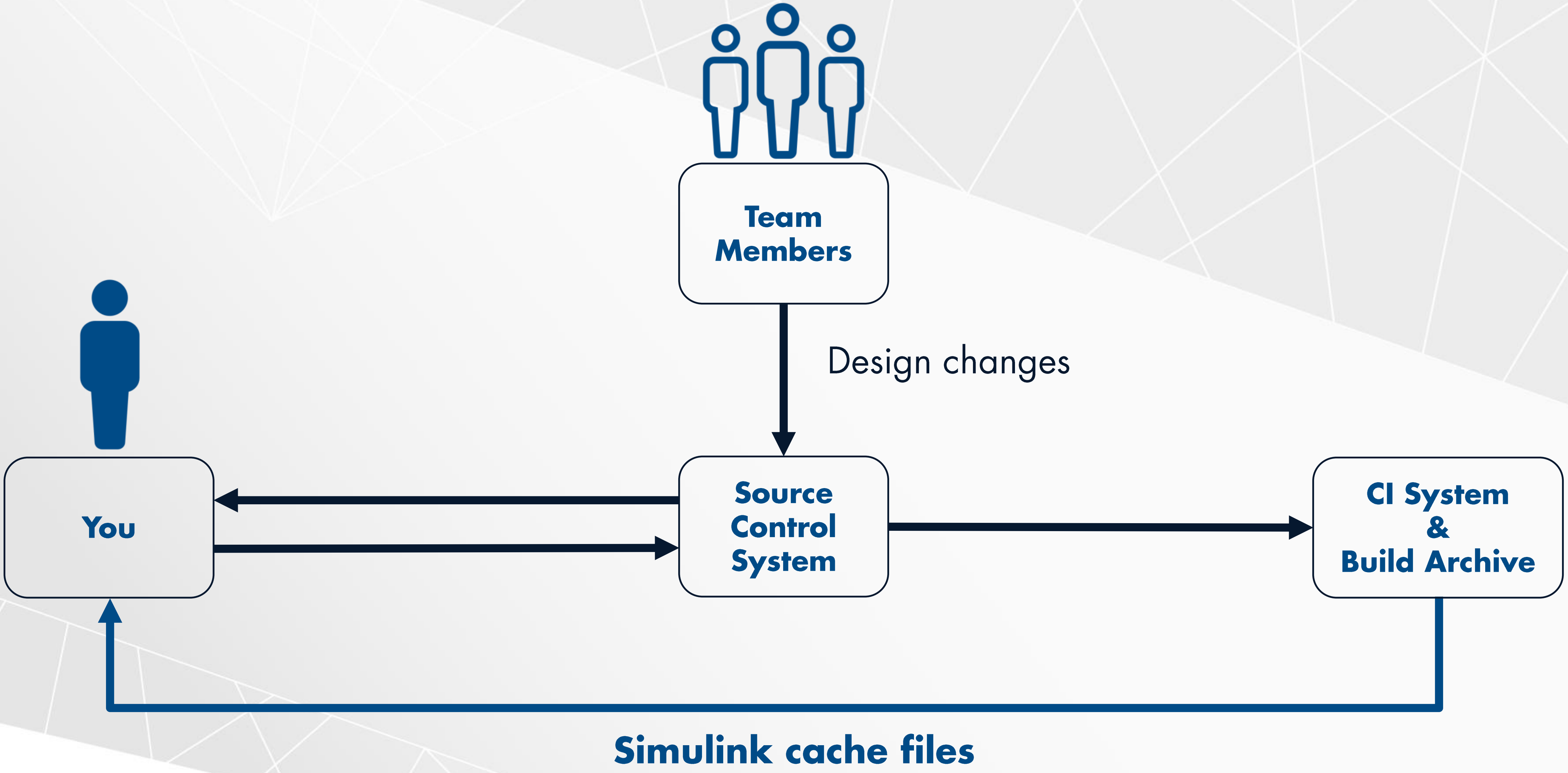
Parallel Execution

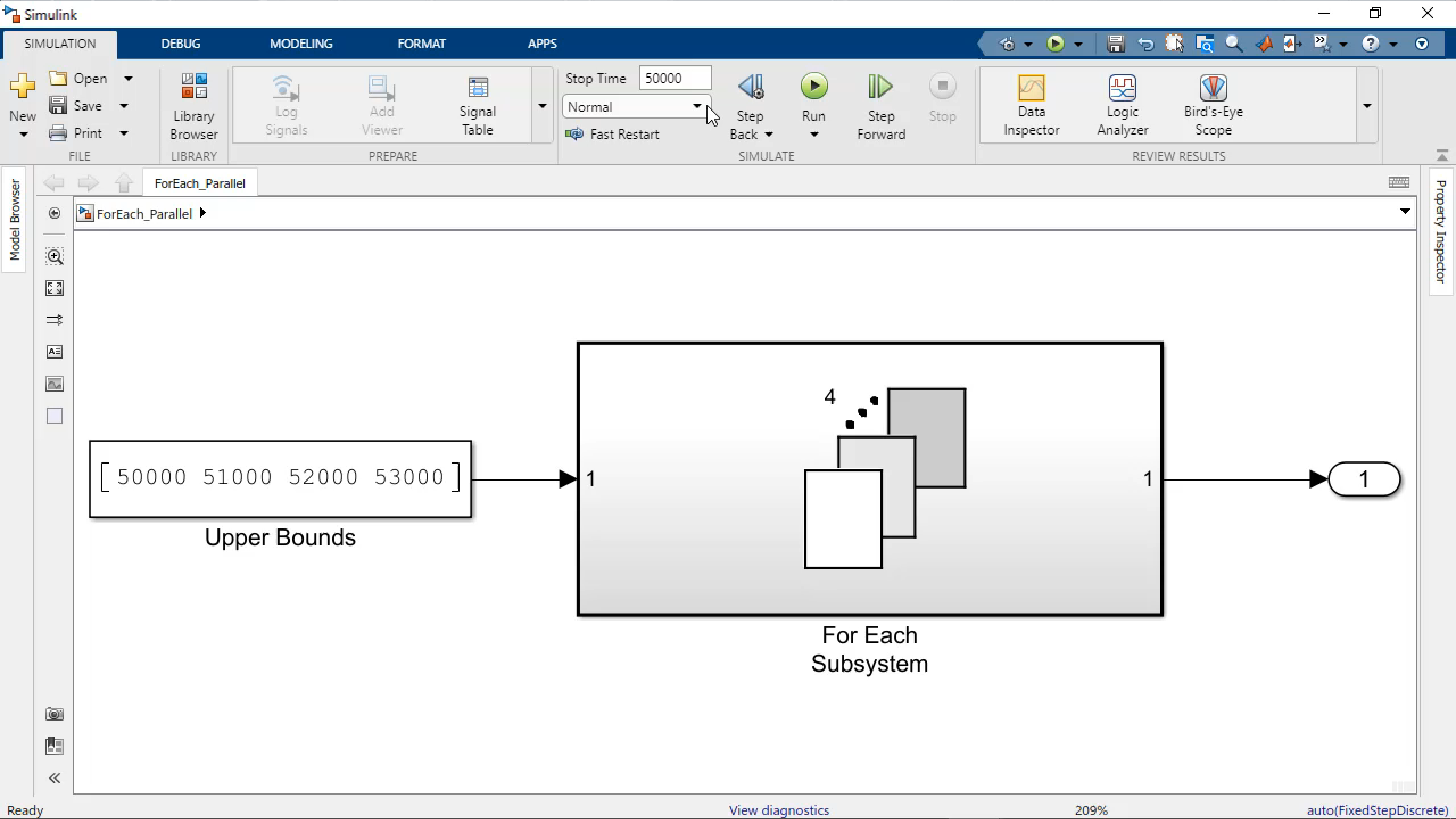
≈ 3x Speedup



Simulink Cache




Team Members
Design changes
You
Source Control System
CI System & Build Archive
Simulink cache files


Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
New
Open
Save
Print
FILE
Library Browser
LIBRARY
Log Signals
Add Viewer
Signal Table
PREPARE
Stop Time
50000
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
SIMULATE
Data Inspector
Logic Analyzer
Bird's-Eye Scope
REVIEW RESULTS
Model Browser
Property Inspector
ForEach_Parallel
ForEach_Parallel
[50000 51000 52000 53000]
Upper Bounds
4
1
1
For Each Subsystem
1
Ready
View diagnostics
209%
auto(FixedStepDiscrete)

SIMD: Single Instruction Multiple Data

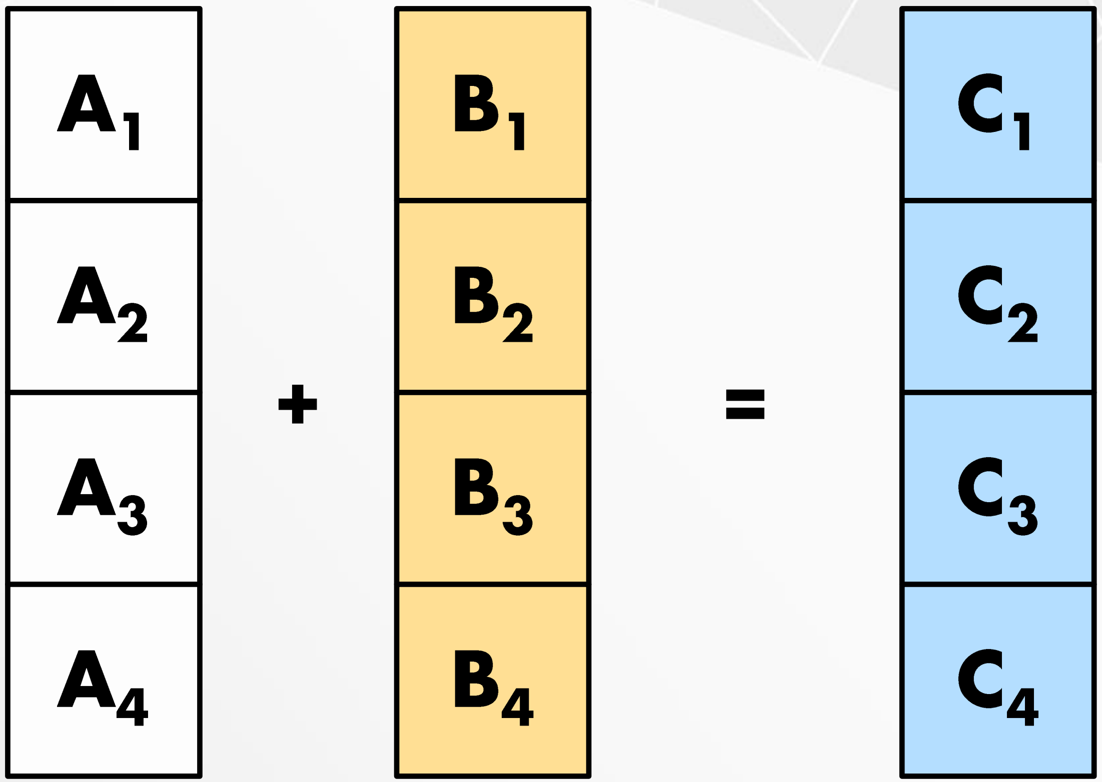
$$A_1 + B_1 = C_1$$

$$A_2 + B_2 = C_2$$

$$A_3 + B_3 = C_3$$

$$A_4 + B_4 = C_4$$

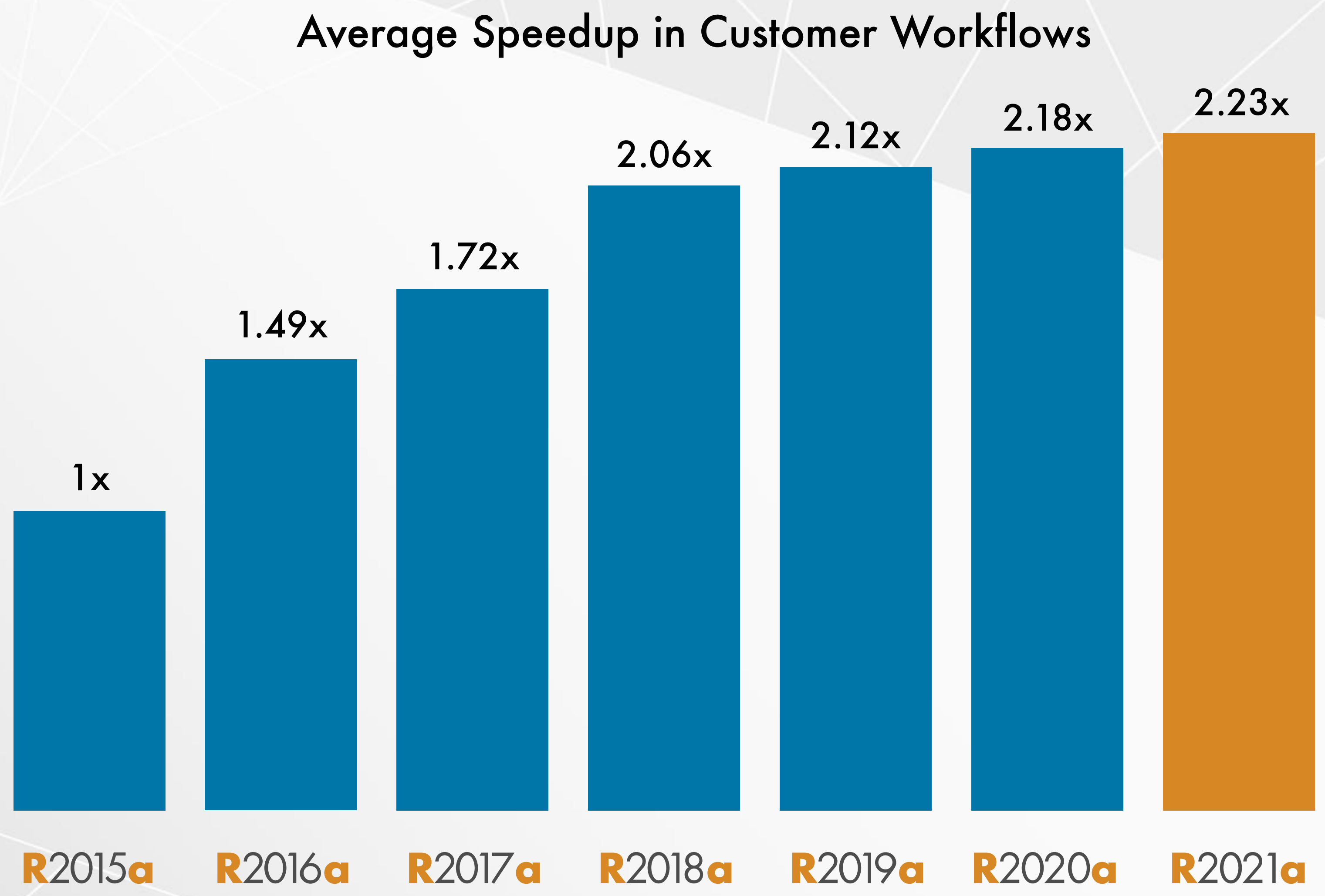
Scalar operation



SIMD operation

parsim

batchsim


Average Speedup in Customer Workflows
1x
1.49x
1.72x
2.06x
2.12x
2.18x
2.23x
R2015a
R2016a
R2017a
R2018a
R2019a
R2020a
R2021a

Area	Description	Performance Improvement	Release
Graphics	rendering performance, large data sets in UI figures	6x	R2020a

Area	Description	Performance Improvement	Release
Graphics	rendering performance, large data sets in UI figures	6x	R2020a
Indexing	`datetime`, `duration`, and `calendarDuration` arrays	25x	R2020a
	`table` arrays	2x	R2020a

Area	Description	Performance Improvement	Release
Graphics	rendering performance, large data sets in UI figures	6x	R2020a
Indexing	`datetime`, `duration`, and `calendarDuration` arrays	25x	R2020a
	`table` arrays	2x	R2020a
Sparse	matrix multiplication linear systems	4-5x	R2021a

MATLAB Release Notes

R2021a

R2021a

Performance

- Sparse Matrix Multiplication: Improved performance multiplying large sparse matrices
- Sparse Linear Systems: Improved performance solving sparse linear systems A*X = B with multicolumn B

MATLAB Release Notes

R2021a

R2021a

Performance

- Sparse Matrix Multiplication: Improved performance multiplying large sparse matrices
- Sparse Linear Systems: Improved performance solving sparse linear systems A*X = B with multicolumn B

R2021a

Performance

- Sparse Matrix Multiplication: Improved performance multiplying large sparse matrices
- Sparse Linear Systems: Improved performance solving sparse linear systems A*X = B with multicolumn B

Solving a linear system of the form `A*X = B` by executing `X = A\B` shows improved performance when `A` is a sparse square matrix and `B` is a matrix with two or more columns. The speedup applies to the solving step of the calculation but not the factorization step. The performance improvement arises from added support for multithreading, and therefore the speedup gets better as the number of columns in `B` increases.

For example, if you solve `A*X = B` using a `1e4`-by-`1e4` sparse coefficient matrix with approximately 40,000 nonzeros and a `B` matrix with 100 columns, performance in R2021a is about 5x faster than in R2020b on a machine with 6 physical cores. This code uses `decomposition` to factor the coefficient matrix, so only the solving process is timed. If you use `X = A\B` instead, you still see a speedup, but the time required to factor the matrix is included and has not changed.

```
function timingSparseBackslashMultRHS
rng default
A = sprand(1e4,1e4,0.0003) + speye(1e4);
B = sprand(1e4,100,0.002);
dA = decomposition(A);
tic
x = dA\B;
toc
end
```

The approximate execution times are:

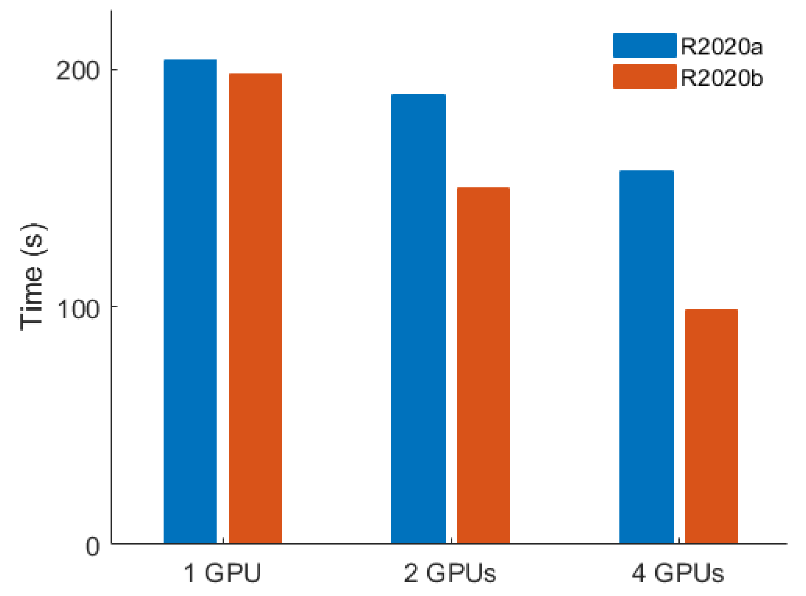
R2020b: 1.5 s

R2021a: 0.3 s

The code was timed on a Windows 10, Intel Xeon W-2133 CPU @ 3.60 GHz test system by calling the function `timingSparseBackslashMultRHS`.

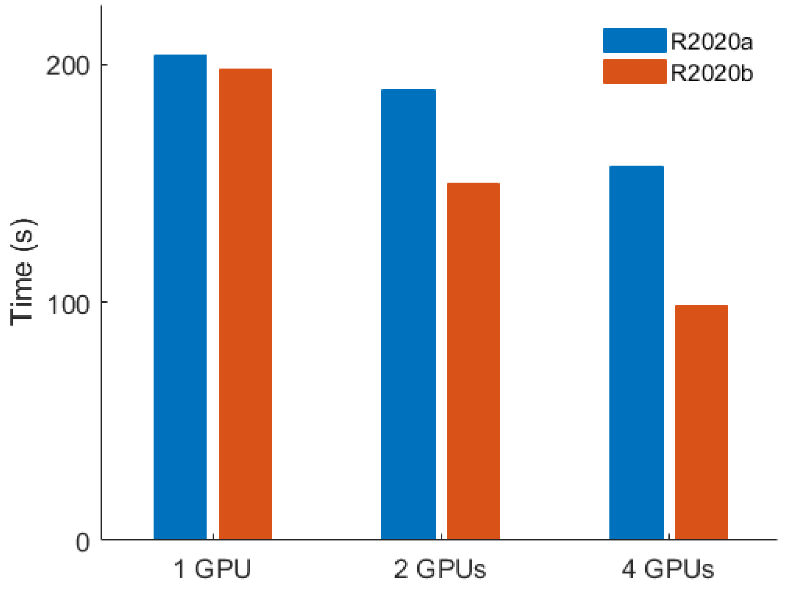
Deep Learning

Area	Description	Performance Improvement	Release
Training	Multi-GPU	1.6x	R2020a → R2020b



Deep Learning

Area	Description	Performance Improvement	Release
Training	Multi-GPU	1.6x	R2020a → R2020b
Inference	GPU	2.8x	R2018b → R2021a
	CPU	2.5x	



```
readtable("myfile.xlsx","TextType","string","Encoding","UTF-8")
```

```
readtable("myfile.xlsx", TextType="string", Encoding="UTF-8")
```

name=value syntax

```
str = ["String was introduced in R2016b."
       " Pattern was added in R2020b."];
```

pattern object

```
str = ["String was introduced in R2016b."
       " Pattern was added in R2020b."];
```

Create a pattern to match releases

```
pat = "R" + digitsPattern(4) + ("a"|"b");
```

pattern object

```
str = ["String was introduced in R2016b."
       " Pattern was added in R2020b."];
```

Create a pattern to match releases

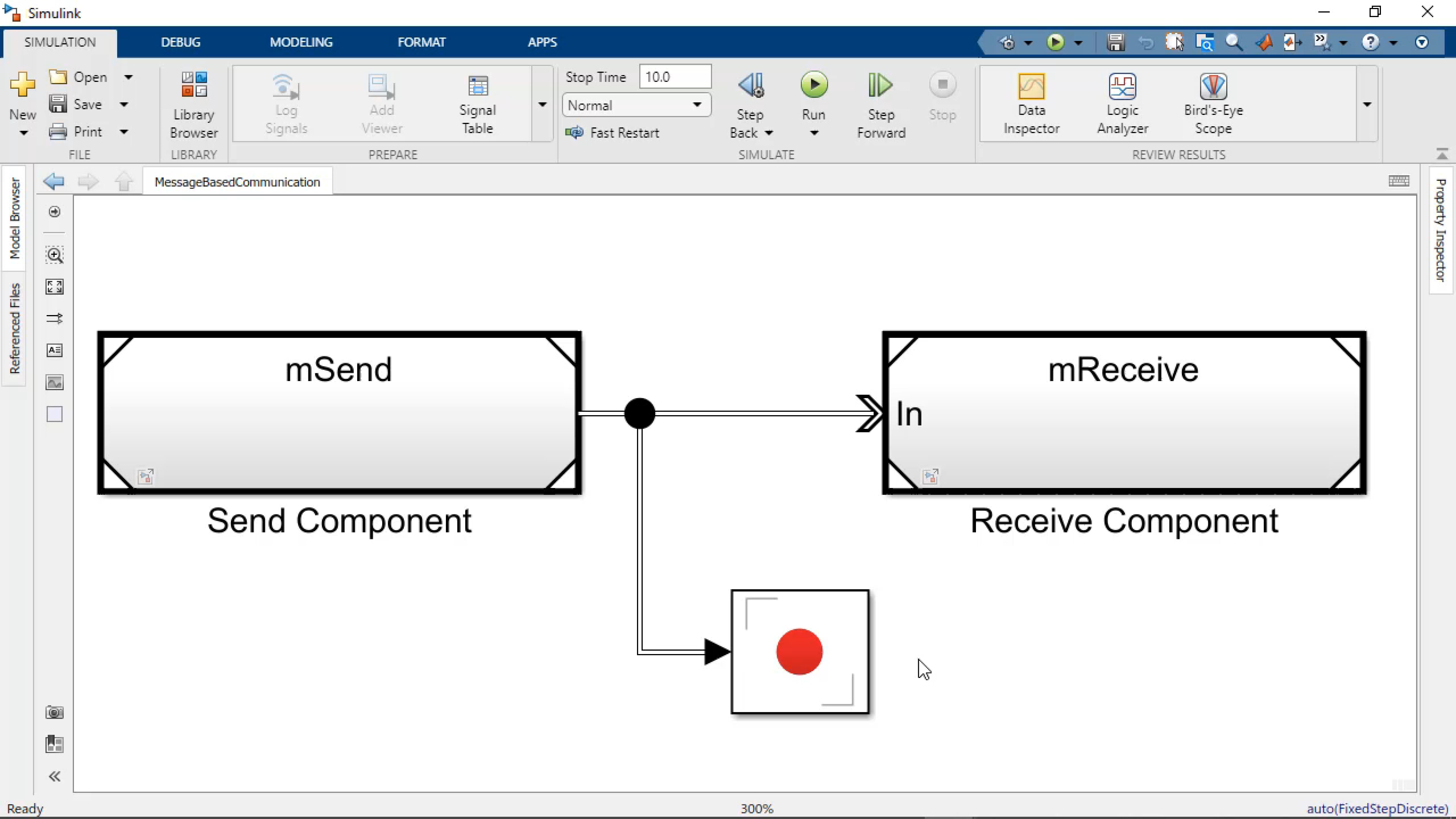
```
pat = "R" + digitsPattern(4) + ("a"|"b");
```

Extract the releases that were mentioned

```
extract(str,pat)
```

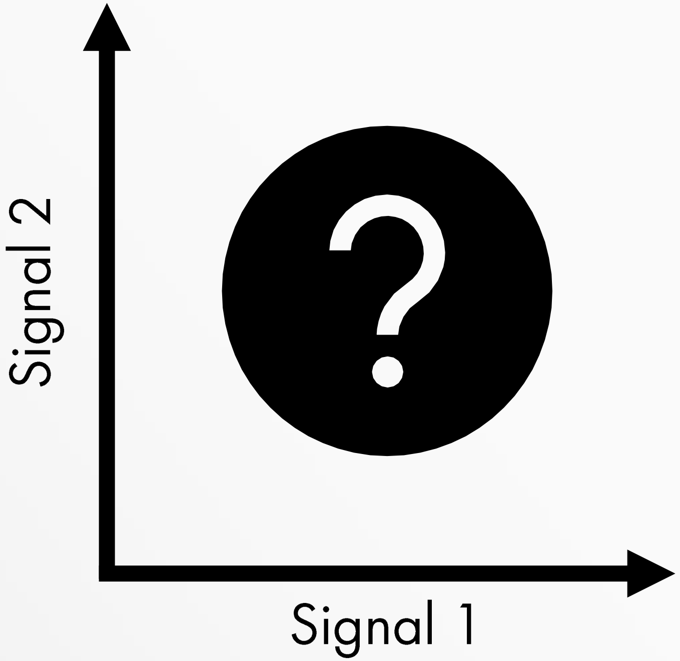
```
ans = 2×1 string
    "R2016b"
    "R2020b"
```

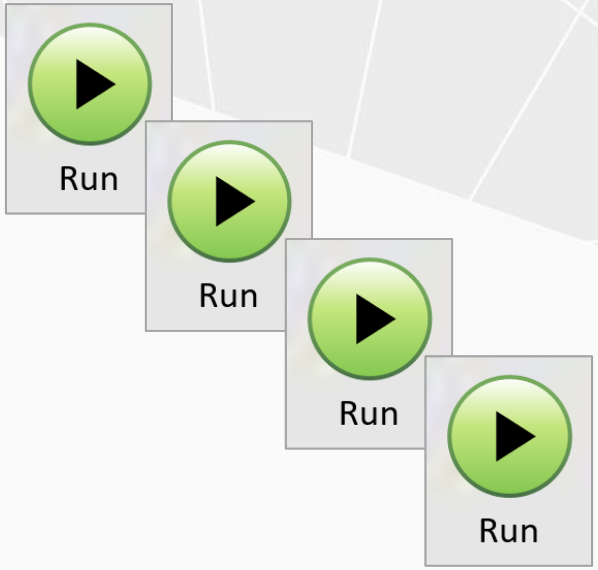
pattern object

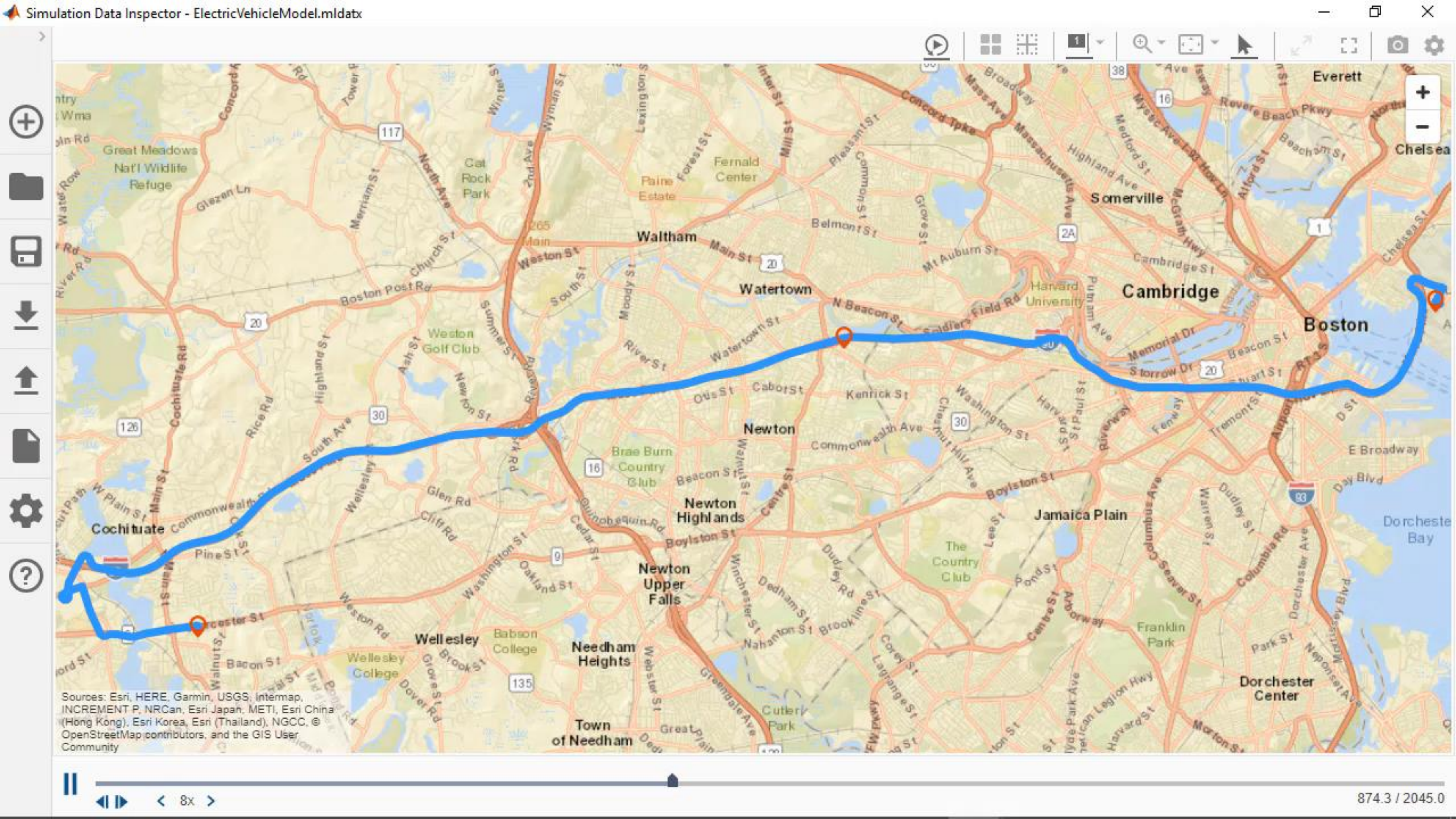

Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
New
Open
Save
Print
FILE
Library Browser
LIBRARY
Log Signals
Add Viewer
Signal Table
PREPARE
Stop Time
10.0
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
SIMULATE
Data Inspector
Logic Analyzer
Bird's-Eye Scope
REVIEW RESULTS
Model Browser
Referenced Files
Property Inspector
MessageBasedCommunication
mSend
Send Component
mReceive
In
Receive Component
Ready
300%
auto(FixedStepDiscrete)

How do you...

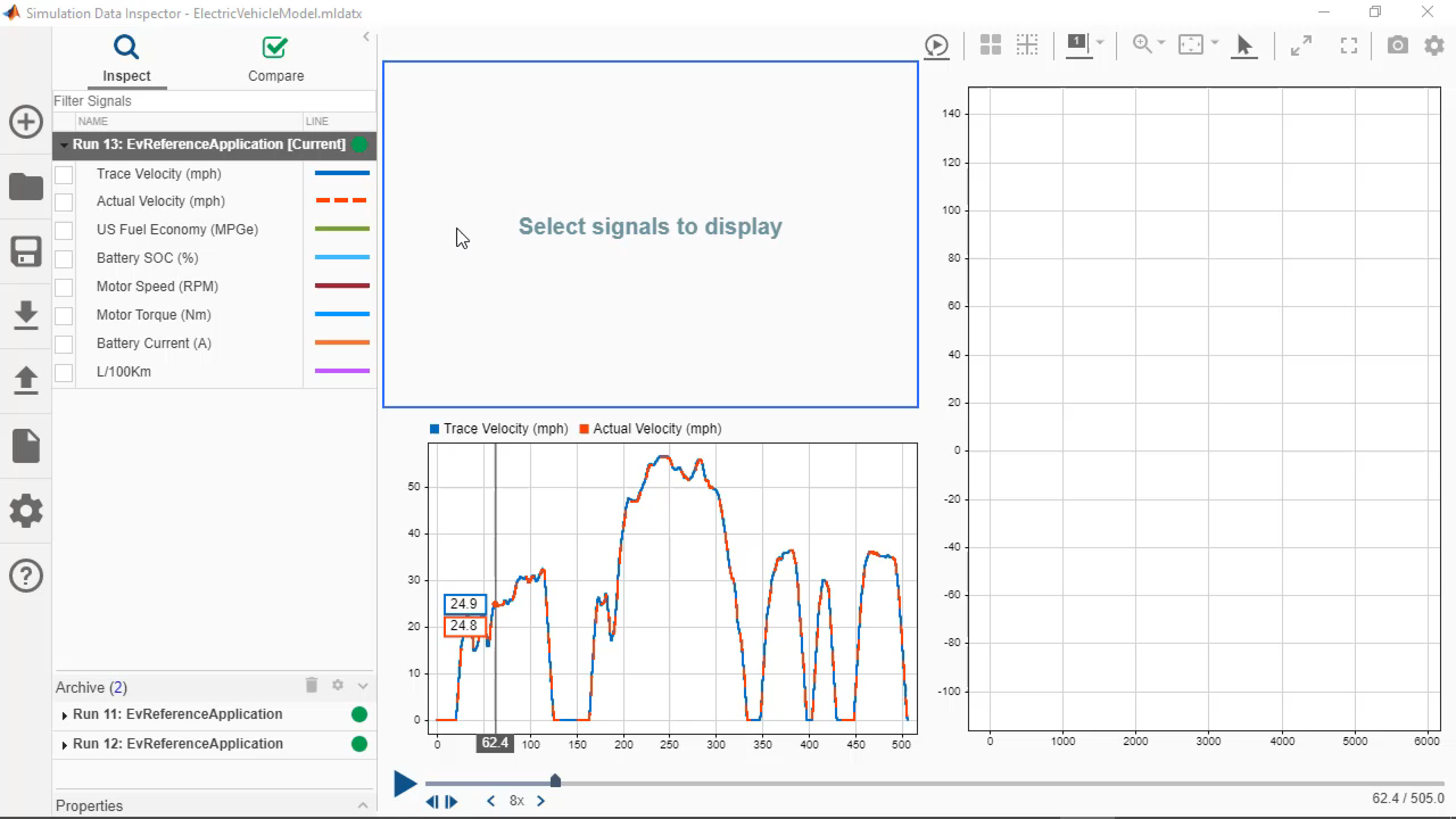

Belmont
Arlington
Medford
Malden
Melrose
Waltham
Watertown
Cambridge
Somerville
Everett
Revere
Chelsea
Newton
Brookline
Boston
Winthrop
Dorchester Heights Monument
Dedham
SUFFOLK
NORFOLK
John F. Kennedy Nat'l. Hist. Site

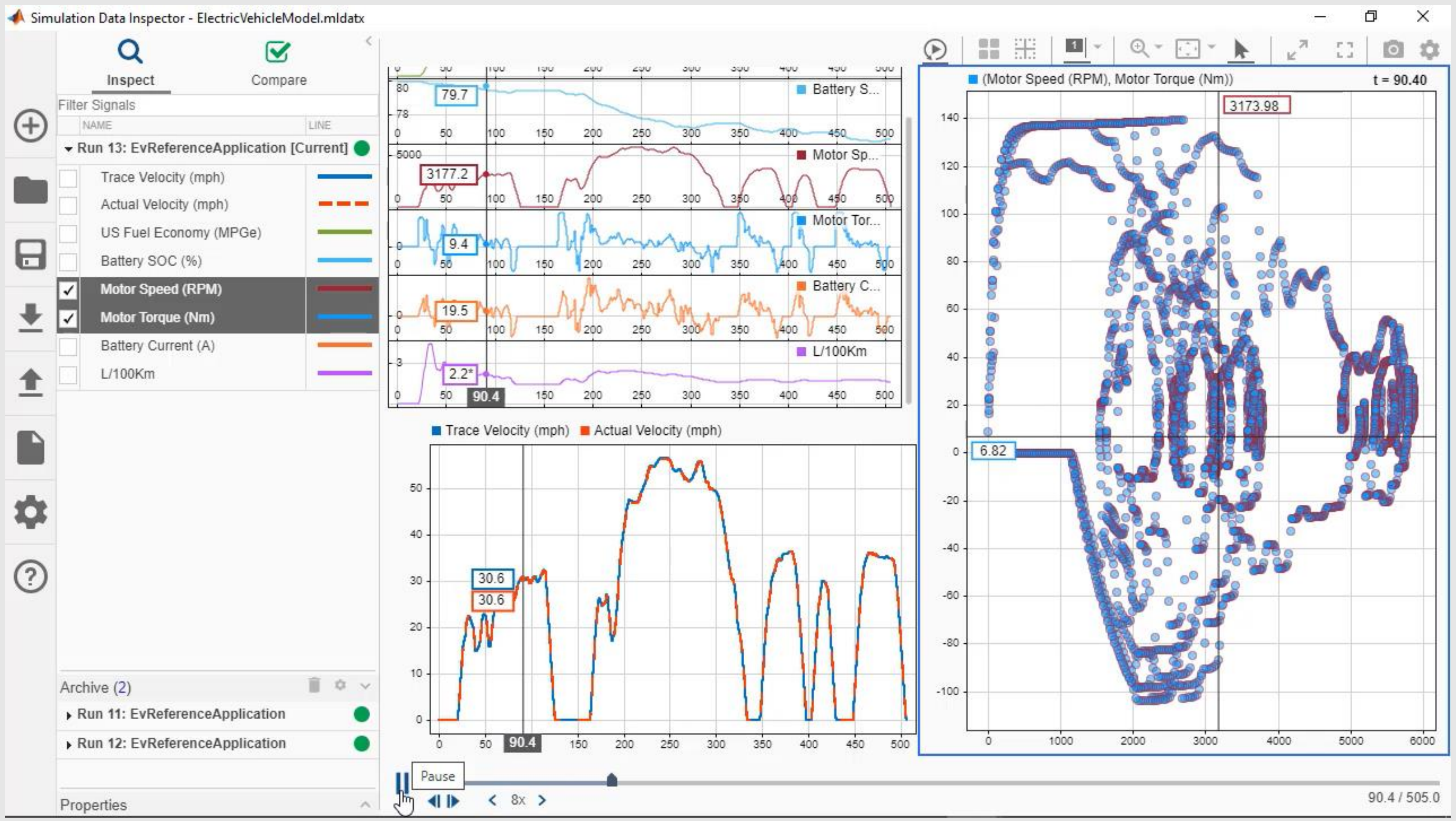

Signal 2
Signal 1


Run
Run
Run
Run



Simulation Data Inspector - ElectricVehicleModel.mldatx
Everett
Chelsea
Somerville
Cambridge
Boston
Waltham
Watertown
Harvard University
Newton
Newton Highlands
Newton Upper Falls
Jamaica Plain
Cochituate
Wellesley
Babson College
Wellesley College
Needham Heights
Town of Needham
Great Meadows Nat'l Wildlife Refuge
Weston Golf Club
Brae Burn Country Club
The Country Club
Franklin Park
Dorchester Center
Fernald Center
Paine Estate
Cat Rock Park
Cutler Park
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
8x
874.3 / 2045.0

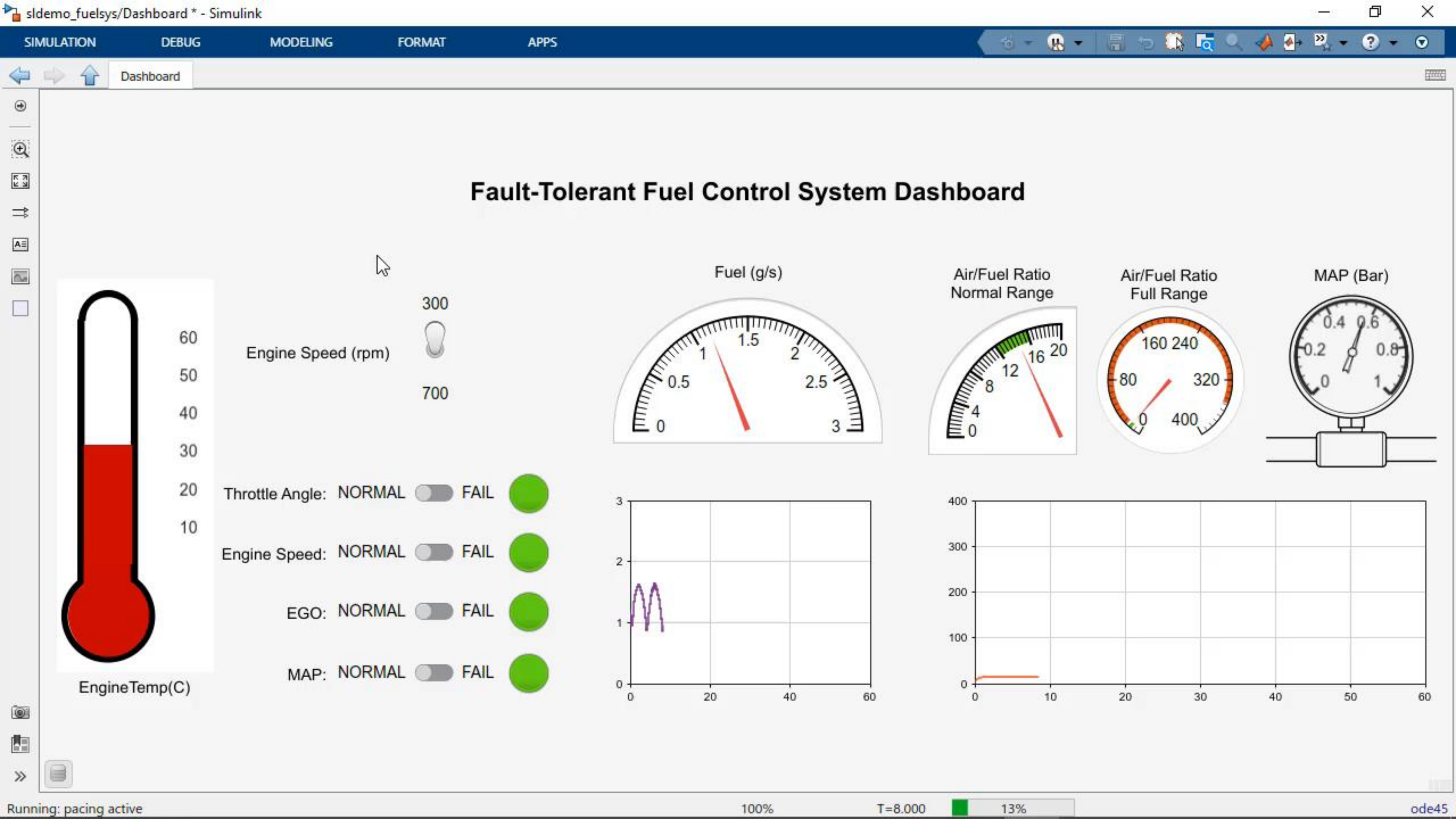

Simulation Data Inspector - ElectricVehicleModel.mldatx
Inspect
Compare
Filter Signals
NAME
LINE
Run 13: EvReferenceApplication [Current]
Trace Velocity (mph)
Actual Velocity (mph)
US Fuel Economy (MPGe)
Battery SOC (%)
Motor Speed (RPM)
Motor Torque (Nm)
Battery Current (A)
L/100Km
Archive (2)
Run 11: EvReferenceApplication
Run 12: EvReferenceApplication
Properties
Select signals to display
Trace Velocity (mph)
Actual Velocity (mph)
24.9
24.8
62.4
8x
62.4 / 505.0

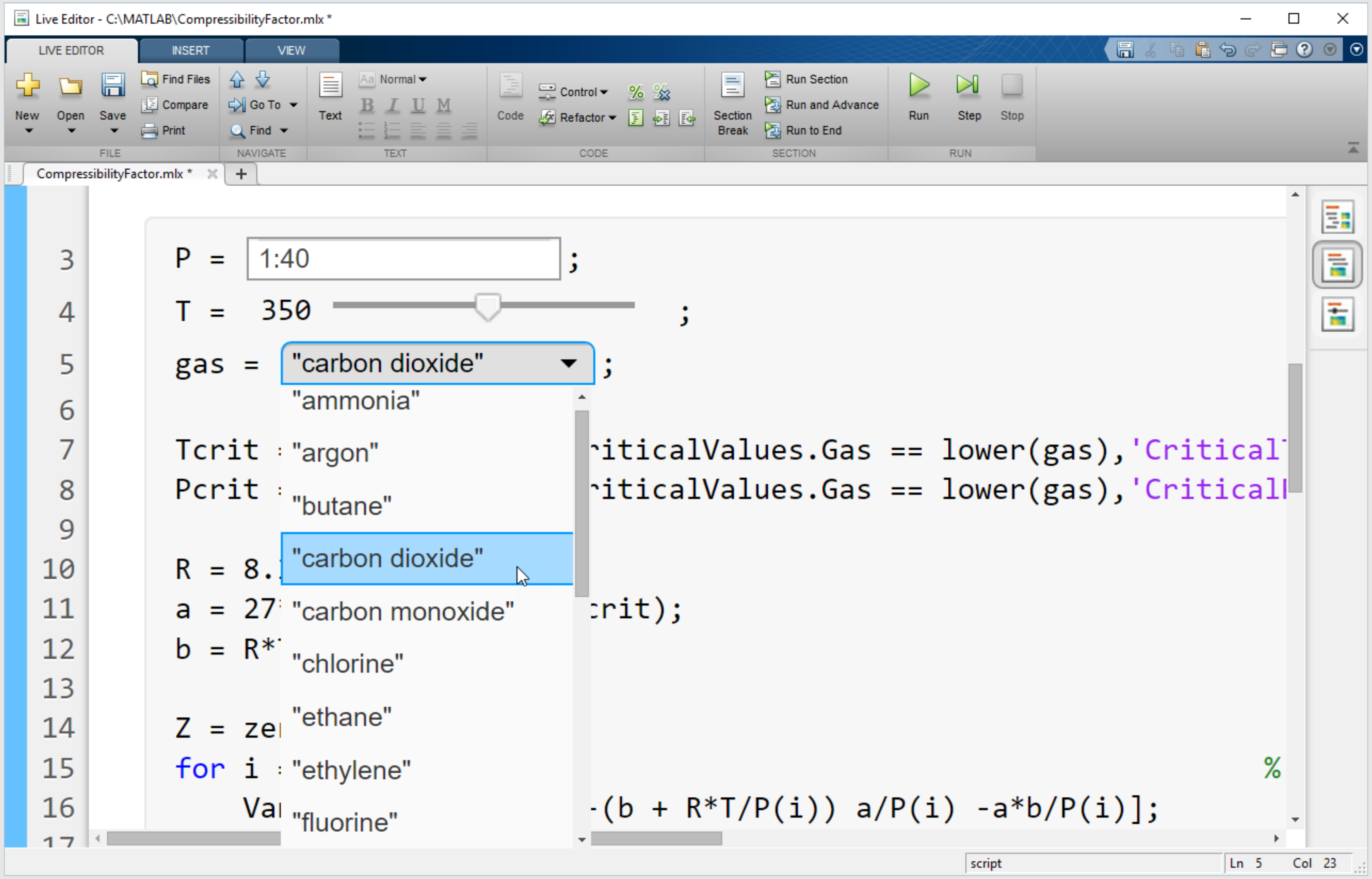


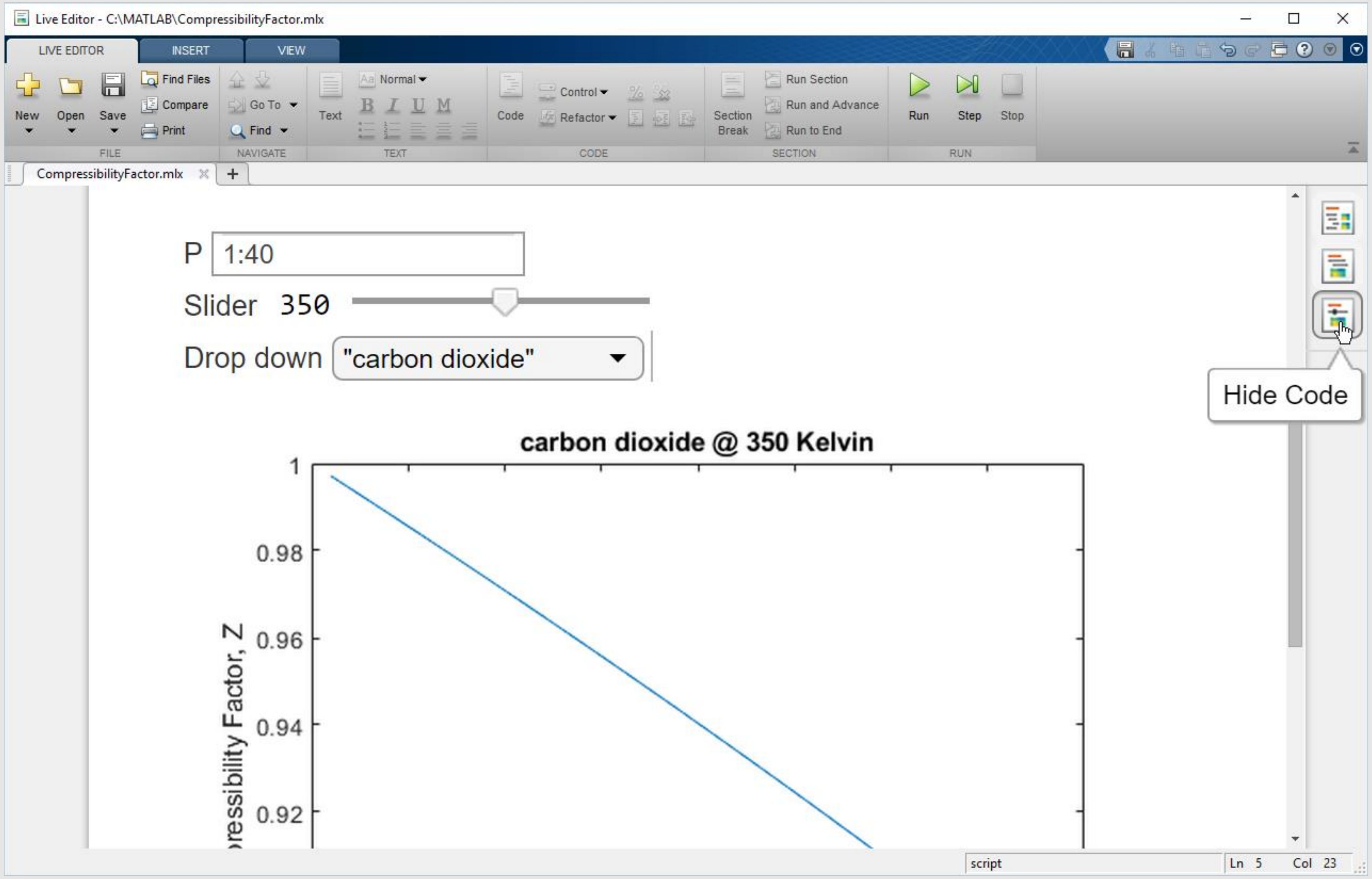
Get insights from simulations quickly **without writing code**

Tune and monitor simulations

without going into the details


sldemo_fuelsys/Dashboard * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Dashboard
Fault-Tolerant Fuel Control System Dashboard
60
50
40
30
20
10
EngineTemp(C)
300
Engine Speed (rpm)
700
Throttle Angle: NORMAL FAIL
Engine Speed: NORMAL FAIL
EGO: NORMAL FAIL
MAP: NORMAL FAIL
Fuel (g/s)
0 0.5 1 1.5 2 2.5 3
Air/Fuel Ratio
Normal Range
0 4 8 12 16 20
Air/Fuel Ratio
Full Range
0 80 160 240 320 400
MAP (Bar)
0 0.2 0.4 0.6 0.8 1
3
2
1
0
0 20 40 60
400
300
200
100
0
0 10 20 30 40 50 60
Running: pacing active
100%
T=8.000
13%
ode45


Live Editor - C:\MATLAB\CompressibilityFactor.mlx *
LIVE EDITOR
INSERT
VIEW
New
Open
Save
Find Files
Compare
Print
Go To
Find
Text
Normal
Code
Control
Refactor
Section Break
Run Section
Run and Advance
Run to End
Run
Step
Stop
FILE
NAVIGATE
TEXT
CODE
SECTION
RUN
CompressibilityFactor.mlx *
P = 1:40 ;
T = 350 ;
gas = "carbon dioxide" ;
"ammonia"
"argon"
"butane"
"carbon dioxide"
"carbon monoxide"
"chlorine"
"ethane"
"ethylene"
"fluorine"
Tcrit
iticalValues.Gas == lower(gas),'Critical
Pcrit
iticalValues.Gas == lower(gas),'Critical
R = 8.
a = 27
crit);
b = R*
Z = ze
for i
%
Va
-(b + R*T/P(i)) a/P(i) -a*b/P(i)];
script
Ln 5
Col 23



Turn a script into a simple app in seconds

C:\Demos\SunriseSunset.mlx

LIVE EDITOR INSERT VIEW

Estimating Sunrise and Sunset

We can estimate sunrise and sunset times if we know the latitude, longitude, and UTC offset. We need to calculate two values:

- Solar time correction
- Solar declination

The solar time correction is the difference (in minutes) between solar time and local time.

The solar declination (δ) is the angle of the sun relative to the earth's equatorial plane. On any given day of the year (d), solar declination (δ) can be calculated from the following formula:

$$\delta = \sin^{-1}\left[\sin(23.45)\sin\left(\frac{360}{365}(d-81)\right)\right]$$

Using the latitude (ϕ), the sun's declination (δ) and the solar time correction (SC) we can calculate sunrise and sunset times.

$$\text{sunrise} = 12 - \frac{\cos^{-1}(-\tan\phi\tan\delta)}{15^\circ} - \frac{SC}{60} \qquad \text{sunset} = 12 + \frac{\cos^{-1}(-\tan\phi\tan\delta)}{15^\circ} - \frac{SC}{60}$$

Estimating the Sunrise and Sunset Times

Set the latitude, longitude, and UT offset. Notice what happens to the sunrise and sunset times when the latitude is more than 66 degrees N or S (within the polar circles).

```
lat = 42 ;
lon = -71 ;
UTCoff = -5 ;
```

Estimate the sunrise and sunset times. We use the custom `equationOfTime` function to calculate the solar time correction (SC).

```
day = 1:365;
timeCorr = equationOfTime(day);
solarCorr = 4*(lon - 15*UTCoff) + timeCorr;
delta = asind(sind(23.45)*sind(360*(day - 81)/365));
sunrise = 12 - acosd(-tand(lat)*tand(delta))/15 - solarCorr/60;
```

C:\Demos\SunriseSunset_fonts.mlx

LIVE EDITOR INSERT VIEW

Estimating Sunrise and Sunset

We can estimate sunrise and sunset times if we know the latitude, longitude, and UTC offset. We need to calculate two values:

- Solar time correction
- Solar declination

The solar time correction is the difference (in minutes) between solar time and local time.

The solar declination (δ) is the angle of the sun relative to the earth's equatorial plane. On any given day of the year (d), solar declination (δ) can be calculated from the following formula:

$$\delta = \sin^{-1}\left[\sin(23.45)\,\sin\left(\frac{360}{365}(d-81)\right)\right]$$

Using the latitude (ϕ), the sun's declination (δ) and the solar time correction (SC) we can calculate sunrise and sunset times.

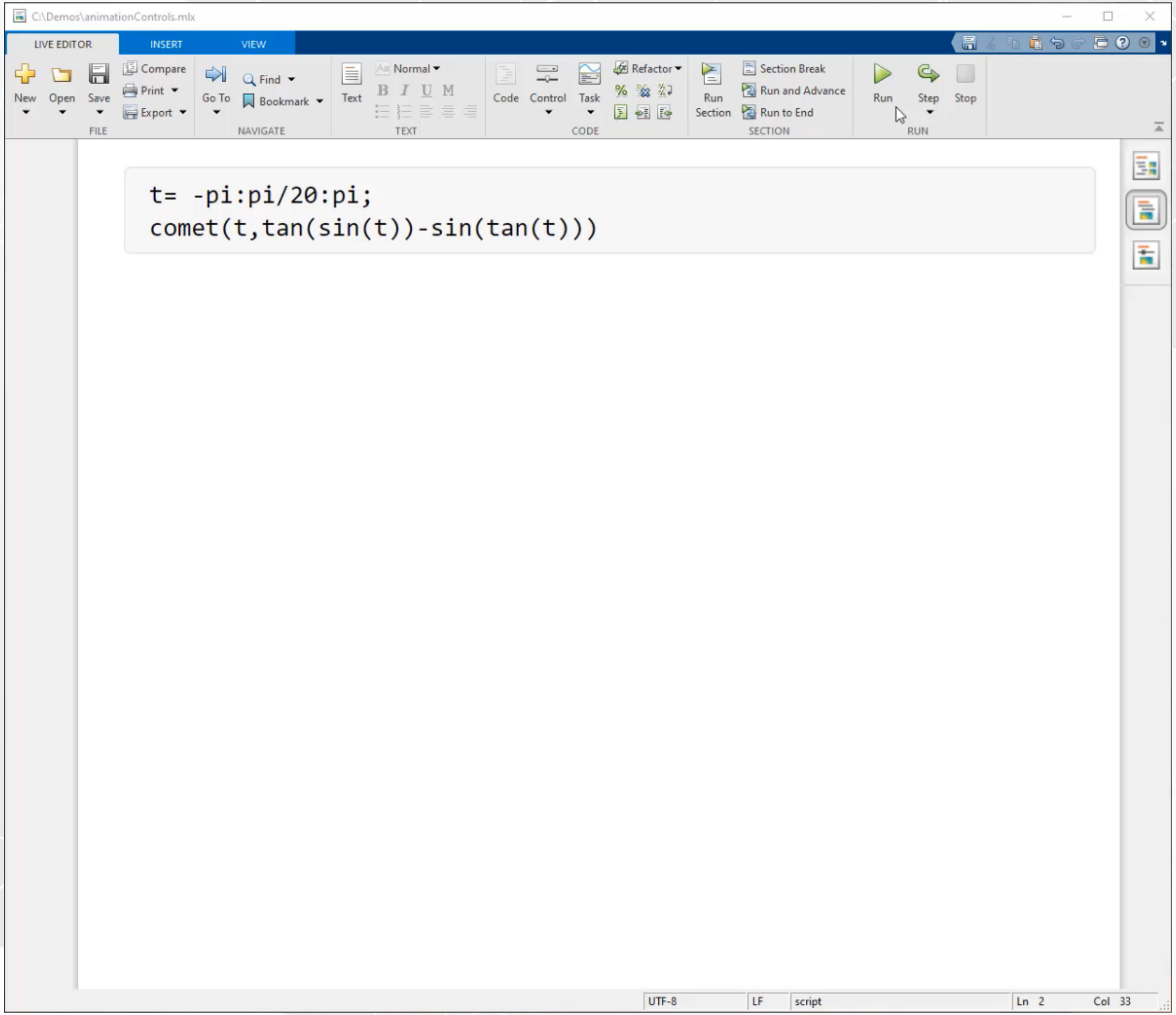
$$\text{sunrise} = 12 - \frac{\cos^{-1}(-\tan\phi\tan\delta)}{15^\circ} - \frac{SC}{60} \qquad \text{sunset} = 12 + \frac{\cos^{-1}(-\tan\phi\tan\delta)}{15^\circ} - \frac{SC}{60}$$

Estimating the Sunrise and Sunset Times

Set the latitude, longitude, and UT offset. Notice what happens to the sunrise and sunset times when the latitude is more than 66 degrees N or S (within the polar circles).

```
lat  =  42 ;
lon =  -71 ;
UTCoff = -5 ;
```

Estimate the sunrise and sunset times. We use the custom `equationOfTime` function to calculate the solar time correction (SC)


C:\Demos\animationControls.mlx
LIVE EDITOR
INSERT
VIEW
New
Open
Save
Compare
Print
Export
FILE
Go To
Find
Bookmark
NAVIGATE
Normal
Text
TEXT
Code
Control
Task
Refactor
CODE
Run Section
Section Break
Run and Advance
Run to End
SECTION
Run
Step
Stop
RUN
t= -pi:pi/20:pi;
comet(t,tan(sin(t))-sin(tan(t)))
UTF-8
LF
script
Ln 2
Col 33

Focus

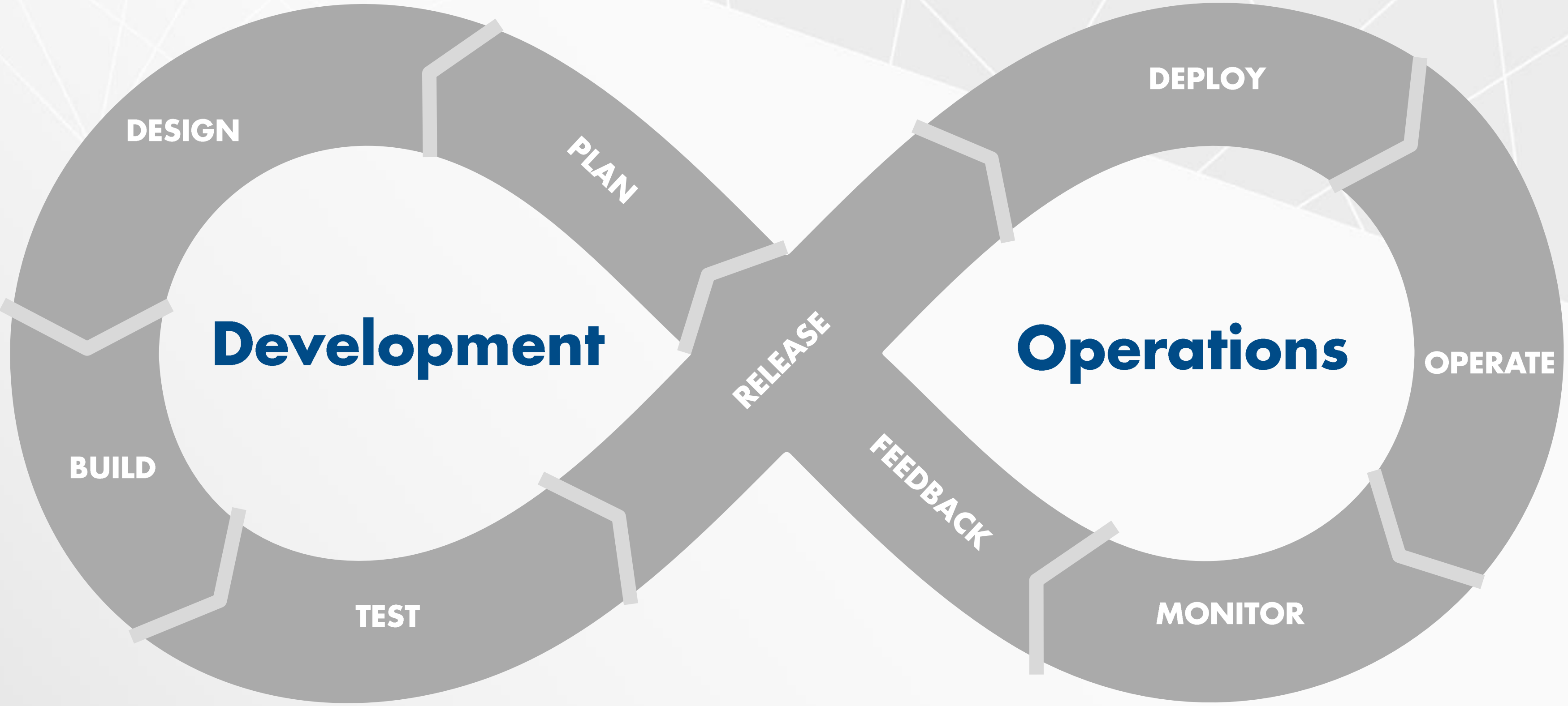
Collaboration

Production

Focus

Collaboration

Production

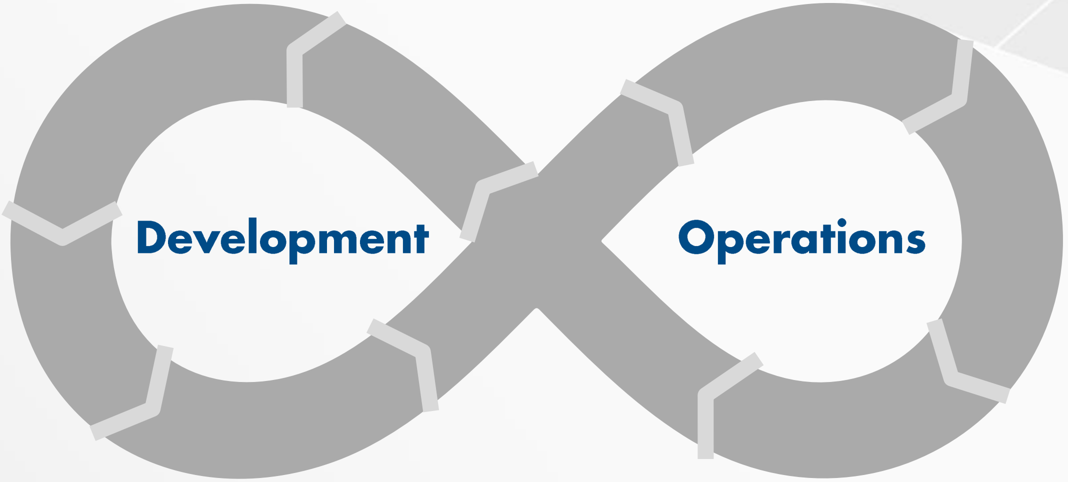

DESIGN
PLAN
Development
BUILD
TEST
RELEASE
DEPLOY
Operations
OPERATE
FEEDBACK
MONITOR

Languages

C/C++

Python

Java



Languages

C/C++

Python

Java

Source Control & CI

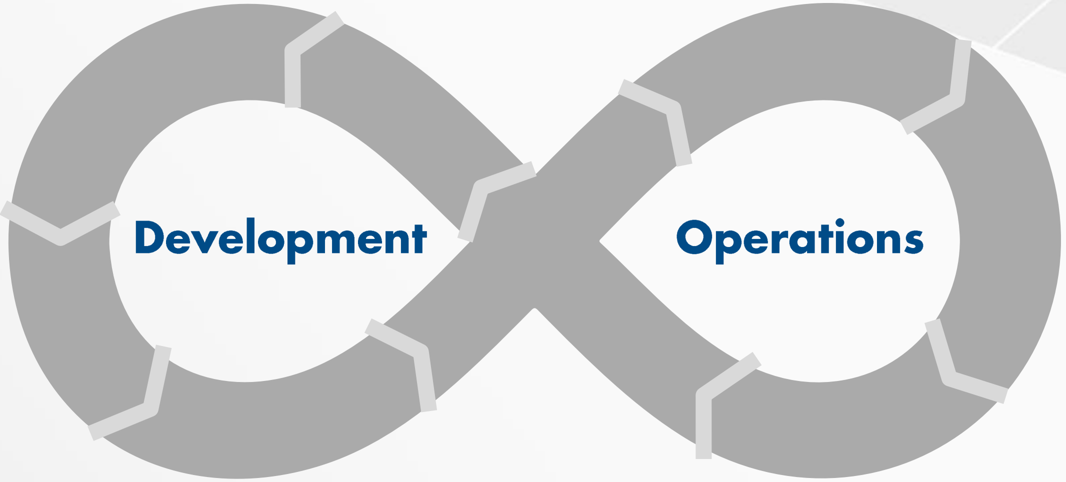
GitHub

Git

Jenkins

Travis CI

CircleCi



Languages

C/C++

Python

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Source Control & CI

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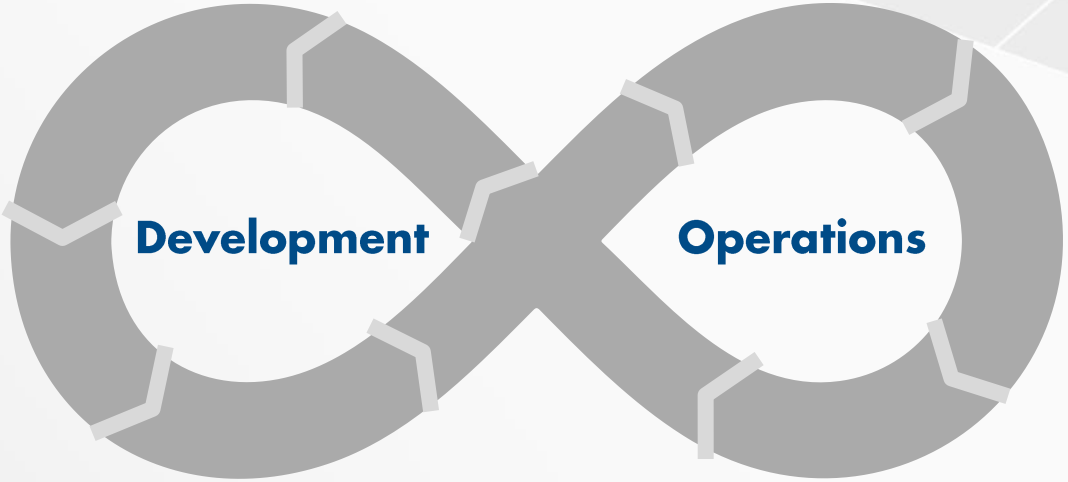
CircleCi



Cloud Platforms & Technology

AWS

Azure

Docker

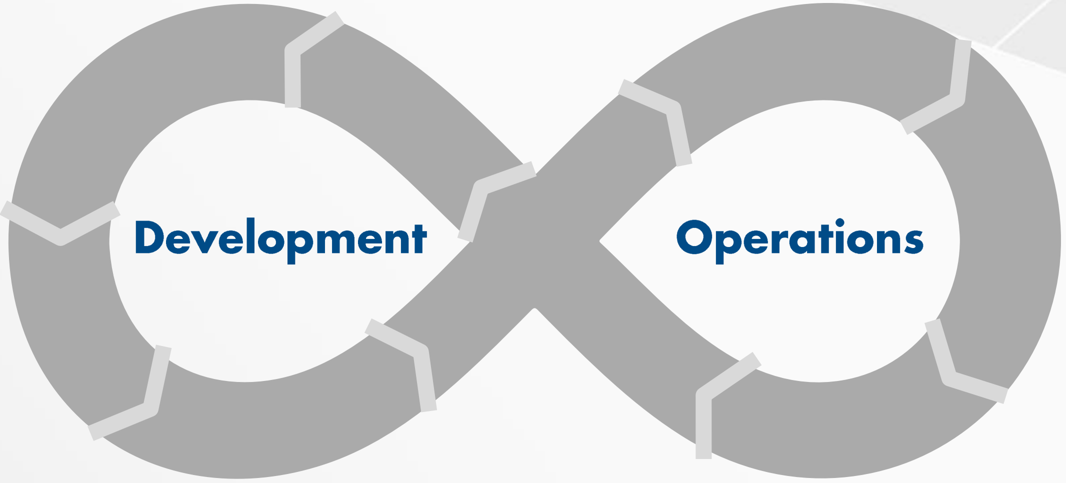
Docker Hub

Languages

- C/C++
- Python
- Java

Source Control & CI

- GitHub
- Git
- Jenkins
- Travis CI
- CircleCi

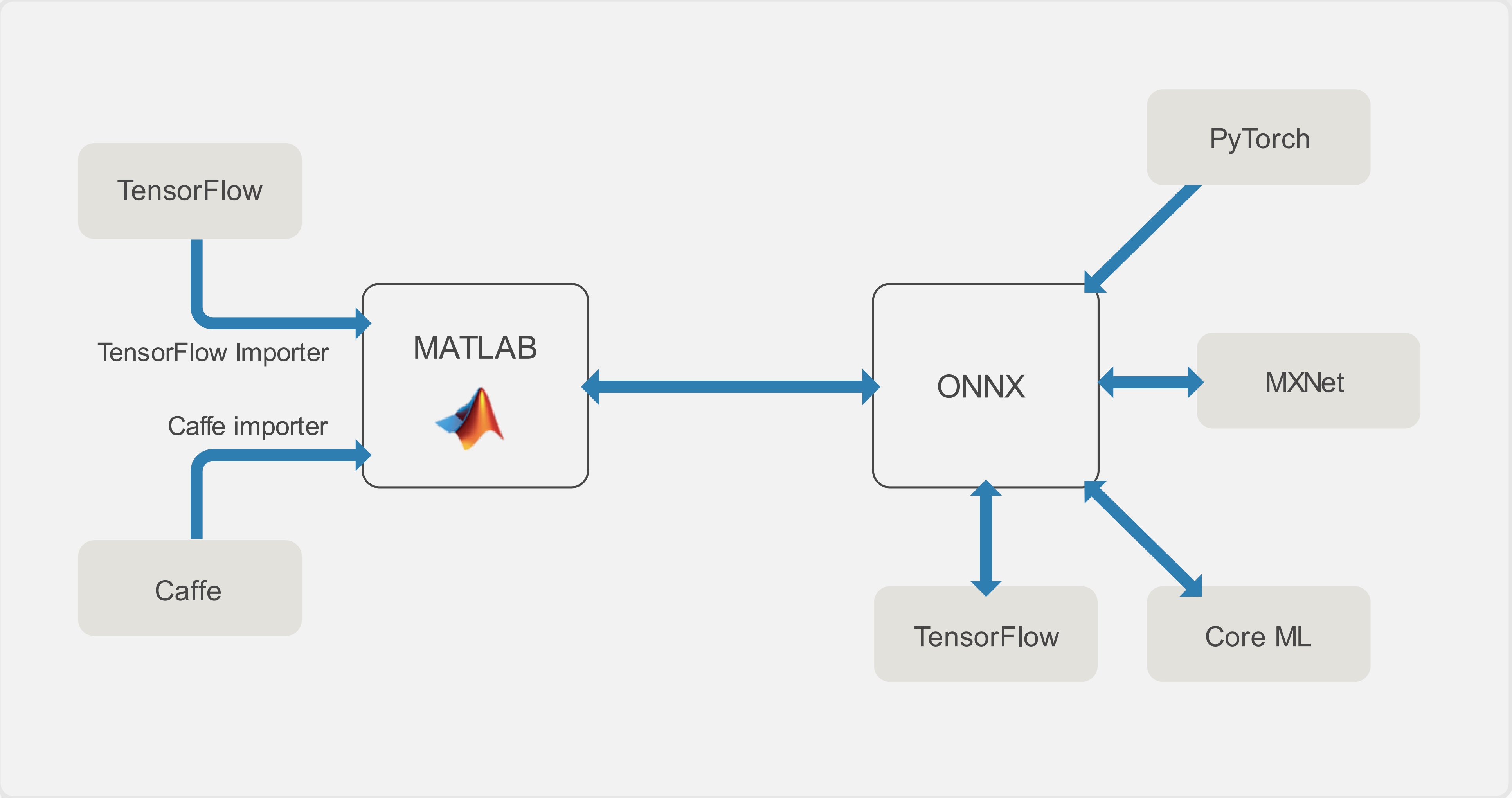


Data Platforms & Technology

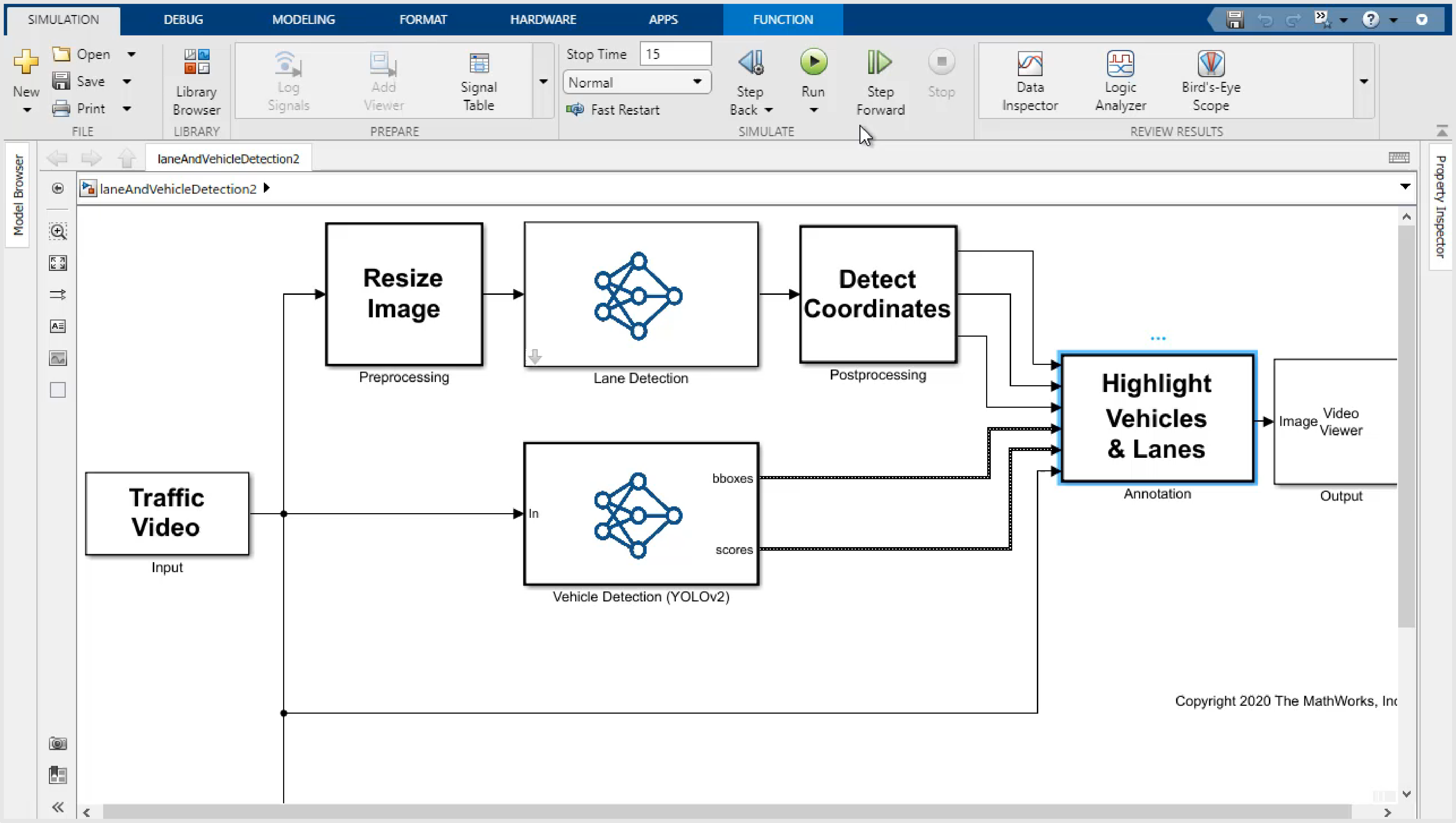
- Domino Data Lab
- Databricks
- Jupyter
- Tableau
- Kafka
- Hadoop
- MQTT
- RabbitMQ

Cloud Platforms & Technology

- AWS
- Azure
- Docker
- Docker Hub



Integrate with Python-Based Frameworks

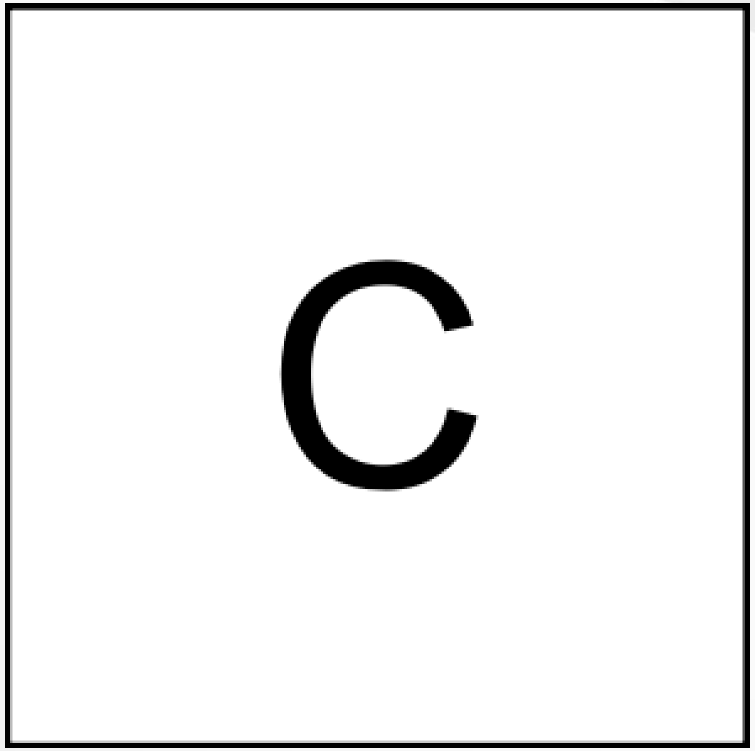


Deep Learning in Simulink

Simulink is the Simulation Integration Platform

Integrating your C code into Simulink is simple

R2020a



C Function

R2018b

<FunctionName>

C Caller

Simulink Coverage

Simulink Test

Simulink Design Verifier

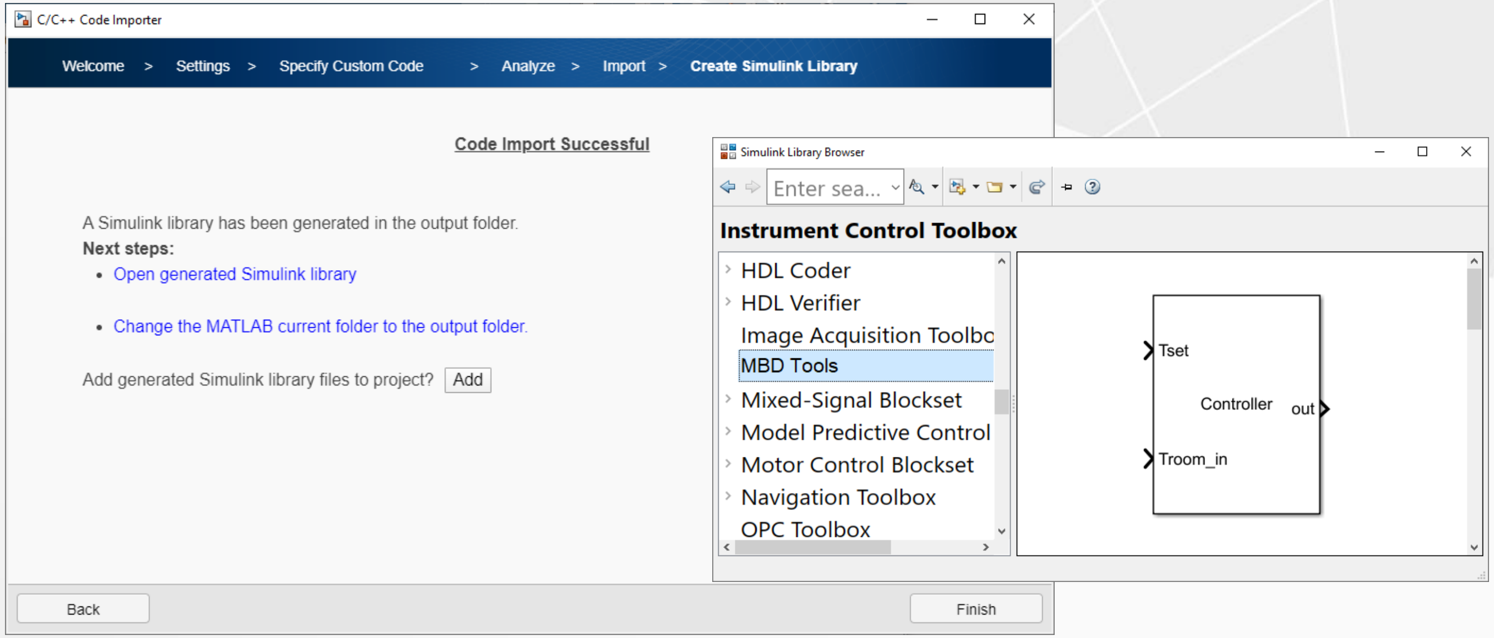
Simulink Coder

R2020a

C

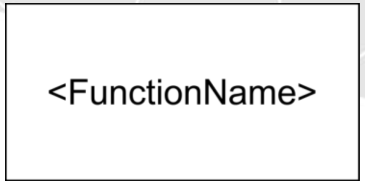
C Function

R2021a



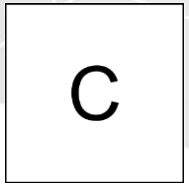
Code Importer

R2018b



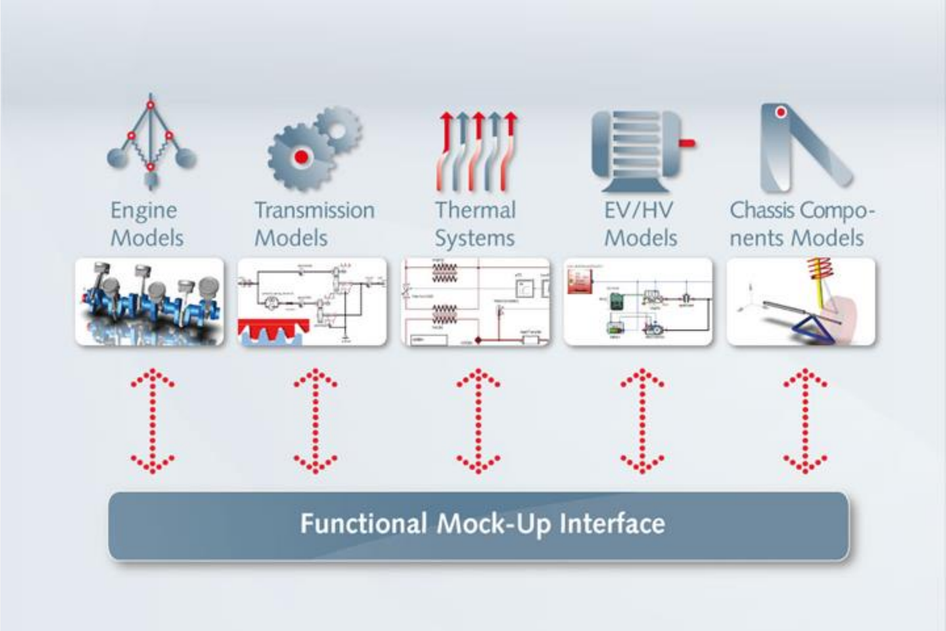
C Caller

R2020a



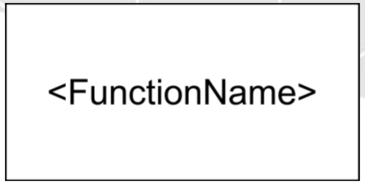
C Function

Flexibility to simulate and co-simulate



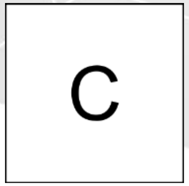
FMU Import and Export

R2018**b**



C Caller

R2020**a**

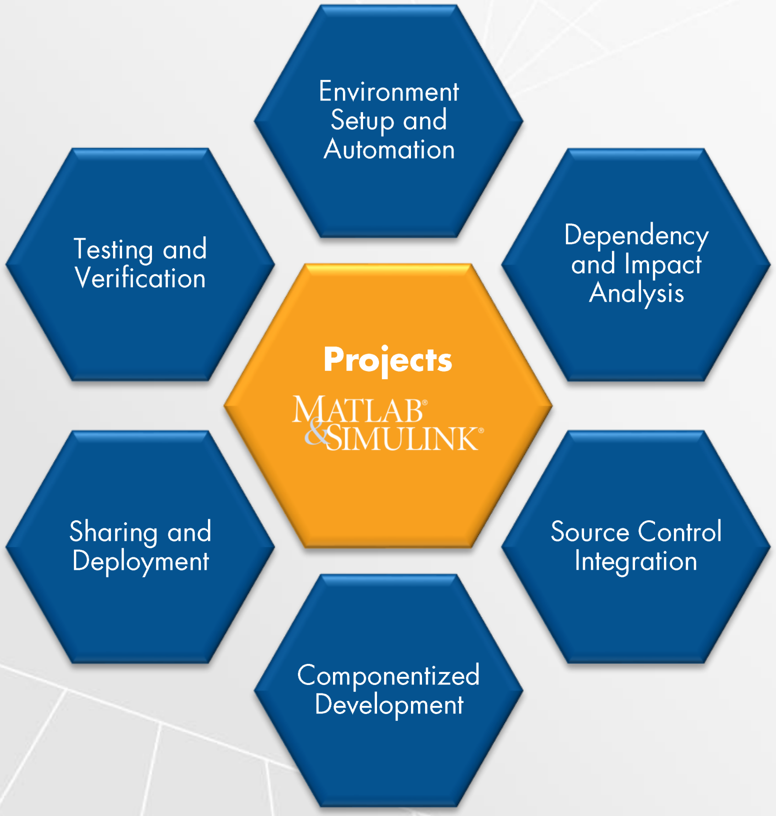


C Function

R2021**a**

Code Importer


Environment Setup and Automation
Testing and Verification
Dependency and Impact Analysis
Projects
MATLAB & SIMULINK
Sharing and Deployment
Source Control Integration
Componentized Development


Environment Setup and Automation
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MATLAB & SIMULINK
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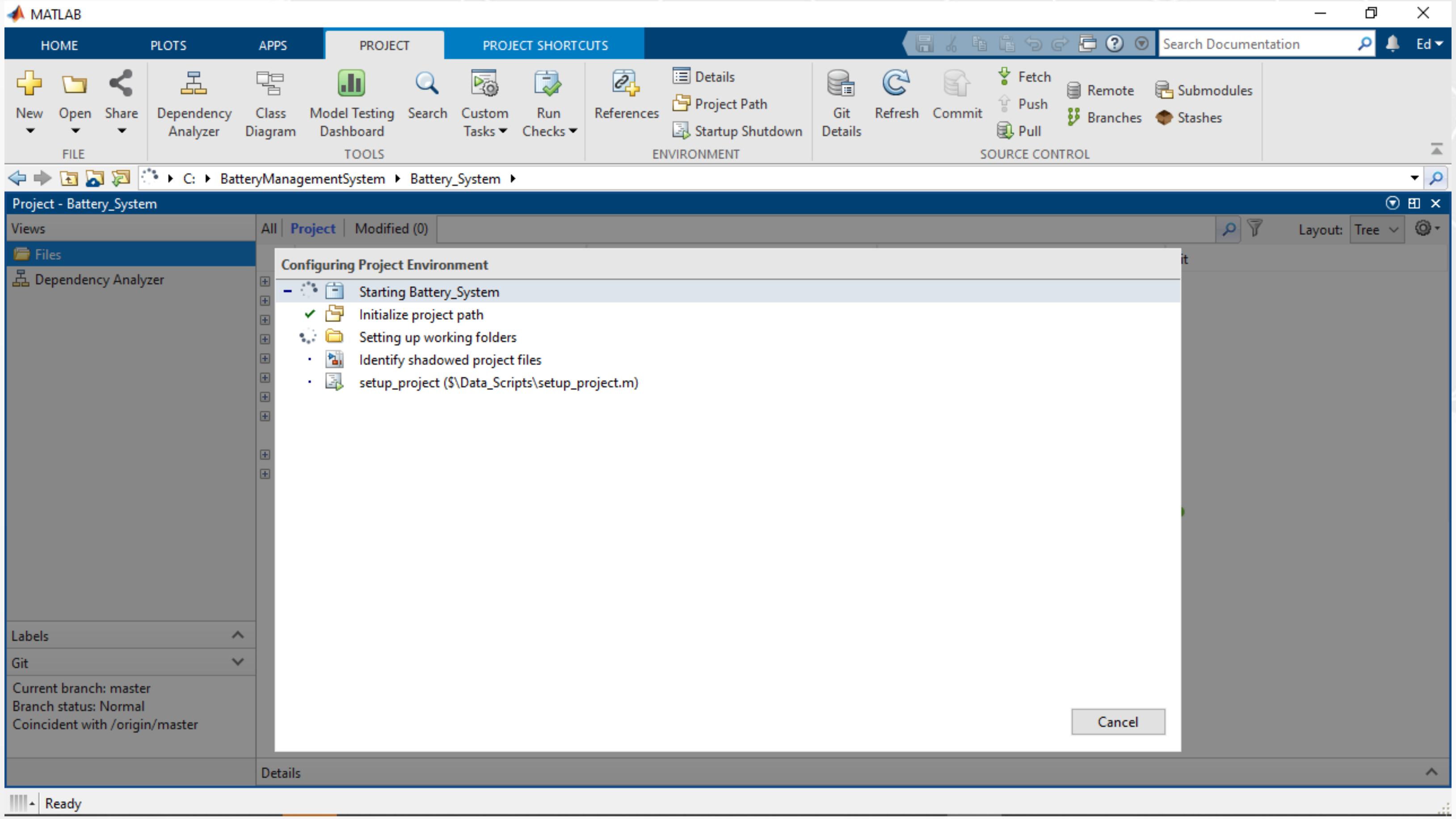
Source Control Integration
Componentized Development


MATLAB
HOME
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Search Documentation
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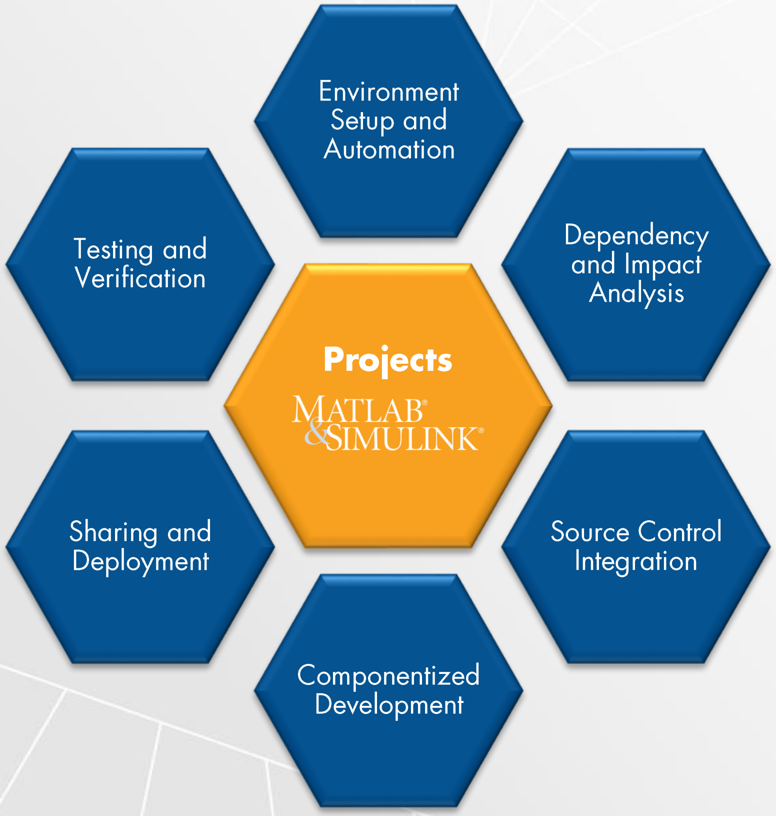
C: ▸ BatteryManagementSystem ▸ Battery_System ▸
Project - Battery_System
Views
Files
Dependency Analyzer
All | Project | Modified (0)
Layout: Tree
Configuring Project Environment
Starting Battery_System
Initialize project path
Setting up working folders
Identify shadowed project files
setup_project ($\Data_Scripts\setup_project.m)
Cancel
Labels
Git
Current branch: master
Branch status: Normal
Coincident with /origin/master
Details
Ready


Environment Setup and Automation
Testing and Verification
Dependency and Impact Analysis
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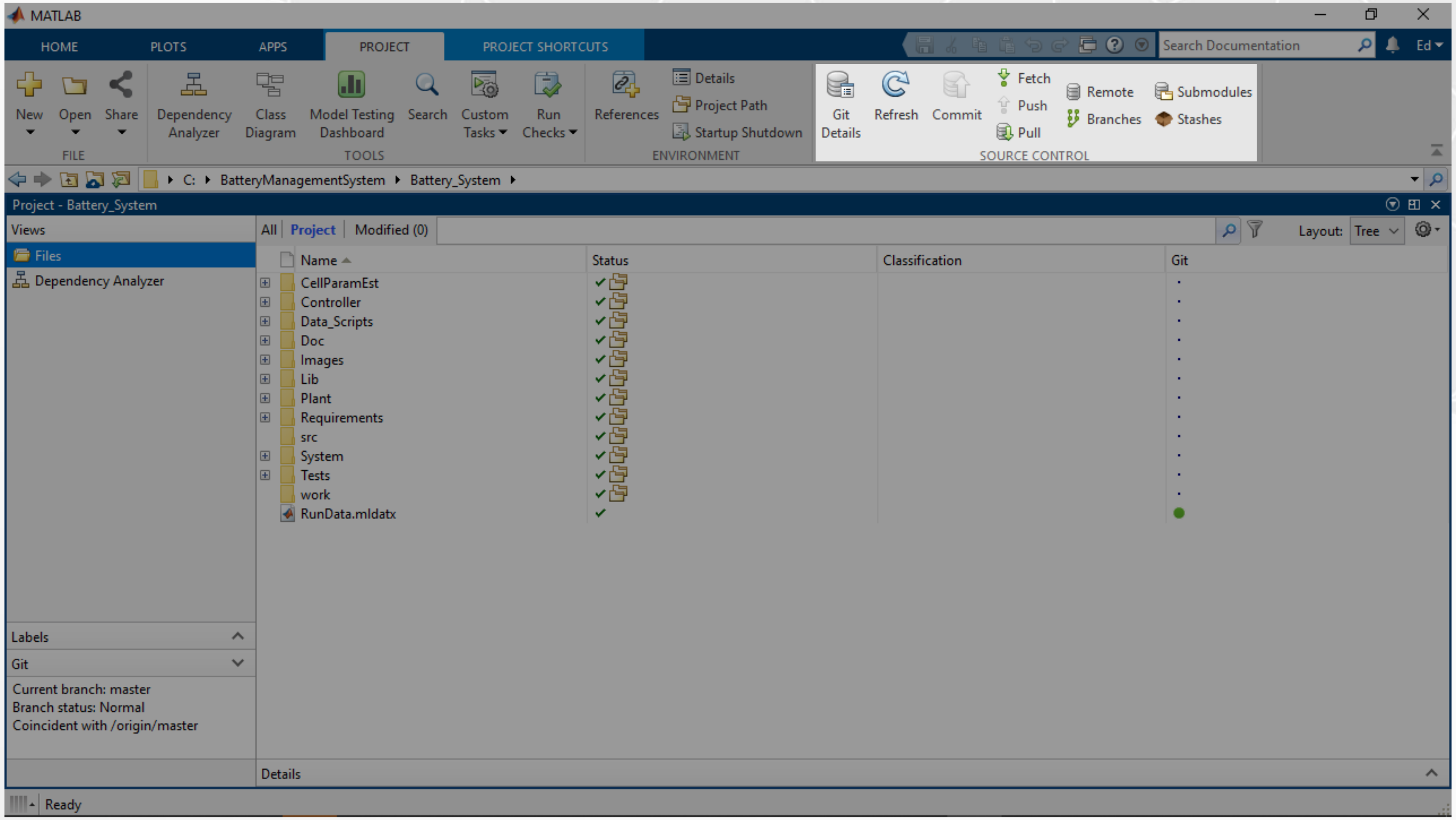
MATLAB & SIMULINK
Sharing and Deployment
Source Control Integration
Componentized Development


MATLAB
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PROJECT SHORTCUTS
Search Documentation
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Model Testing Dashboard
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SOURCE CONTROL
C: BatteryManagementSystem Battery_System
Project - Battery_System
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Files
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All
Project
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Layout:
Tree
Name
Status
Classification
Git
CellParamEst
Controller
Data_Scripts
Doc
Images
Lib
Plant
Requirements
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work
RunData.mldatx
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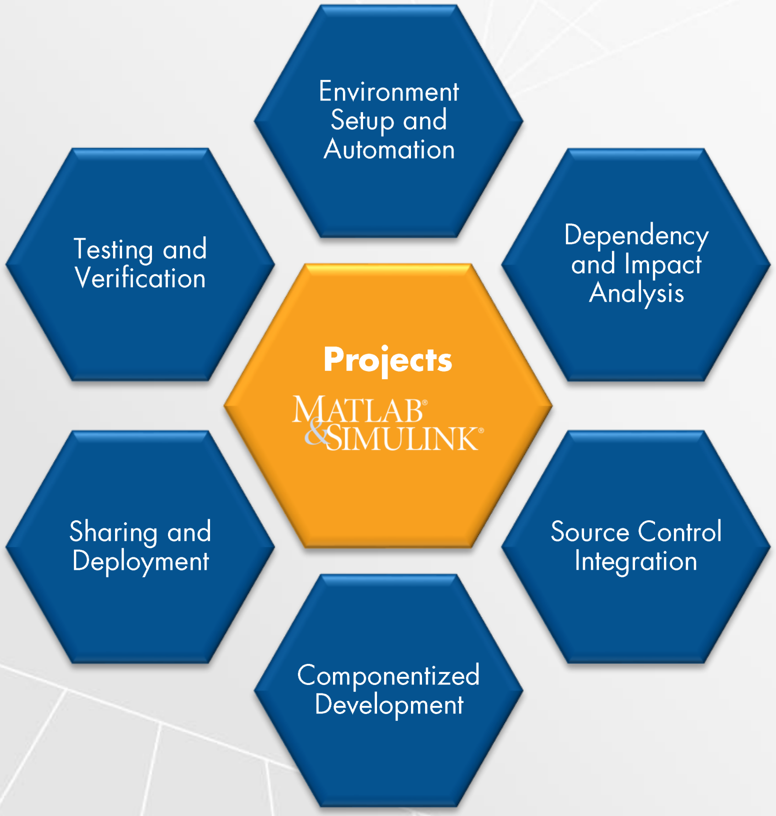
Git
Current branch: master
Branch status: Normal
Coincident with /origin/master
Details
Ready


Environment Setup and Automation
Testing and Verification
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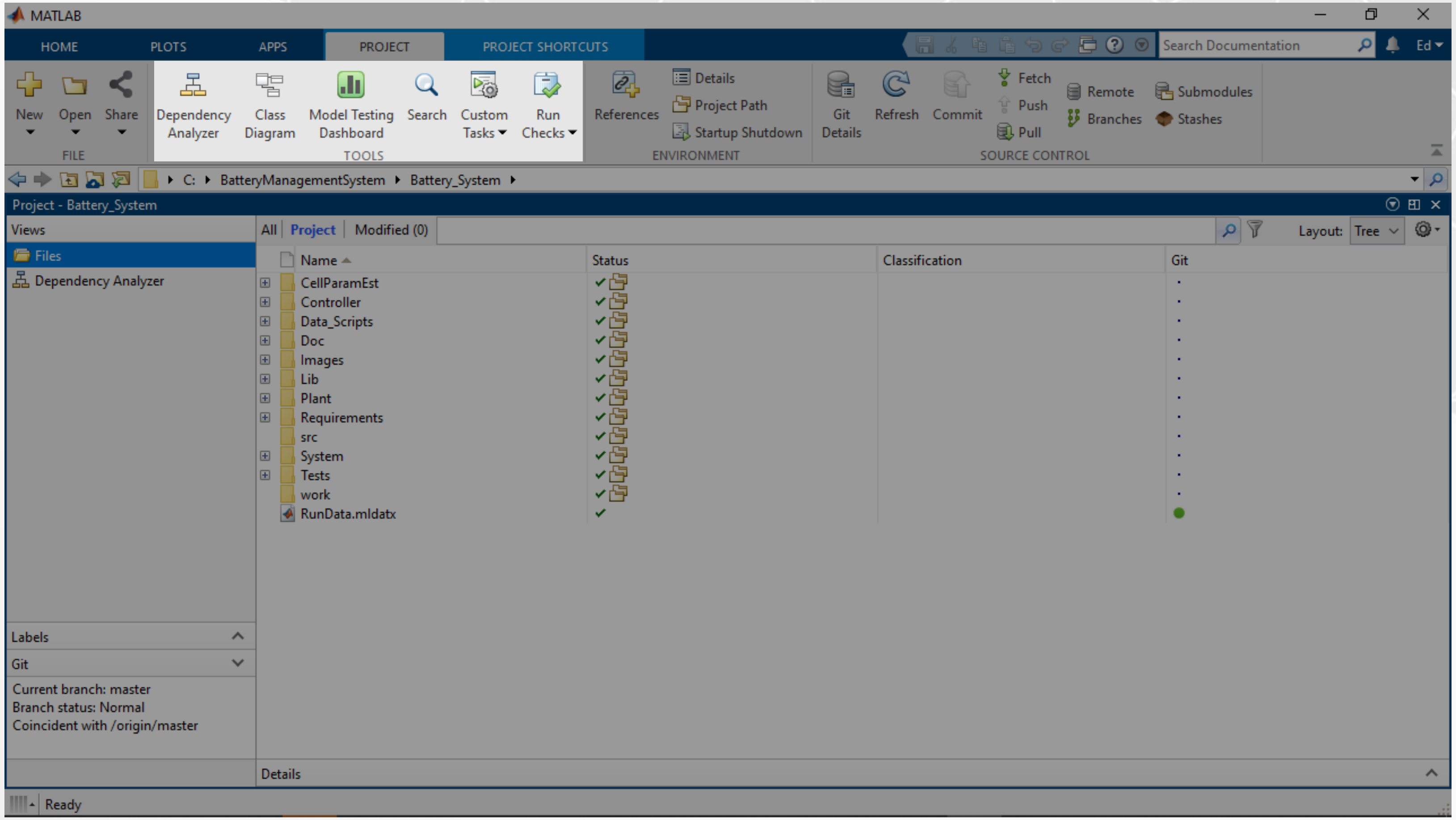
Source Control Integration
Componentized Development


MATLAB
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PROJECT SHORTCUTS
Search Documentation
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FILE
Dependency Analyzer
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Dependency Analyzer
All
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Modified (0)
Layout:
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Name
Status
Classification
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Data_Scripts
Doc
Images
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Requirements
src
System
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work
RunData.mldatx
Labels
Git
Current branch: master
Branch status: Normal
Coincident with /origin/master
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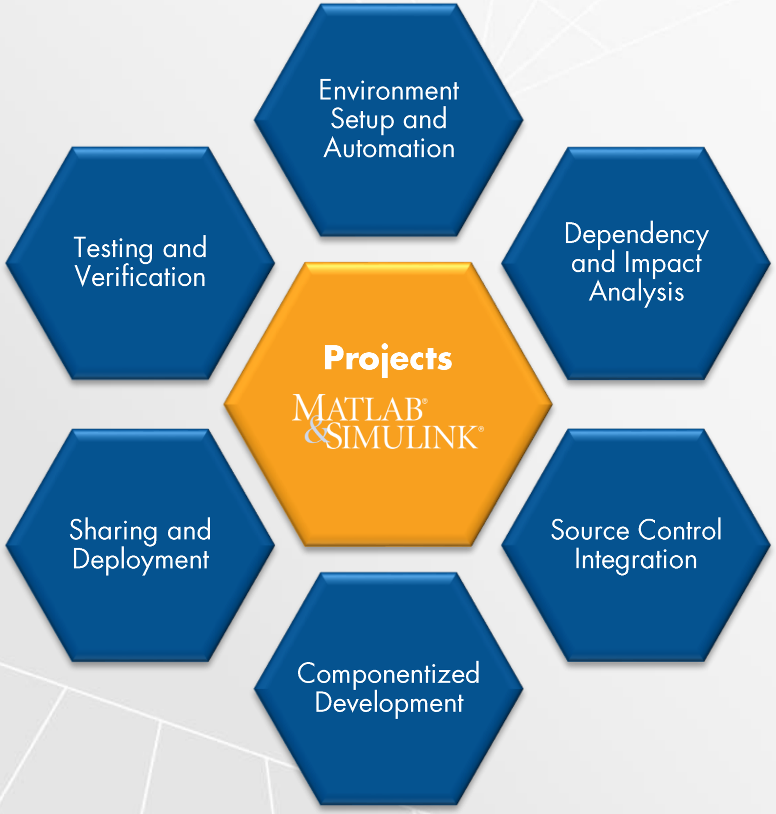
Environment Setup and Automation
Testing and Verification
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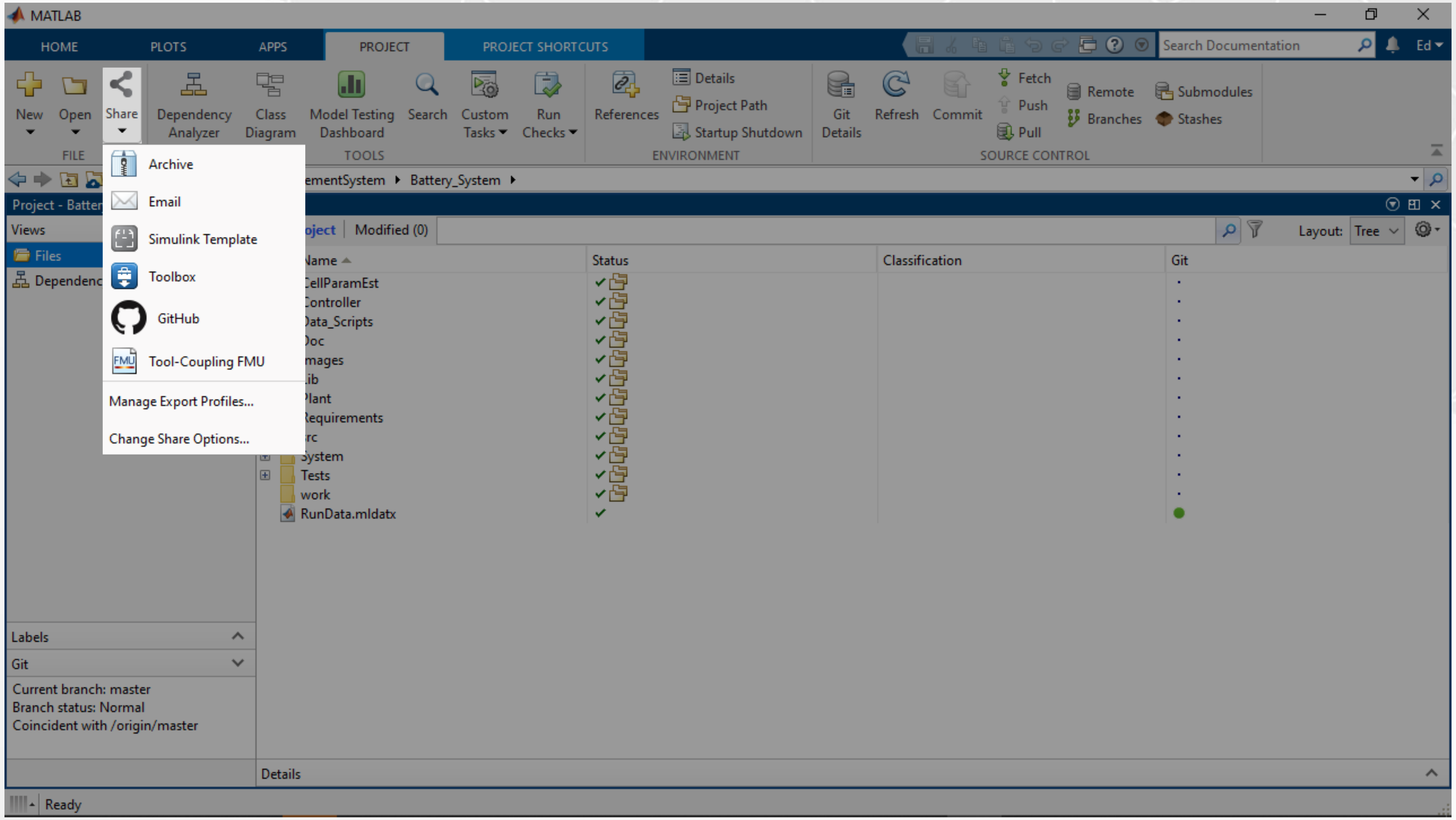
Sharing and Deployment
Source Control Integration
Componentized Development


MATLAB
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Model Testing Dashboard
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Toolbox
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Tool-Coupling FMU
Manage Export Profiles...
Change Share Options...
Battery_System
Views
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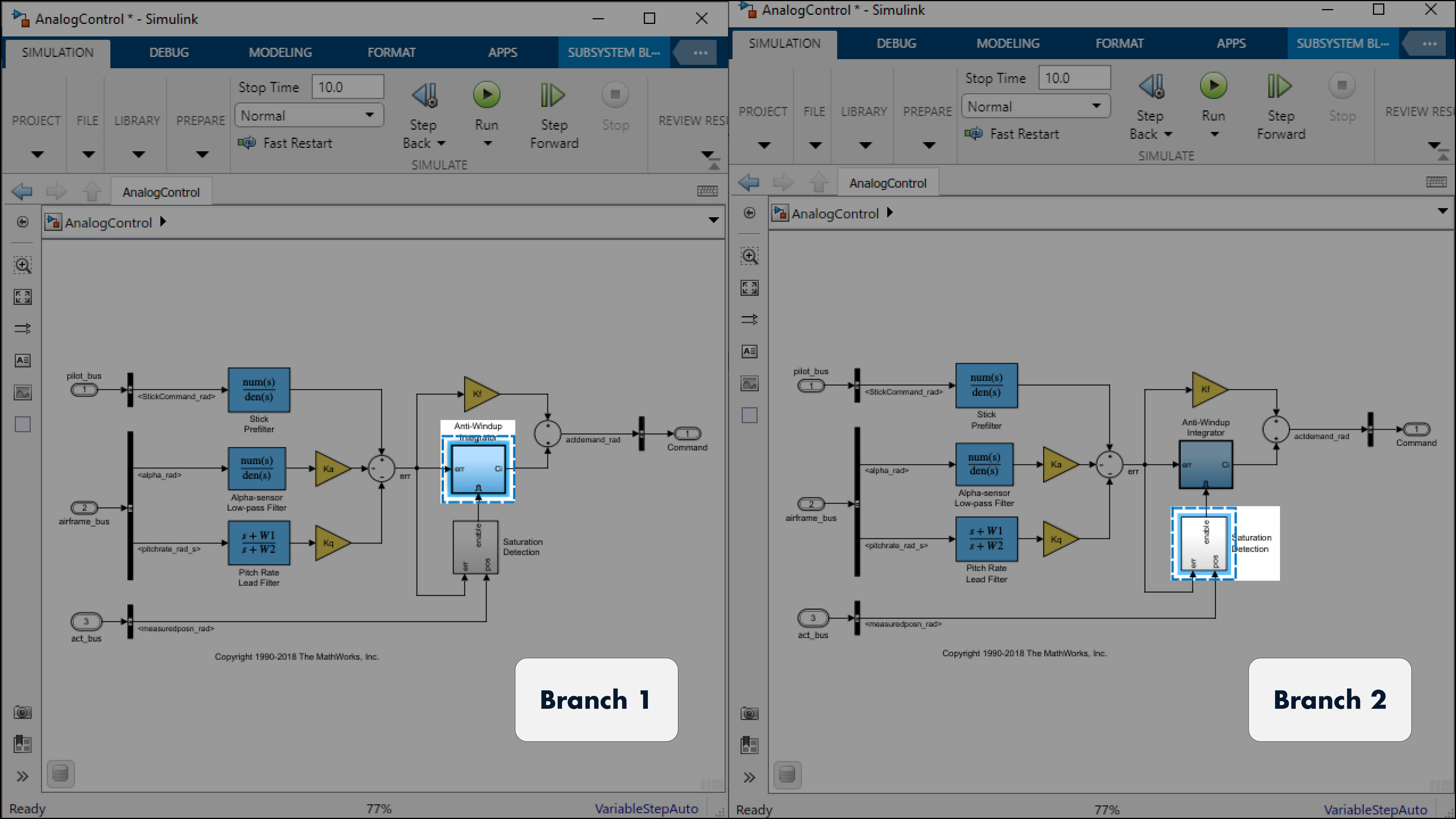
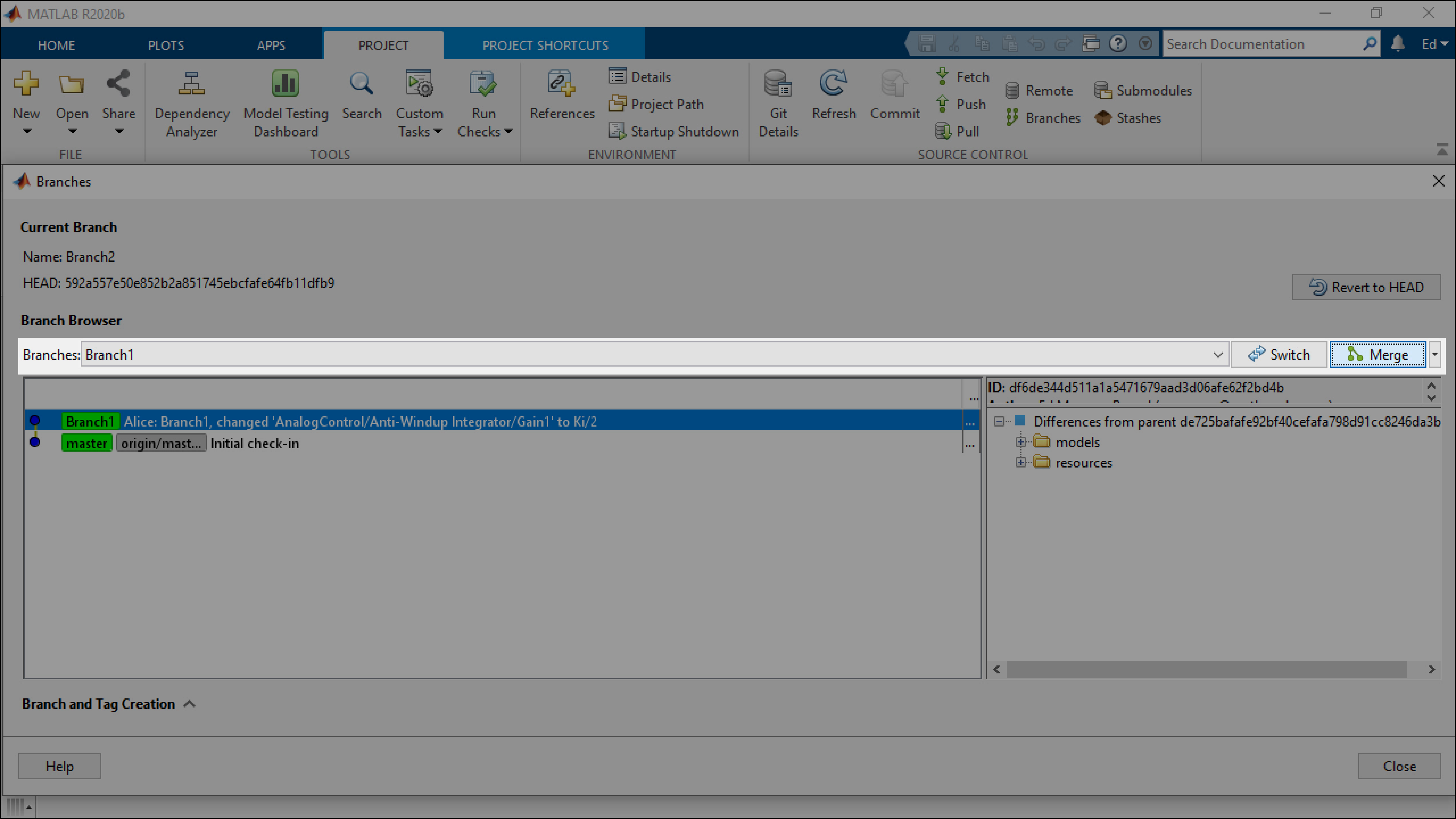
Layout:
Tree
Status
Classification
Git
Tests
work
RunData.mldatx
Labels
Git
Current branch: master
Branch status: Normal
Coincident with /origin/master
Details
Ready


AnalogControl * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
SUBSYSTEM BL...
PROJECT
FILE
LIBRARY
PREPARE
Stop Time
10.0
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
SIMULATE
AnalogControl
pilot_bus
<StickCommand_rad>
num(s)
den(s)
Stick Prefilter
<alpha_rad>
Alpha-sensor Low-pass Filter
airframe_bus
<pitchrate_rad_s>
s + W1
s + W2
Pitch Rate Lead Filter
Ka
Kq
Kf
err
Anti-Windup Integrator
Cl
enable
pos
Saturation Detection
actdemand_rad
Command
act_bus
<measuredposn_rad>
Copyright 1990-2018 The MathWorks, Inc.
Branch 1
Branch 2
Ready
77%
VariableStepAuto


MATLAB R2020b
HOME
PLOTS
APPS
PROJECT
PROJECT SHORTCUTS
Search Documentation
Ed
New
Open
Share
FILE
Dependency Analyzer
Model Testing Dashboard
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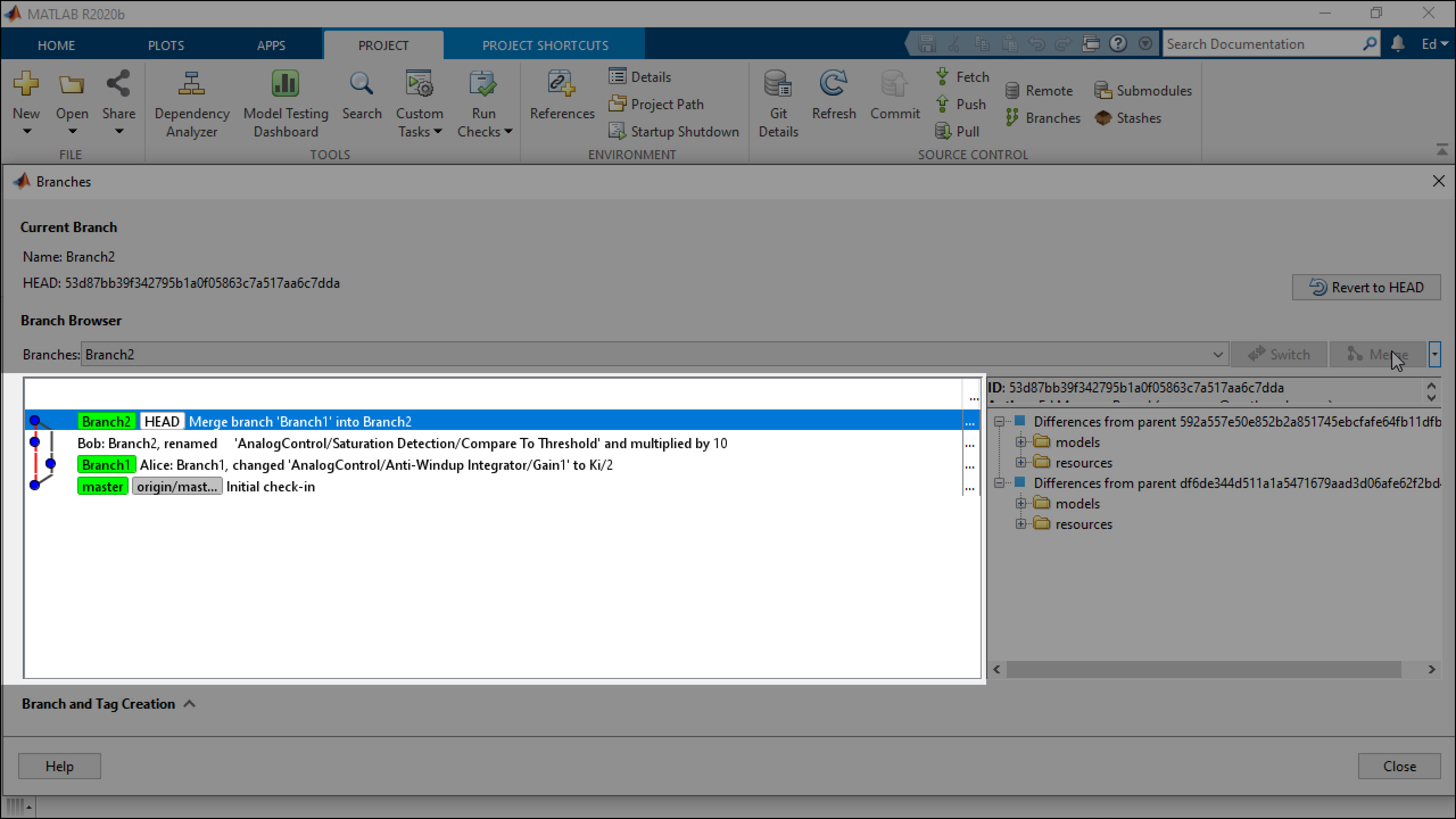
ENVIRONMENT
Git Details
Refresh
Commit
Fetch
Push
Pull
Remote
Branches
Submodules
Stashes
SOURCE CONTROL
Branches
Current Branch
Name: Branch2
HEAD: 592a557e50e852b2a851745ebcfafe64fb11dfb9
Revert to HEAD
Branch Browser
Branches: Branch1
Switch
Merge
Branch1 Alice: Branch1, changed 'AnalogControl/Anti-Windup Integrator/Gain1' to Ki/2
master origin/mast... Initial check-in
ID: df6de344d511a1a5471679aad3d06afe62f2bd4b
Differences from parent de725bafafe92bf40cefafa798d91cc8246da3b
models
resources
Branch and Tag Creation
Help
Close


MATLAB R2020b
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PROJECT
PROJECT SHORTCUTS
Search Documentation
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New
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Share
FILE
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Model Testing Dashboard
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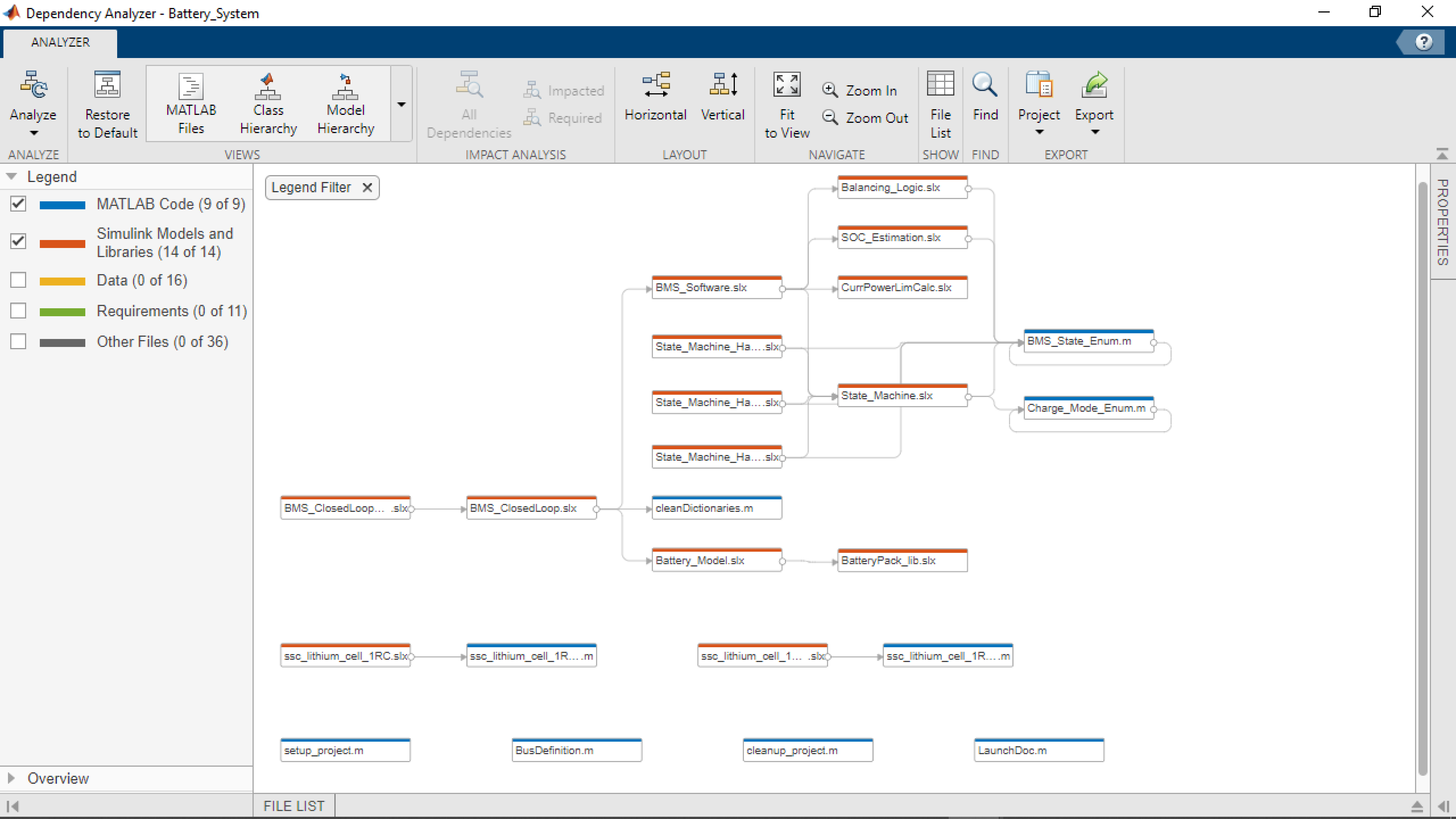
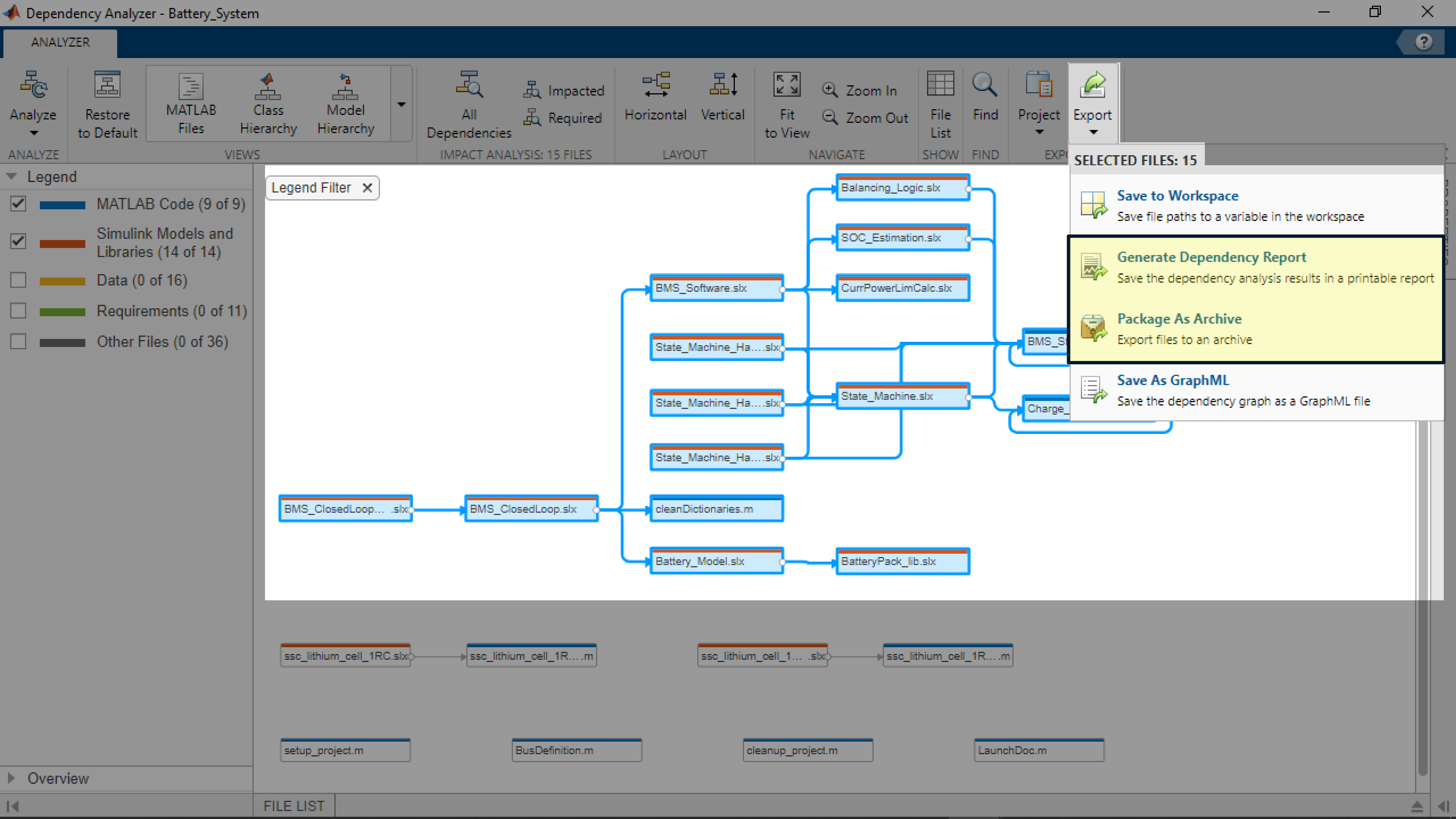
ENVIRONMENT
Git Details
Refresh
Commit
Fetch
Push
Pull
Remote
Branches
Submodules
Stashes
SOURCE CONTROL
Branches
Current Branch
Name: Branch2
HEAD: 53d87bb39f342795b1a0f05863c7a517aa6c7dda
Revert to HEAD
Branch Browser
Branches: Branch2
Switch
Merge
Branch2 HEAD Merge branch 'Branch1' into Branch2
Bob: Branch2, renamed 'AnalogControl/Saturation Detection/Compare To Threshold' and multiplied by 10
Branch1 Alice: Branch1, changed 'AnalogControl/Anti-Windup Integrator/Gain1' to Ki/2
master origin/mast... Initial check-in
ID: 53d87bb39f342795b1a0f05863c7a517aa6c7dda
Differences from parent 592a557e50e852b2a851745ebcfafe64fb11dfb
models
resources
Differences from parent df6de344d511a1a5471679aad3d06afe62f2bd
models
resources
Branch and Tag Creation
Help
Close


Dependency Analyzer - Battery_System
ANALYZER
Analyze
Restore to Default
MATLAB Files
Class Hierarchy
Model Hierarchy
All Dependencies
Impacted
Required
Horizontal
Vertical
Fit to View
Zoom In
Zoom Out
File List
Find
Project
Export
ANALYZE
VIEWS
IMPACT ANALYSIS
LAYOUT
NAVIGATE
SHOW
FIND
EXPORT
Legend
MATLAB Code (9 of 9)
Simulink Models and Libraries (14 of 14)
Data (0 of 16)
Requirements (0 of 11)
Other Files (0 of 36)
Legend Filter
Balancing_Logic.slx
SOC_Estimation.slx
BMS_Software.slx
CurrPowerLimCalc.slx
State_Machine_Ha... .slx
BMS_State_Enum.m
State_Machine_Ha... .slx
State_Machine.slx
Charge_Mode_Enum.m
State_Machine_Ha... .slx
BMS_ClosedLoop... .slx
BMS_ClosedLoop.slx
cleanDictionaries.m
Battery_Model.slx
BatteryPack_lib.slx
ssc_lithium_cell_1RC.slx
ssc_lithium_cell_1R... .m
ssc_lithium_cell_1... .slx
ssc_lithium_cell_1R... .m
setup_project.m
BusDefinition.m
cleanup_project.m
LaunchDoc.m
Overview
FILE LIST
PROPERTIES


Dependency Analyzer - Battery_System
ANALYZER
Analyze
Restore to Default
MATLAB Files
Class Hierarchy
Model Hierarchy
All Dependencies
Impacted
Required
Horizontal
Vertical
Fit to View
Zoom In
Zoom Out
File List
Find
Project
Export
ANALYZE
VIEWS
IMPACT ANALYSIS: 15 FILES
LAYOUT
NAVIGATE
SHOW
FIND
SELECTED FILES: 15
Save to Workspace
Save file paths to a variable in the workspace
Generate Dependency Report
Save the dependency analysis results in a printable report
Package As Archive
Export files to an archive
Save As GraphML
Save the dependency graph as a GraphML file
Legend
MATLAB Code (9 of 9)
Simulink Models and Libraries (14 of 14)
Data (0 of 16)
Requirements (0 of 11)
Other Files (0 of 36)
Legend Filter
Balancing_Logic.slx
SOC_Estimation.slx
BMS_Software.slx
CurrPowerLimCalc.slx
State_Machine_Ha....slx
State_Machine.slx
BMS_ClosedLoop... .slx
BMS_ClosedLoop.slx
cleanDictionaries.m
Battery_Model.slx
BatteryPack_lib.slx
ssc_lithium_cell_1RC.slx
ssc_lithium_cell_1R....m
setup_project.m
BusDefinition.m
cleanup_project.m
LaunchDoc.m
Overview
FILE LIST

`Simulink.exportToVersion(a,b,c)`

Project to export

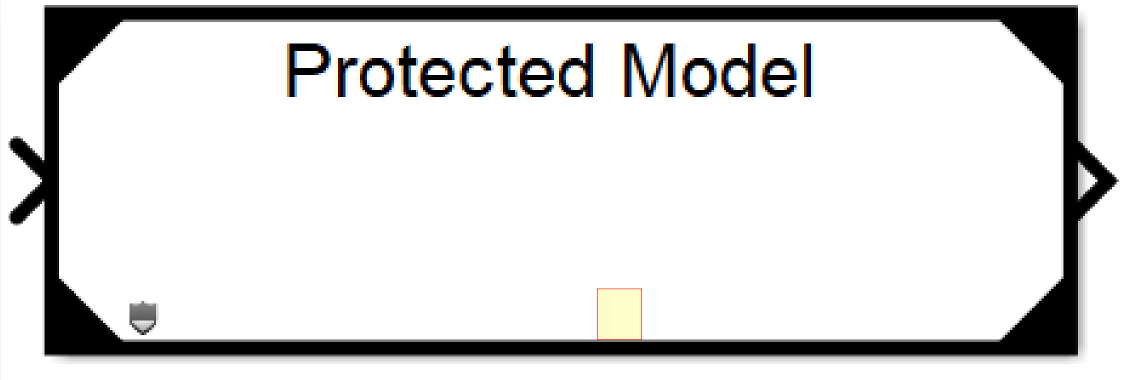
ZIP file name

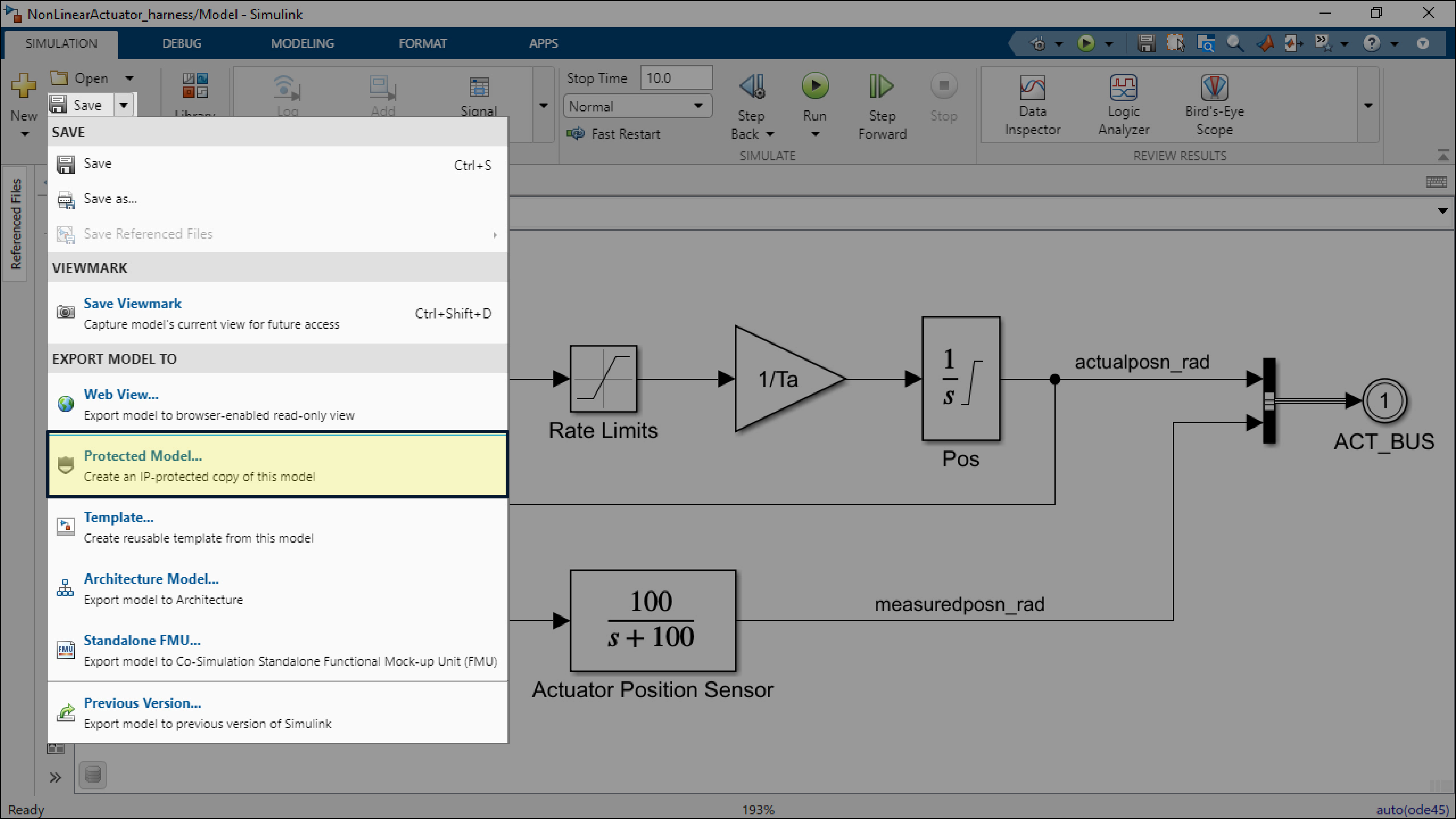
Desired release

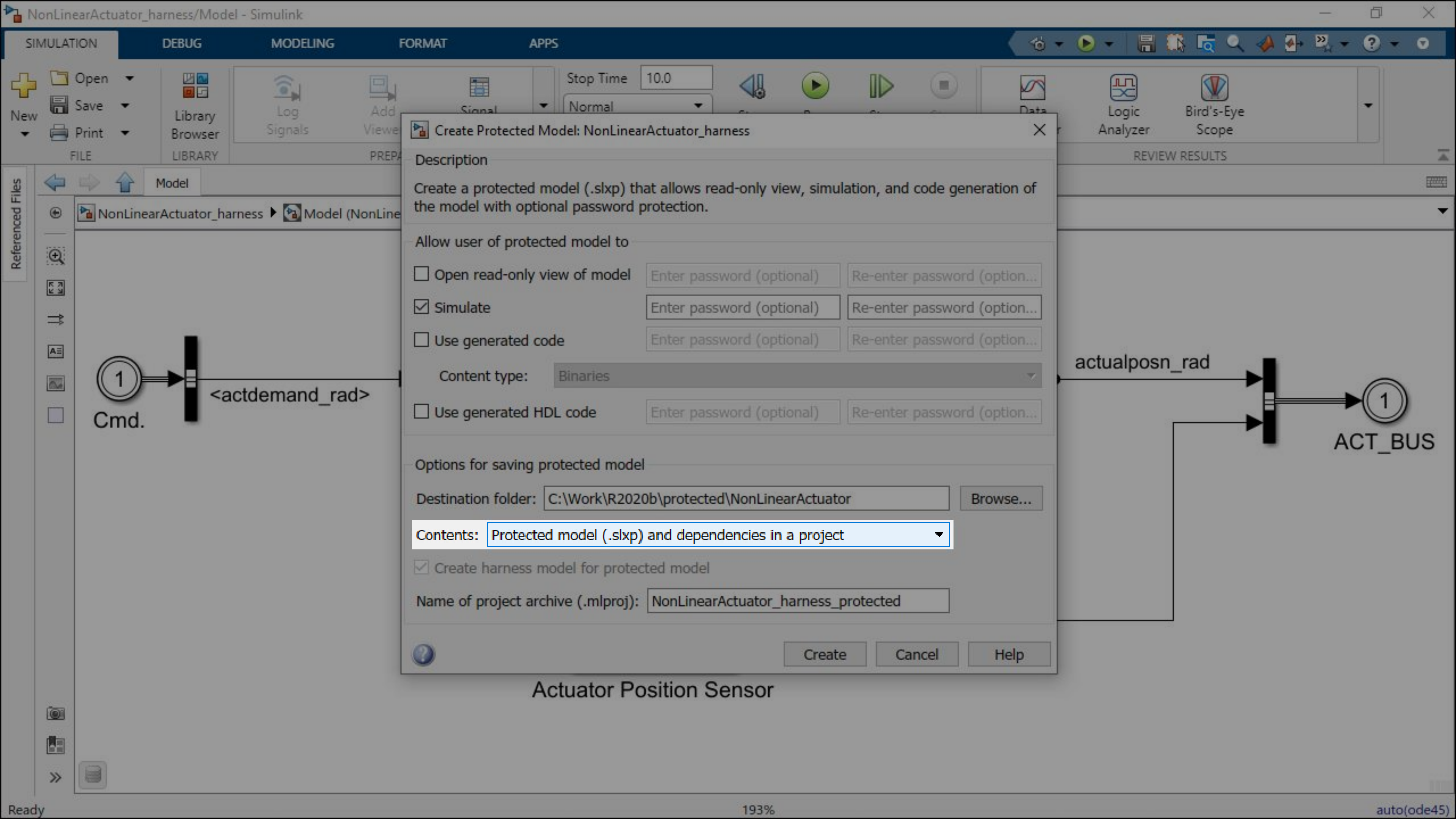
R2021a

Up to 7 years

R2014a


Protected Model


NonLinearActuator_harness/Model - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
New
Open
Save
Stop Time
10.0
Normal
Fast Restart
Step Back
Run
Step Forward
Stop
SIMULATE
Data Inspector
Logic Analyzer
Bird's-Eye Scope
REVIEW RESULTS
Referenced Files
SAVE
Save
Ctrl+S
Save as...
Save Referenced Files
VIEWMARK
Save Viewmark
Capture model's current view for future access
Ctrl+Shift+D
EXPORT MODEL TO
Web View...
Export model to browser-enabled read-only view
Protected Model...
Create an IP-protected copy of this model
Template...
Create reusable template from this model
Architecture Model...
Export model to Architecture
Standalone FMU...
Export model to Co-Simulation Standalone Functional Mock-up Unit (FMU)
Previous Version...
Export model to previous version of Simulink
Rate Limits
1/Ta
1/s
Pos
actualposn_rad
1
ACT_BUS
100/(s + 100)
measuredposn_rad
Actuator Position Sensor
Ready
193%
auto(ode45)


NonLinearActuator_harness/Model - Simulink
SIMULATION
DEBUG
MODELING
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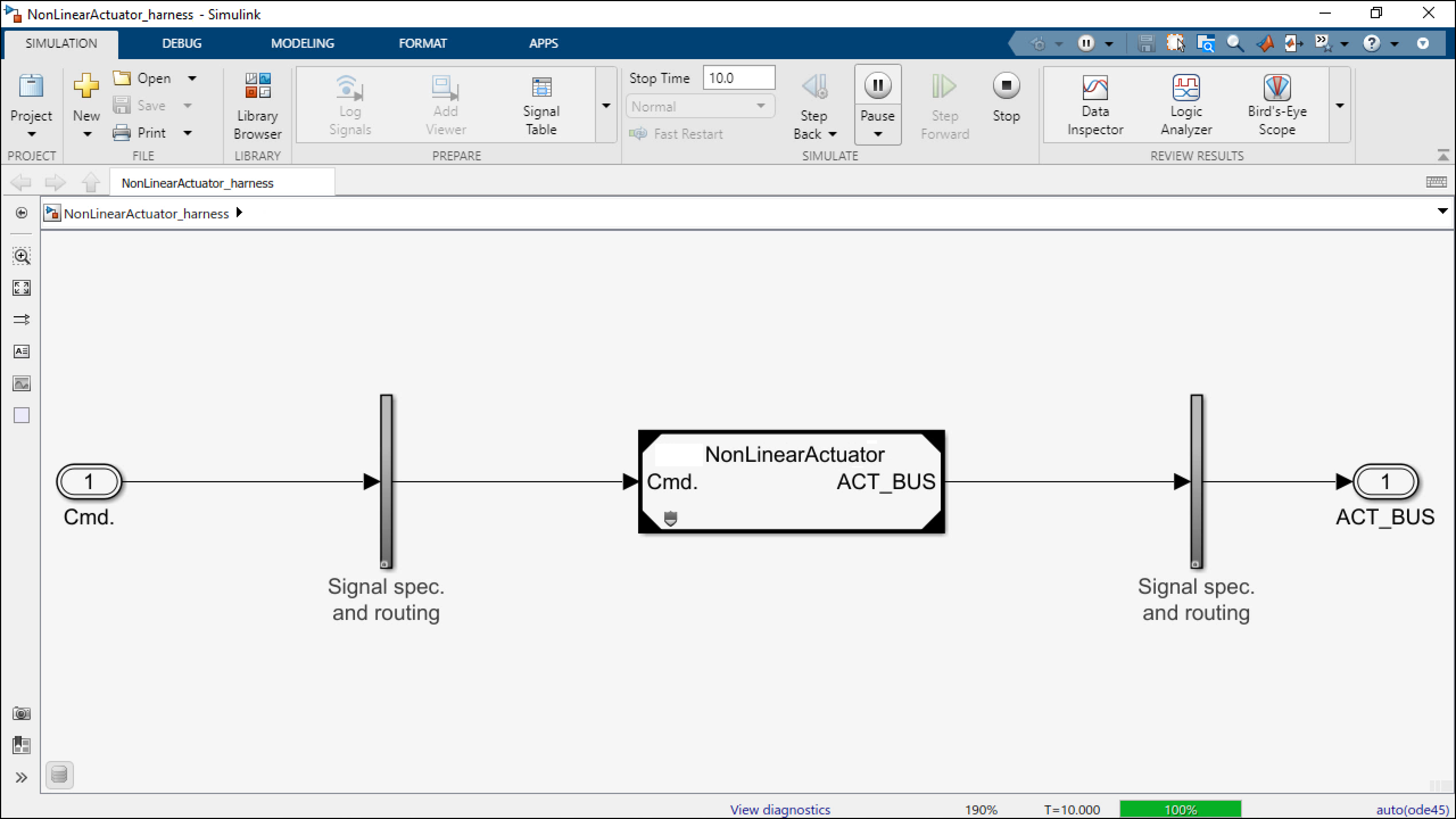
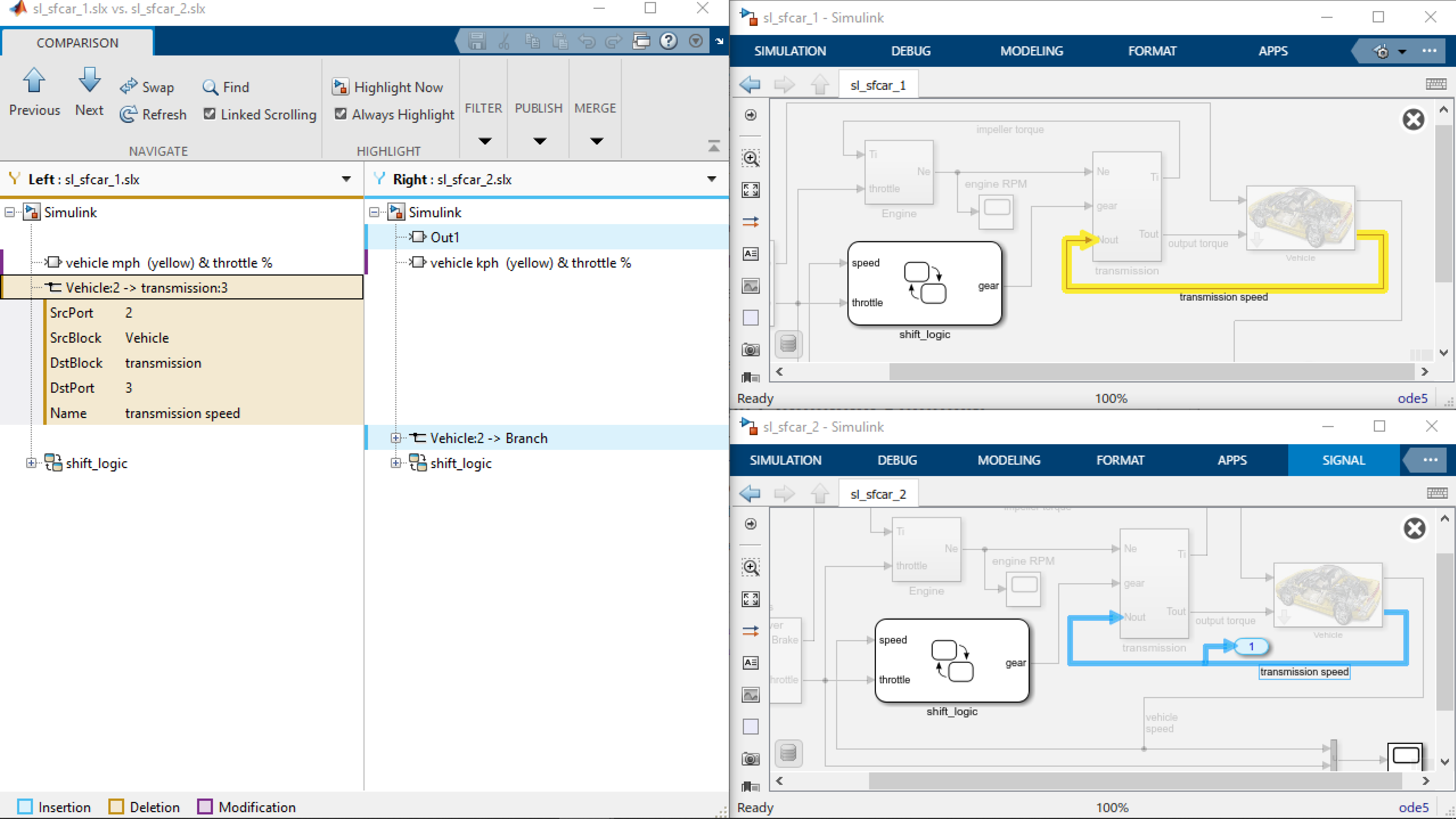
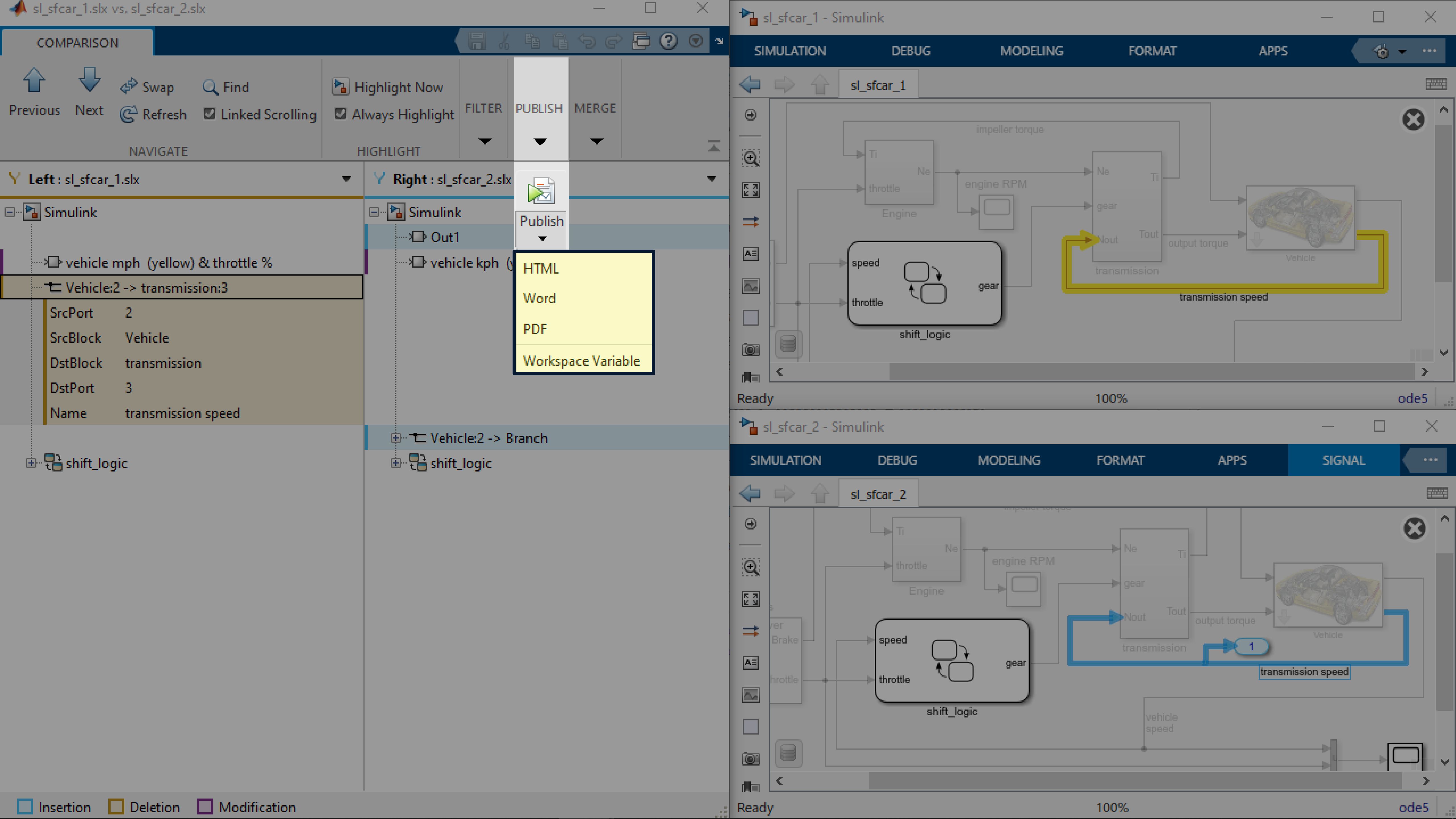
APPS
New
Open
Save
Print
FILE
Library Browser
LIBRARY
Log Signals
Add Viewer
Stop Time
10.0
Normal
Logic Analyzer
Bird's-Eye Scope
REVIEW RESULTS
Model
NonLinearActuator_harness
Referenced Files
Create Protected Model: NonLinearActuator_harness
Description
Create a protected model (.slxp) that allows read-only view, simulation, and code generation of the model with optional password protection.
Allow user of protected model to
Open read-only view of model
Simulate
Use generated code
Content type:
Binaries
Use generated HDL code
Enter password (optional)
Re-enter password (option...
Options for saving protected model
Destination folder:
C:\Work\R2020b\protected\NonLinearActuator
Browse...
Contents:
Protected model (.slxp) and dependencies in a project
Create harness model for protected model
Name of project archive (.mlproj):
NonLinearActuator_harness_protected
Create
Cancel
Help
1
Cmd.
<actdemand_rad>
actualposn_rad
ACT_BUS
Actuator Position Sensor
Ready
193%
auto(ode45)


NonLinearActuator_harness - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Project
New
Open
Save
Print
Library Browser
Log Signals
Add Viewer
Signal Table
Stop Time
10.0
Normal
Fast Restart
Step Back
Pause
Step Forward
Stop
Data Inspector
Logic Analyzer
Bird's-Eye Scope
PROJECT
FILE
LIBRARY
PREPARE
SIMULATE
REVIEW RESULTS
NonLinearActuator_harness
1
Cmd.
Signal spec. and routing
NonLinearActuator
Cmd.
ACT_BUS
Signal spec. and routing
1
ACT_BUS
View diagnostics
190%
T=10.000
100%
auto(ode45)


sl_sfcar_1.slx vs. sl_sfcar_2.slx
COMPARISON
Previous
Next
Swap
Refresh
Find
Linked Scrolling
Highlight Now
Always Highlight
FILTER
PUBLISH
MERGE
NAVIGATE
HIGHLIGHT
Left : sl_sfcar_1.slx
Right : sl_sfcar_2.slx
Simulink
vehicle mph (yellow) & throttle %
Vehicle:2 -> transmission:3
SrcPort 2
SrcBlock Vehicle
DstBlock transmission
DstPort 3
Name transmission speed
shift_logic
Simulink
Out1
vehicle kph (yellow) & throttle %
Vehicle:2 -> Branch
shift_logic
Insertion
Deletion
Modification
sl_sfcar_1 - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
sl_sfcar_1
impeller torque
Ti
Ne
throttle
Engine
engine RPM
Ne
Ti
gear
Nout
Tout
output torque
transmission
Vehicle
speed
throttle
gear
shift_logic
transmission speed
Ready
100%
ode5
sl_sfcar_2 - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
SIGNAL
sl_sfcar_2
Ti
Ne
throttle
Engine
engine RPM
Ne
Ti
gear
Nout
Tout
output torque
transmission
Vehicle
Brake
speed
throttle
gear
shift_logic
1
transmission speed
vehicle
speed
Ready
100%
ode5


sl_sfcar_1.slx vs. sl_sfcar_2.slx
COMPARISON
Previous
Next
Swap
Refresh
Find
Linked Scrolling
Highlight Now
Always Highlight
FILTER
PUBLISH
MERGE
NAVIGATE
HIGHLIGHT
Left : sl_sfcar_1.slx
Right : sl_sfcar_2.slx
Simulink
vehicle mph (yellow) & throttle %
Vehicle:2 -> transmission:3
SrcPort 2
SrcBlock Vehicle
DstBlock transmission
DstPort 3
Name transmission speed
shift_logic
Simulink
Out1
vehicle kph
Vehicle:2 -> Branch
shift_logic
Publish
HTML
Word
PDF
Workspace Variable
Insertion
Deletion
Modification
sl_sfcar_1 - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
sl_sfcar_1
impeller torque
engine RPM
Engine
transmission
output torque
Vehicle
speed
throttle
gear
shift_logic
transmission speed
Ready
100%
ode5
sl_sfcar_2 - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
SIGNAL
sl_sfcar_2
engine RPM
Engine
transmission
output torque
Vehicle
speed
throttle
gear
shift_logic
transmission speed
vehicle speed
Ready
100%
ode5

Object-Oriented Programming in MATLAB

Model real-world objects and manage software complexity

Use Object-Oriented Programming to Model Real-World Objects

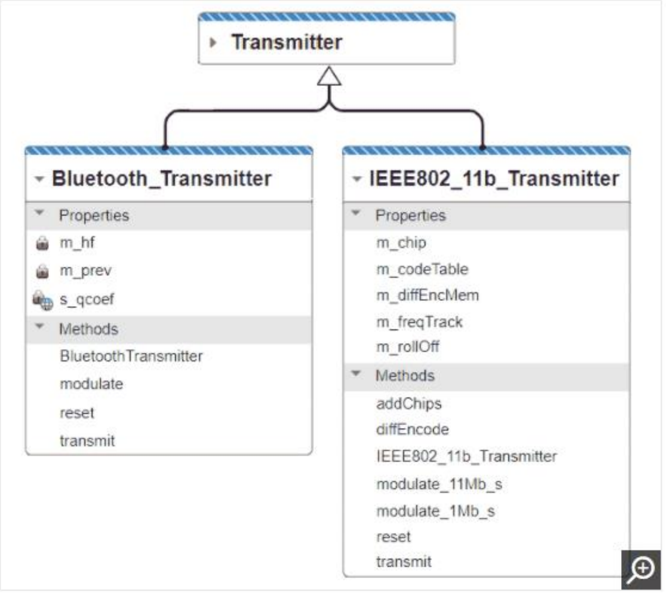
Object-oriented programming is a design approach that enables you to programmatically define structures called *objects* that combine data (properties) together with functions that operate on that data (methods). In MATLAB®, you can create objects that model the behavior of devices and systems in the real world. Those objects can then be used as building blocks in applications used to simulate and analyze complex systems.

Learn more

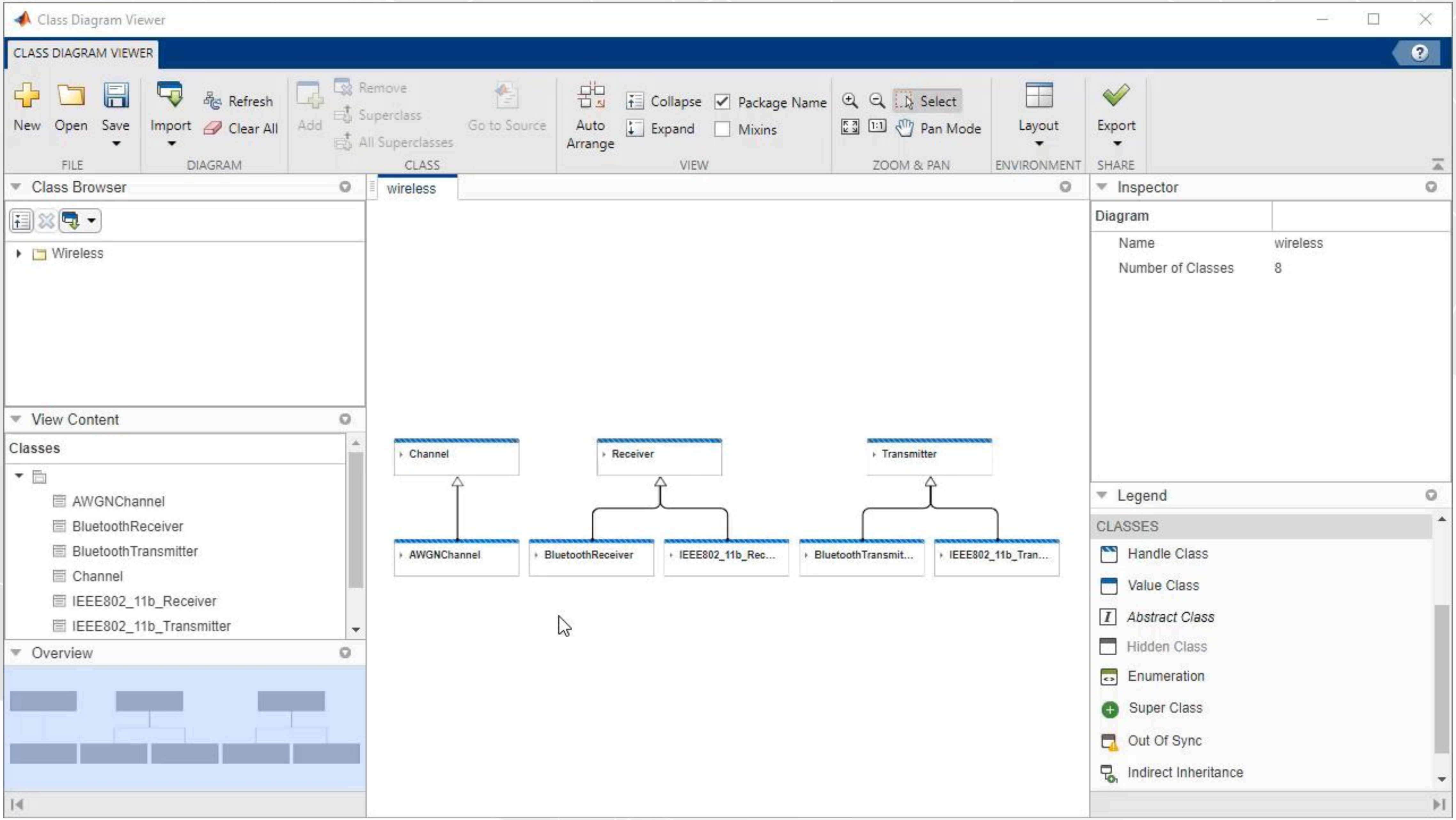
Developing and Deploying Sonar and Echosounder Data Analysis Software

Building and Extending Portfolio Optimization Models with MATLAB

Control System Modeling with Model Objects



Example Transmitter classes in a wireless communications application.


Class Diagram Viewer
CLASS DIAGRAM VIEWER
New
Open
Save
FILE
Import
Refresh
Clear All
DIAGRAM
Add
Remove
Superclass
All Superclasses
Go to Source
CLASS
Auto Arrange
Collapse
Expand
Package Name
Mixins
VIEW
Select
Pan Mode
ZOOM & PAN
Layout
ENVIRONMENT
Export
SHARE
Class Browser
Wireless
View Content
Classes
AWGNChannel
BluetoothReceiver
BluetoothTransmitter
Channel
IEEE802_11b_Receiver
IEEE802_11b_Transmitter
Overview
wireless
Channel
Receiver
Transmitter
AWGNChannel
BluetoothReceiver
IEEE802_11b_Rec...
BluetoothTransmit...
IEEE802_11b_Tran...
Inspector
Diagram
Name
wireless
Number of Classes
8
Legend
CLASSES
Handle Class
Value Class
Abstract Class
Hidden Class
Enumeration
Super Class
Out Of Sync
Indirect Inheritance

Focus

Collaboration

Production

Focus

Collaboration

Production

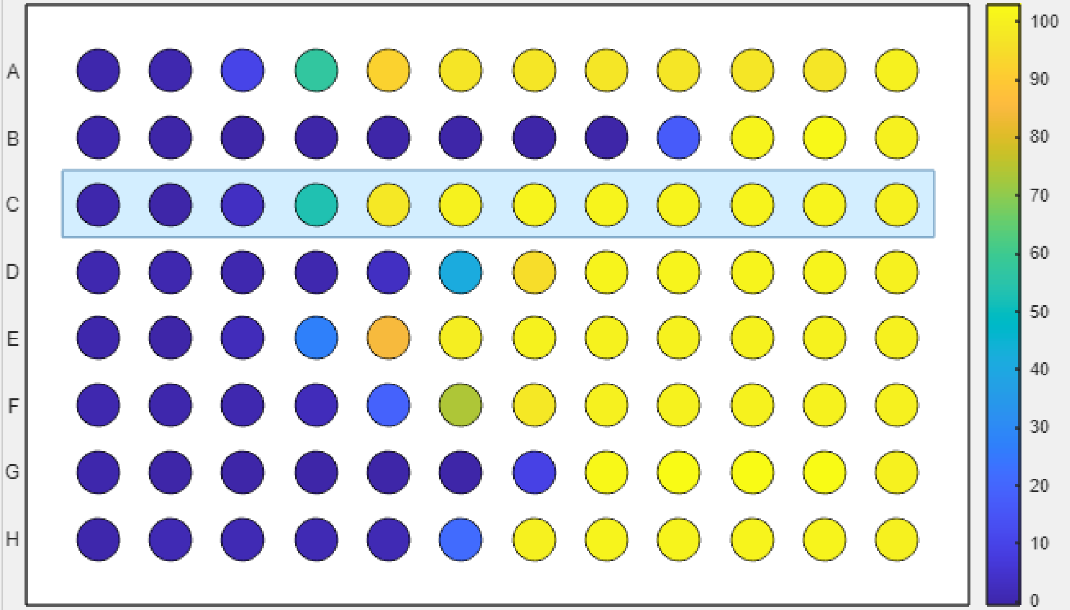
Microplate analysis

Plate Browser | Summary Tables

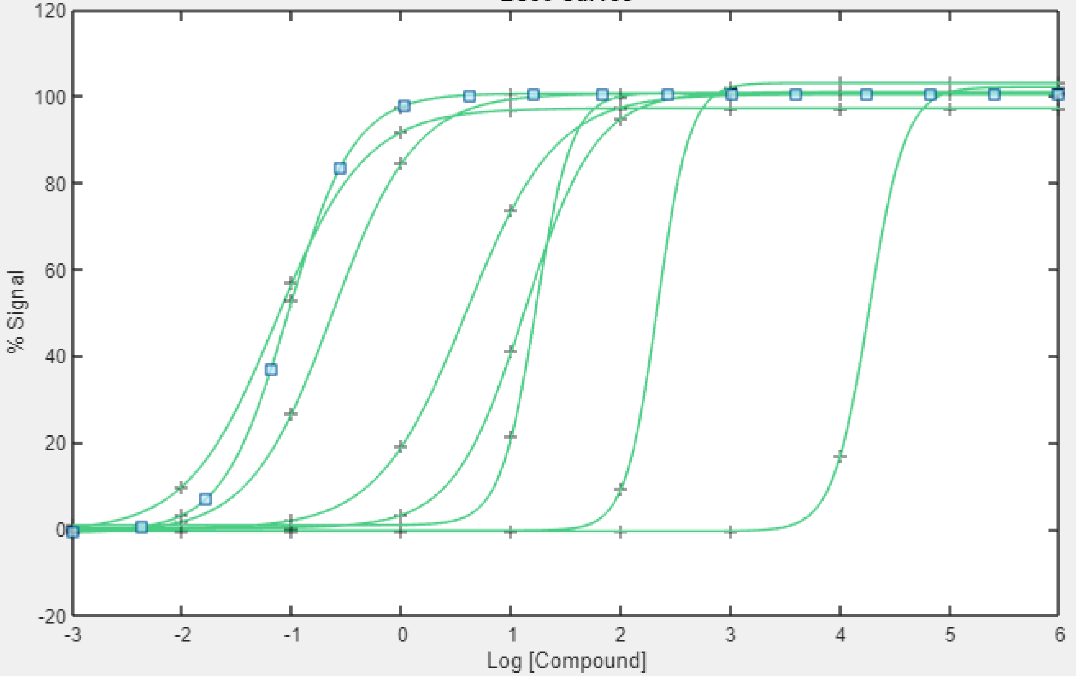
Select Files

Current File: microtiter_data0001.csv

Microplate Plot



EC50 Curves



Previous File

Next File

Clear selection

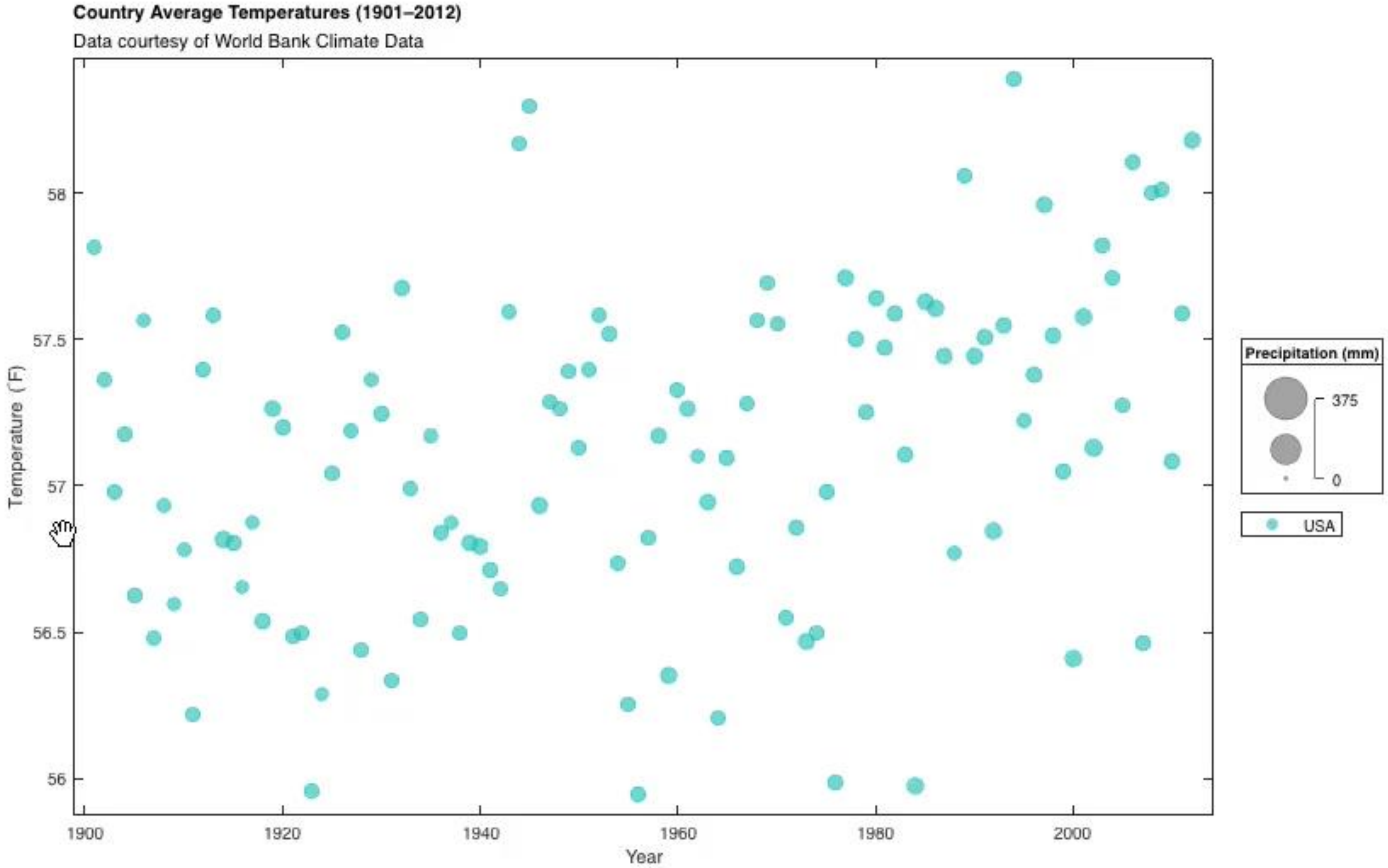
File	Compound Nr	NegControl	Conc1	Conc2	Conc3	Conc4	Conc5	Conc6	Conc7	Conc8	Conc9	Conc10	PosControl	EC50	Hills slope
microtiter_data...	1	-0.0741	0.3564	9.8759	56.8743	91.7323	96.7084	97.1532	97.1910	97.1940	97.1940	97.1940	100	0.0719	1.0740
microtiter_data...	2	-0.0143	-0.5044	-0.5044	-0.5044	-0.5044	-0.5044	-0.5043	-0.4544	17.0436	100.9448	102.1084	100	1.8246e+04	2.6249
microtiter_data...	3	0.0054	-0.4702	3.1998	52.9698	97.5746	100.5006	100.6086	100.6086	100.6086	100.6086	100.6086	100	0.0923	1.4589
microtiter_data...	4	0.1096	0.2325	0.2385	0.3712	3.2339	41.1060	94.7343	100.6591	100.9487	100.9587	100.9587	100	13.2732	1.3469
microtiter_data...	5	-0.0572	-0.7461	1.7104	26.8872	84.5134	99.2335	100.4717	100.5601	100.5700	100.5700	100.5700	100	0.2334	1.1490
microtiter_data...	6	0.0667	0.0146	0.1713	1.9726	19.0989	73.6380	97.3556	100.1063	100.3510	100.3710	100.3710	100	3.8757	1.0690
microtiter_data...	7	0.0044	-0.3527	-0.3527	-0.3527	-0.3527	-0.3417	9.2696	101.9774	103.0170	103.0170	103.0170	100	214.5800	2.9816

World Climate

Select a Country +

Select a Visualization +

Configure Settings +

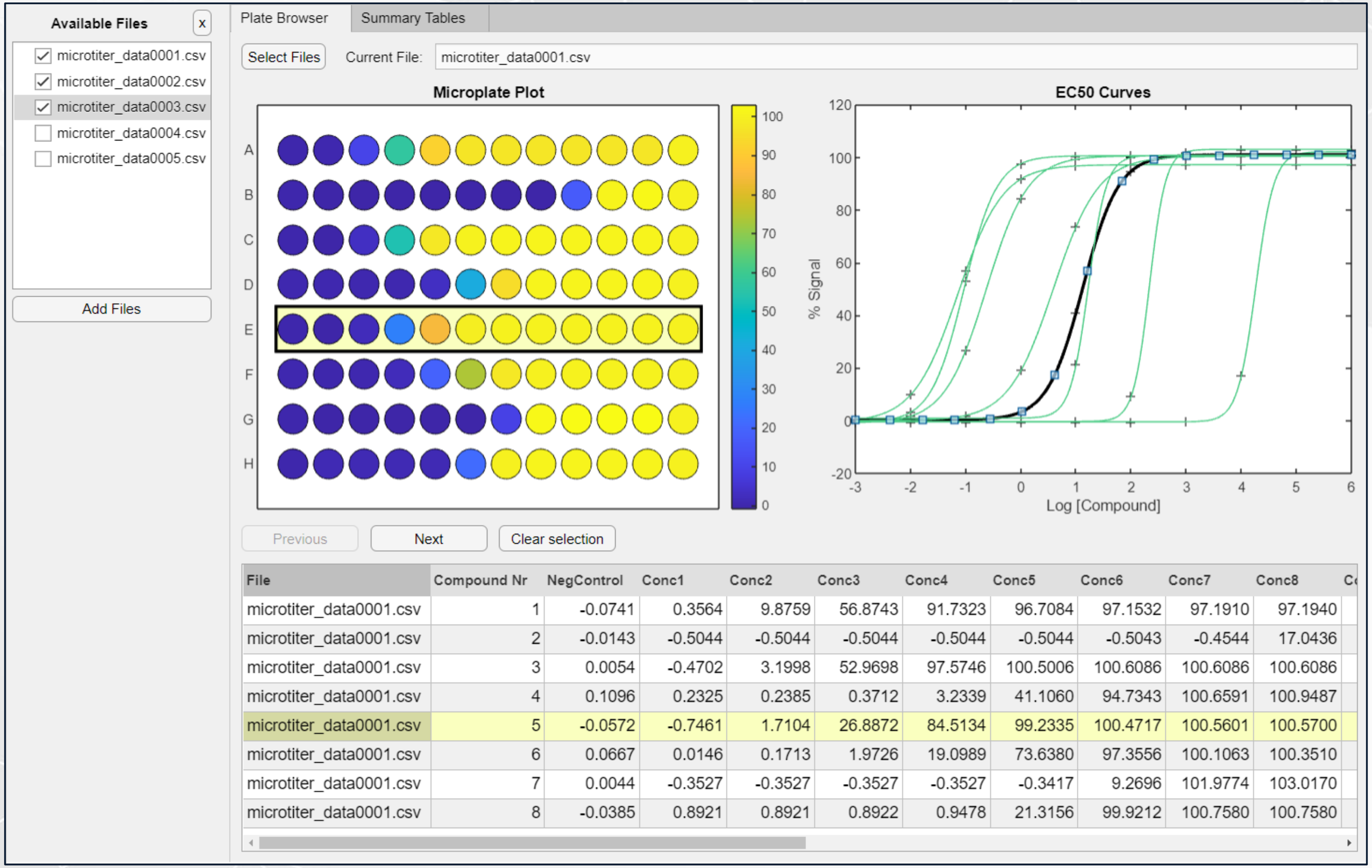


About This App

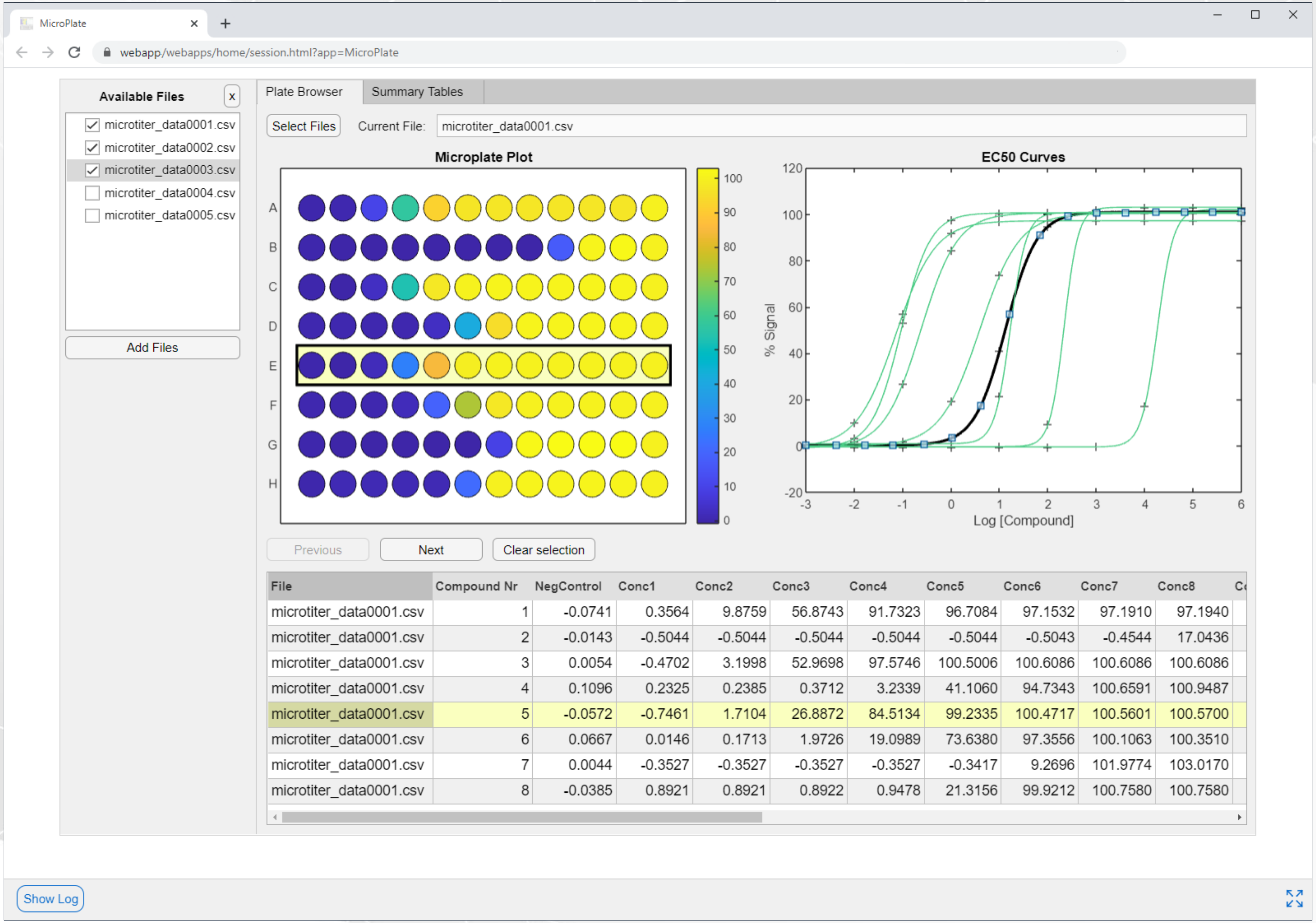
This app was built in MATLAB® using features from R2019a through R2021a. The app's layout is managed using **UIGRIDLAYOUT**. The side panel is a combination of HTML, JavaScript, and CSS integrated via the **UIHTML** function, plus **UIIMAGE** for the MathWorks logo. The layout for the legends and the **BUBBLECHART** and **SWARMCHART** visualizations are managed using a flow **TILEDLAYOUT**. Interactivity makes use of default interactions and custom **DataTipTemplate** properties. Lastly, this info panel uses an HTML interpreter for the label's text, and a **UIHYPERLINK** for the link.

Learn More

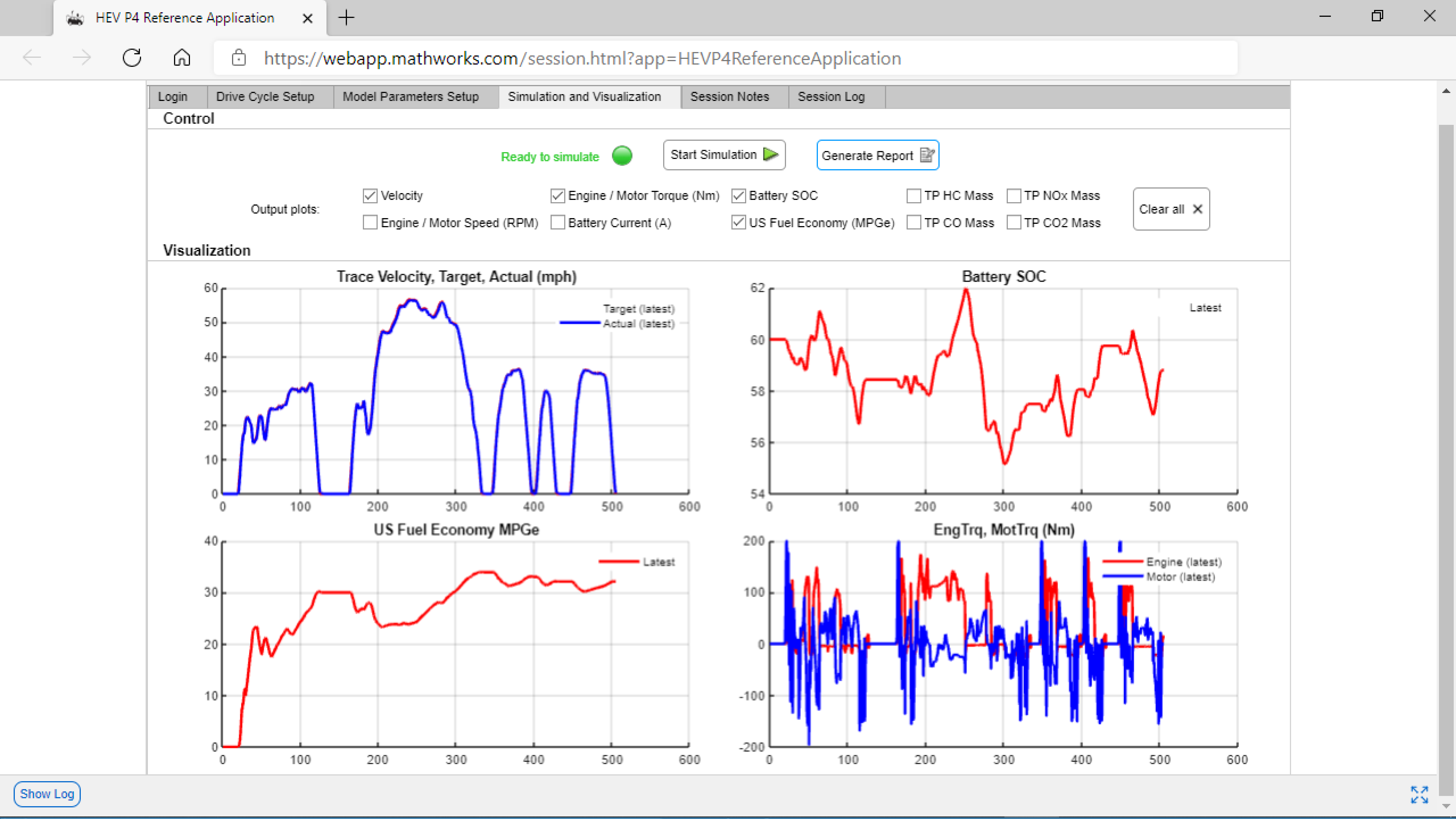
MathWorks

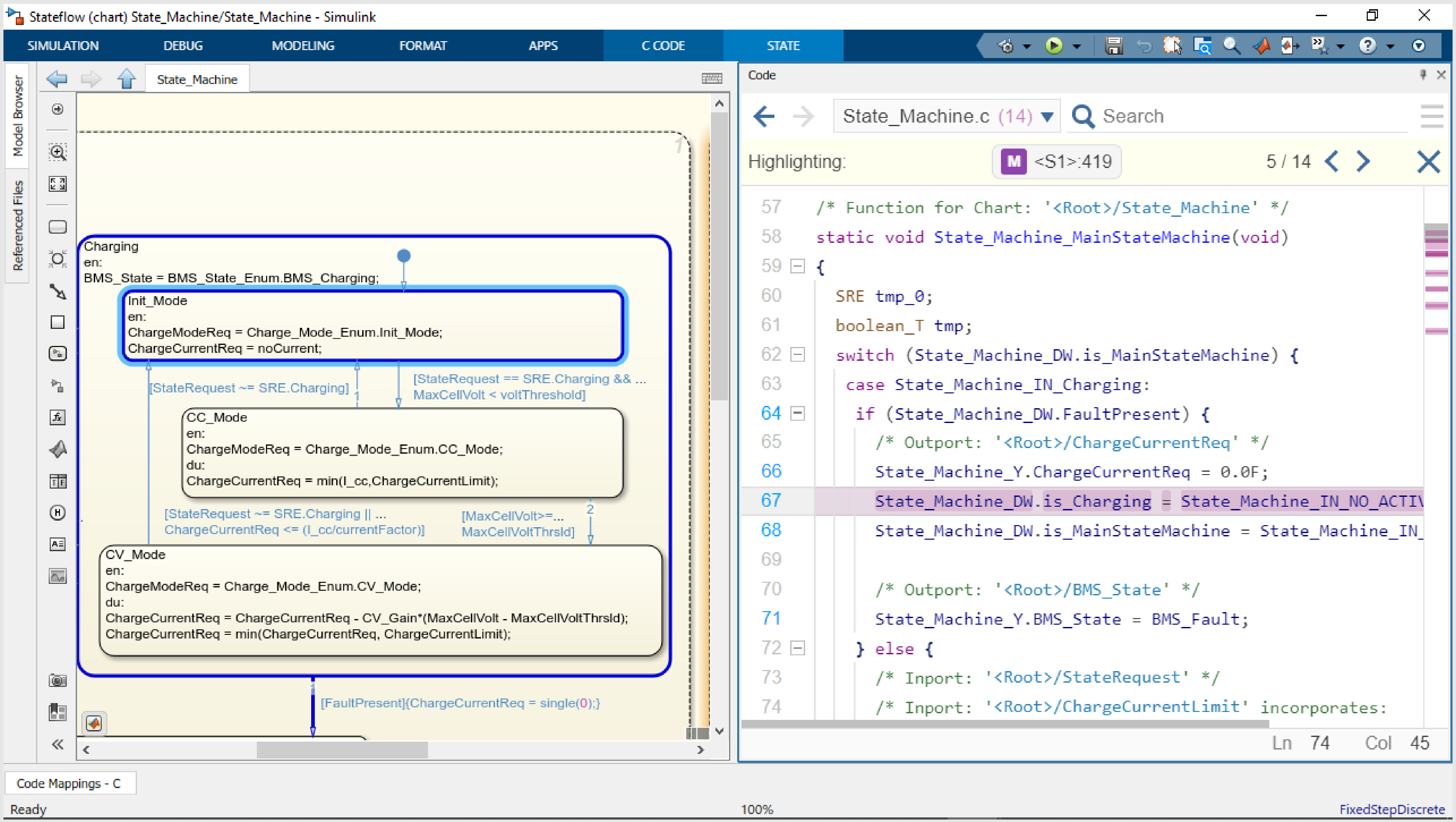

Available Files
x
microtiter_data0001.csv
microtiter_data0002.csv
microtiter_data0003.csv
microtiter_data0004.csv
microtiter_data0005.csv
Add Files
Plate Browser
Summary Tables
Select Files
Current File: microtiter_data0001.csv
Microplate Plot
A
B
C
D
E
F
G
H
100
90
80
70
60
50
40
30
20
10
0
EC50 Curves
% Signal
Log [Compound]
120
100
80
60
40
20
0
-20
-3
-2
-1
0
1
2
3
4
5
6
Previous
Next
Clear selection

File	Compound Nr	NegControl	Conc1	Conc2	Conc3	Conc4	Conc5	Conc6	Conc7	Conc8	Co
microtiter_data0001.csv	1	-0.0741	0.3564	9.8759	56.8743	91.7323	96.7084	97.1532	97.1910	97.1940	
microtiter_data0001.csv	2	-0.0143	-0.5044	-0.5044	-0.5044	-0.5044	-0.5044	-0.5043	-0.4544	17.0436	
microtiter_data0001.csv	3	0.0054	-0.4702	3.1998	52.9698	97.5746	100.5006	100.6086	100.6086	100.6086	
microtiter_data0001.csv	4	0.1096	0.2325	0.2385	0.3712	3.2339	41.1060	94.7343	100.6591	100.9487	
microtiter_data0001.csv	5	-0.0572	-0.7461	1.7104	26.8872	84.5134	99.2335	100.4717	100.5601	100.5700	
microtiter_data0001.csv	6	0.0667	0.0146	0.1713	1.9726	19.0989	73.6380	97.3556	100.1063	100.3510	
microtiter_data0001.csv	7	0.0044	-0.3527	-0.3527	-0.3527	-0.3527	-0.3417	9.2696	101.9774	103.0170	
microtiter_data0001.csv	8	-0.0385	0.8921	0.8921	0.8922	0.9478	21.3156	99.9212	100.7580	100.7580	



File	Compound Nr	NegControl	Conc1	Conc2	Conc3	Conc4	Conc5	Conc6	Conc7	Conc8
microtiter_data0001.csv	1	-0.0741	0.3564	9.8759	56.8743	91.7323	96.7084	97.1532	97.1910	97.1940
microtiter_data0001.csv	2	-0.0143	-0.5044	-0.5044	-0.5044	-0.5044	-0.5044	-0.5043	-0.4544	17.0436
microtiter_data0001.csv	3	0.0054	-0.4702	3.1998	52.9698	97.5746	100.5006	100.6086	100.6086	100.6086
microtiter_data0001.csv	4	0.1096	0.2325	0.2385	0.3712	3.2339	41.1060	94.7343	100.6591	100.9487
microtiter_data0001.csv	5	-0.0572	-0.7461	1.7104	26.8872	84.5134	99.2335	100.4717	100.5601	100.5700
microtiter_data0001.csv	6	0.0667	0.0146	0.1713	1.9726	19.0989	73.6380	97.3556	100.1063	100.3510
microtiter_data0001.csv	7	0.0044	-0.3527	-0.3527	-0.3527	-0.3527	-0.3417	9.2696	101.9774	103.0170
microtiter_data0001.csv	8	-0.0385	0.8921	0.8921	0.8922	0.9478	21.3156	99.9212	100.7580	100.7580

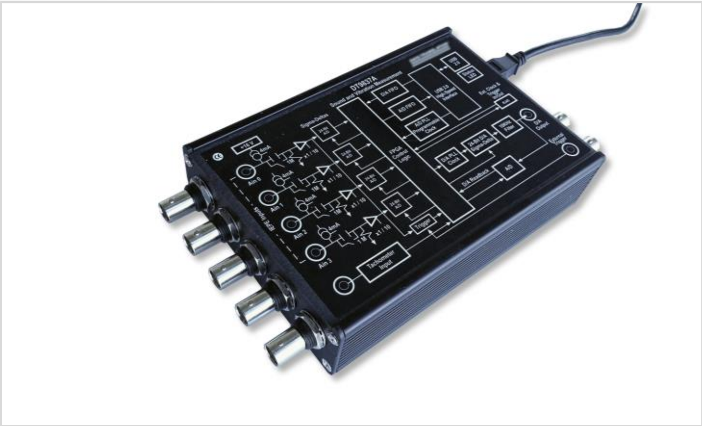

HEV P4 Reference Application
https://webapp.mathworks.com/session.html?app=HEVP4ReferenceApplication
Login
Drive Cycle Setup
Model Parameters Setup
Simulation and Visualization
Session Notes
Session Log
Control
Ready to simulate
Start Simulation
Generate Report
Output plots:
Velocity
Engine / Motor Torque (Nm)
Battery SOC
TP HC Mass
TP NOx Mass
Engine / Motor Speed (RPM)
Battery Current (A)
US Fuel Economy (MPGe)
TP CO Mass
TP CO2 Mass
Clear all
Visualization
Trace Velocity, Target, Actual (mph)
Target (latest)
Actual (latest)
Battery SOC
Latest
US Fuel Economy MPGe
Latest
EngTrq, MotTrq (Nm)
Engine (latest)
Motor (latest)
Show Log

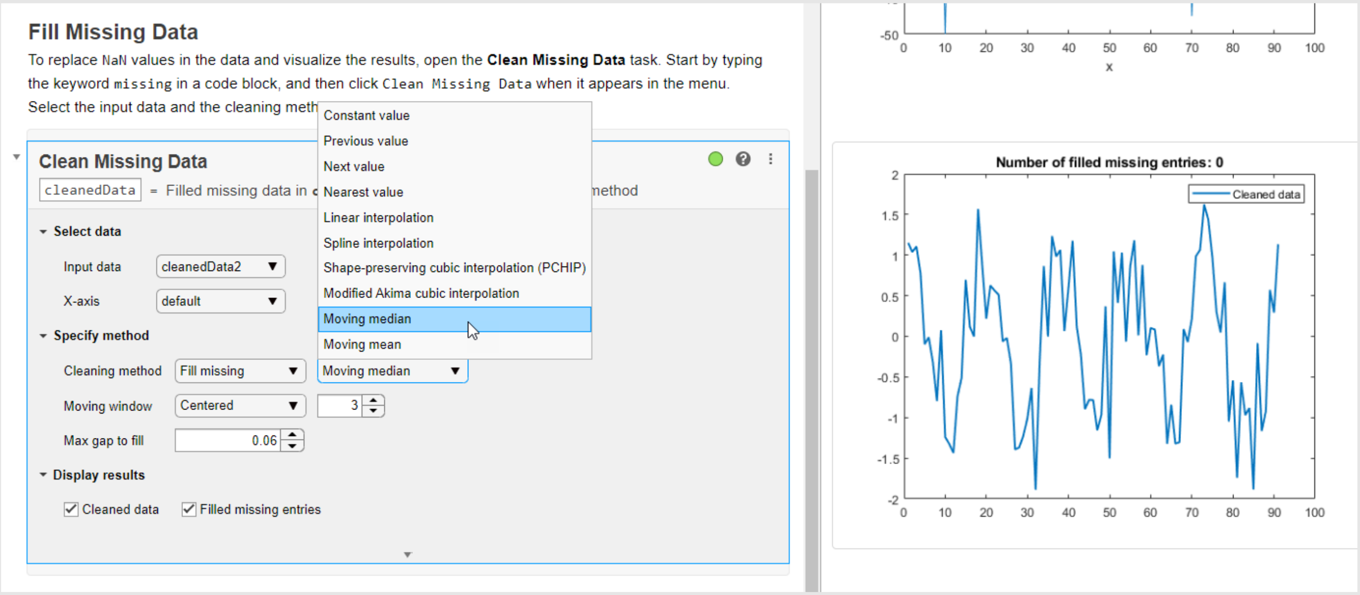
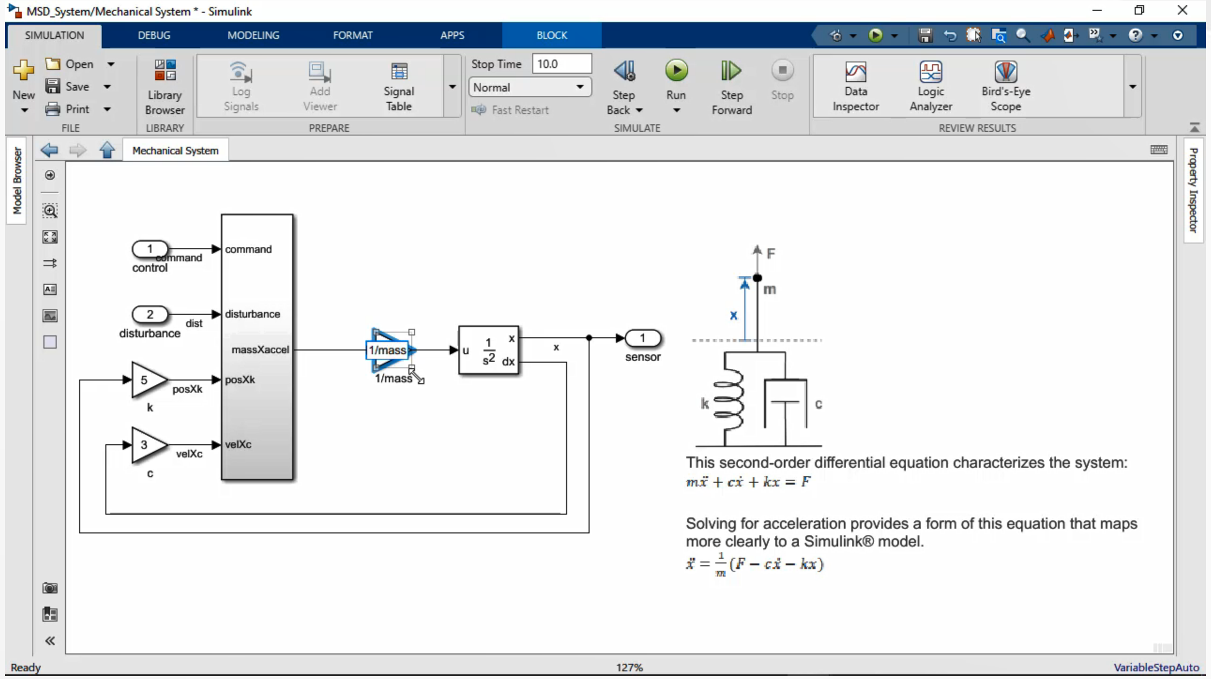

Stateflow (chart) State_Machine/State_Machine - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
C CODE
STATE
Model Browser
Referenced Files
State_Machine
Charging
en:
BMS_State = BMS_State_Enum.BMS_Charging;
Init_Mode
en:
ChargeModeReq = Charge_Mode_Enum.Init_Mode;
ChargeCurrentReq = noCurrent;
[StateRequest ~= SRE.Charging]
[StateRequest == SRE.Charging && ...
MaxCellVolt < voltThreshold]
CC_Mode
en:
ChargeModeReq = Charge_Mode_Enum.CC_Mode;
du:
ChargeCurrentReq = min(I_cc,ChargeCurrentLimit);
[StateRequest ~= SRE.Charging || ...
ChargeCurrentReq <= (I_cc/currentFactor)]
[MaxCellVolt>=...
MaxCellVoltThrsld]
CV_Mode
en:
ChargeModeReq = Charge_Mode_Enum.CV_Mode;
du:
ChargeCurrentReq = ChargeCurrentReq - CV_Gain*(MaxCellVolt - MaxCellVoltThrsld);
ChargeCurrentReq = min(ChargeCurrentReq, ChargeCurrentLimit);
[FaultPresent]{ChargeCurrentReq = single(0);}
Code
State_Machine.c (14)
Search
Highlighting:
<S1>:419
5 / 14
/* Function for Chart: '<Root>/State_Machine' */
static void State_Machine_MainStateMachine(void)
{
SRE tmp_0;
boolean_T tmp;
switch (State_Machine_DW.is_MainStateMachine) {
case State_Machine_IN_Charging:
if (State_Machine_DW.FaultPresent) {
/* Outport: '<Root>/ChargeCurrentReq' */
State_Machine_Y.ChargeCurrentReq = 0.0F;
State_Machine_DW.is_Charging = State_Machine_IN_NO_ACTIV
State_Machine_DW.is_MainStateMachine = State_Machine_IN_
/* Outport: '<Root>/BMS_State' */
State_Machine_Y.BMS_State = BMS_Fault;
} else {
/* Inport: '<Root>/StateRequest' */
/* Inport: '<Root>/ChargeCurrentLimit' incorporates:
Ln 74
Col 45
Code Mappings - C
Ready
100%
FixedStepDiscrete

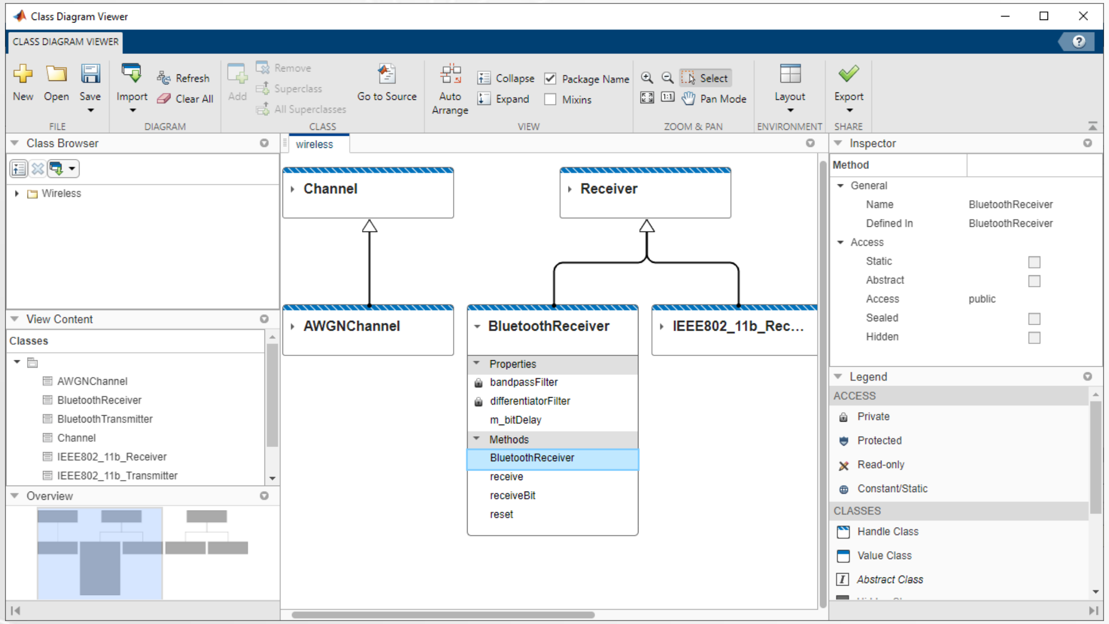

open ecu


performance
real-time
target
machine

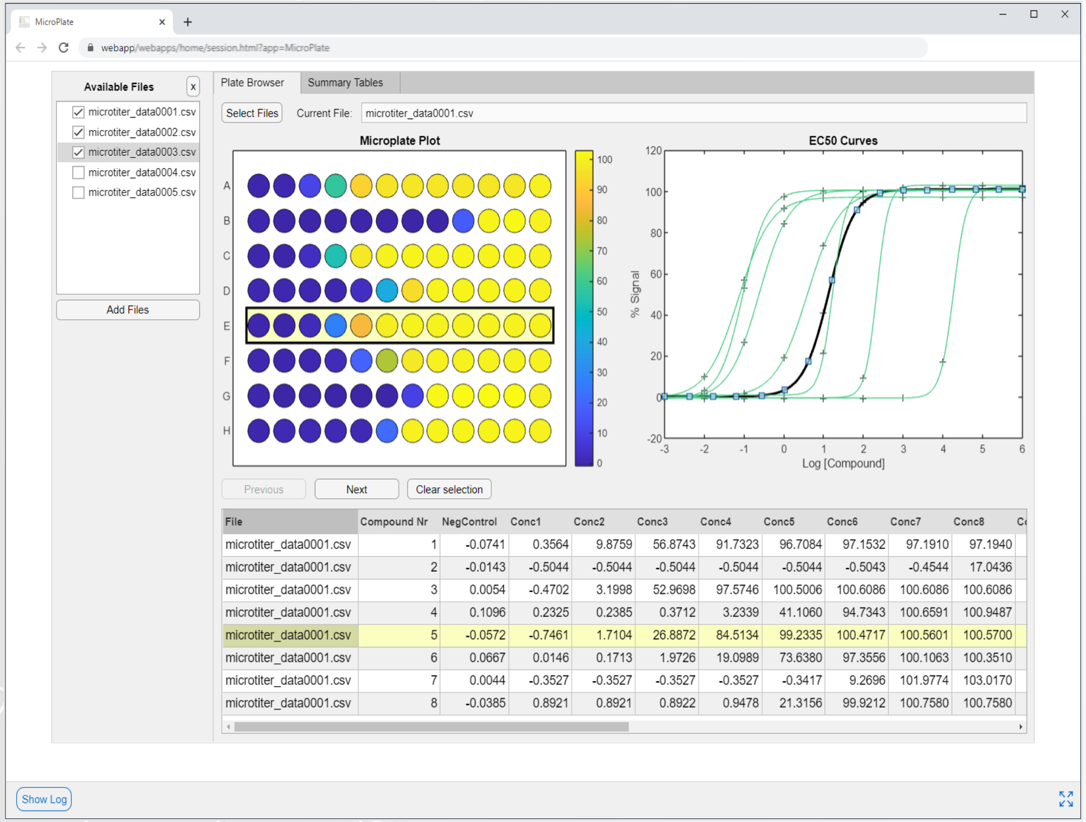

HDMI

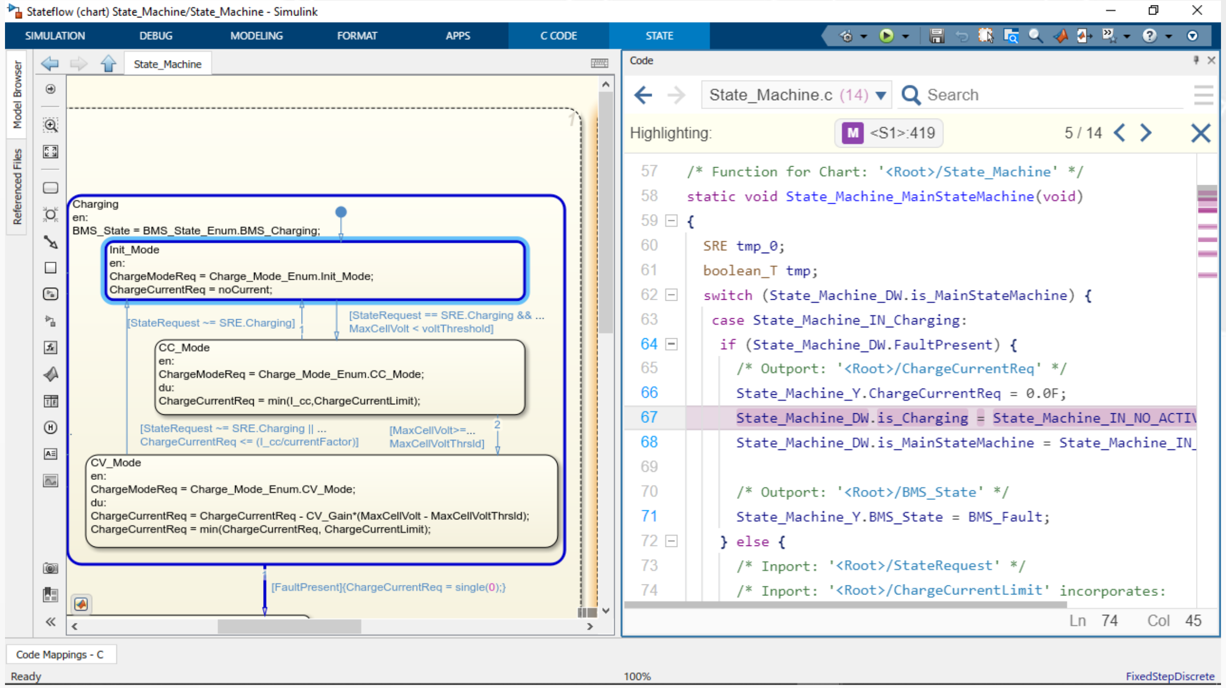


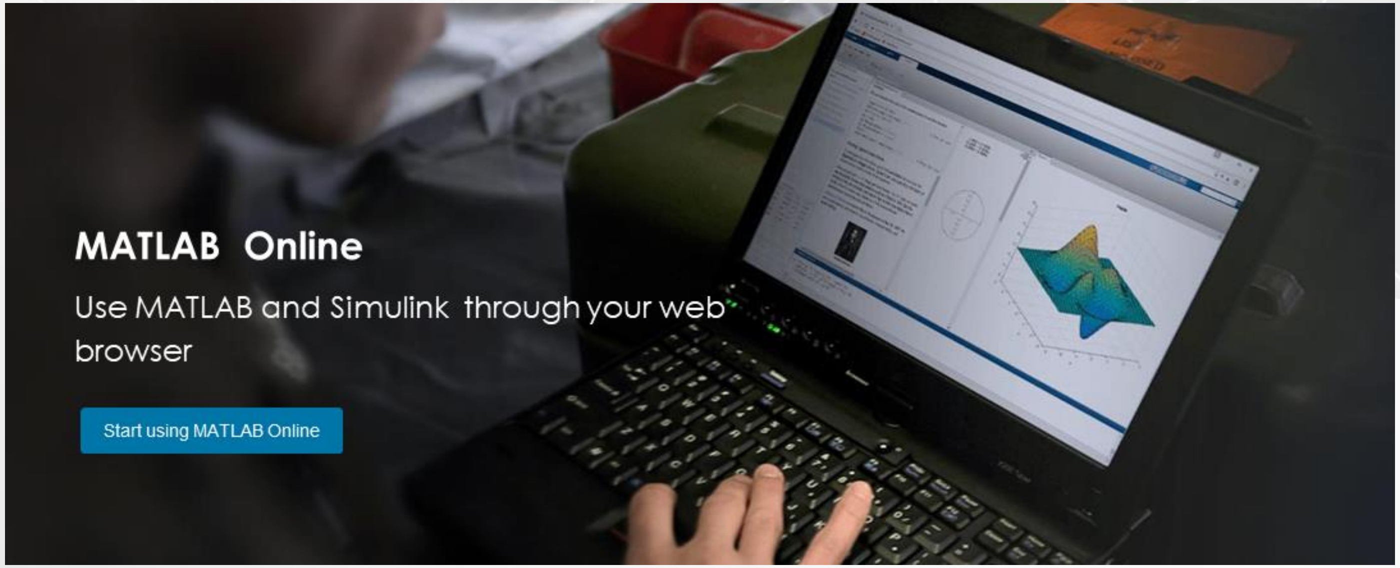

Fill Missing Data
To replace NaN values in the data and visualize the results, open the Clean Missing Data task. Start by typing the keyword missing in a code block, and then click Clean Missing Data when it appears in the menu.
Select the input data and the cleaning meth
Clean Missing Data
cleanedData = Filled missing data in
method
Select data
Input data
cleanedData2
X-axis
default
Specify method
Cleaning method
Fill missing
Moving median
Moving window
Centered
3
Max gap to fill
0.06
Display results
Cleaned data
Filled missing entries
Constant value
Previous value
Next value
Nearest value
Linear interpolation
Spline interpolation
Shape-preserving cubic interpolation (PCHIP)
Modified Akima cubic interpolation
Moving median
Moving mean
Number of filled missing entries: 0
Cleaned data

MSD_System/Mechanical System * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
BLOCK
Mechanical System
command
disturbance
massXaccel
posXk
velXc
control
dist
1/mass
sensor
This second-order differential equation characterizes the system:
$m\ddot{x} + c\dot{x} + kx = F$
Solving for acceleration provides a form of this equation that maps more clearly to a Simulink® model.
$\ddot{x} = \frac{1}{m}(F - c\dot{x} - kx)$
Ready
127%
VariableStepAuto

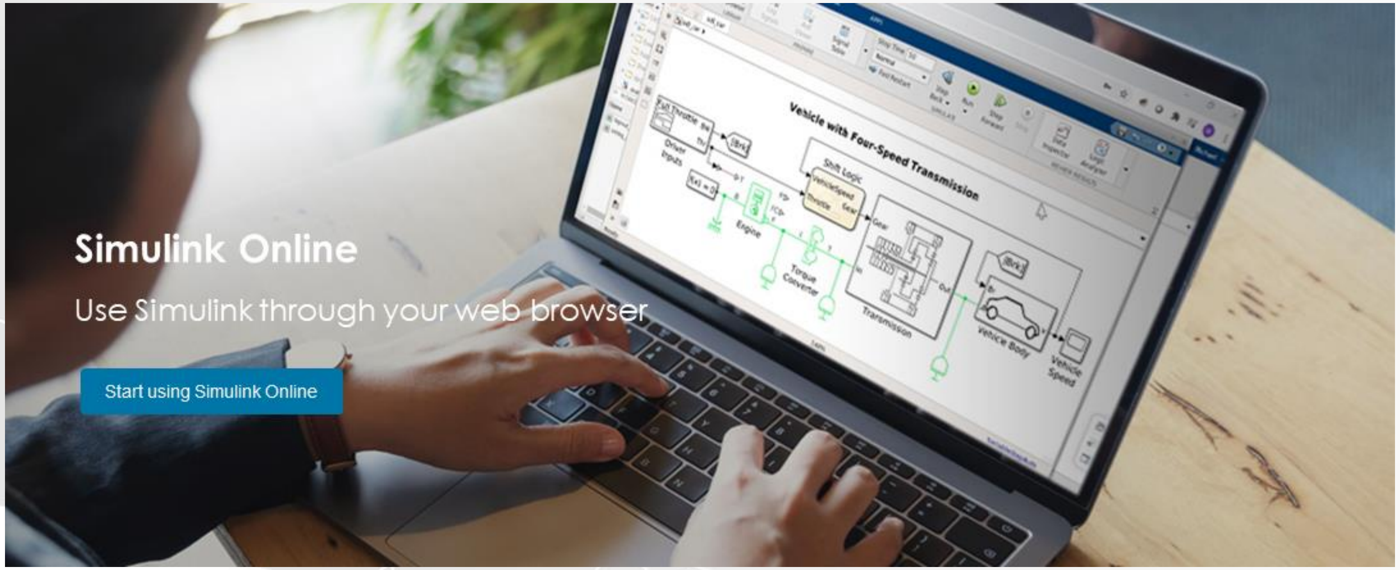


Simulink is the Simulation Integration Platform


MicroPlate
webapp/webapps/home/session.html?app=MicroPlate
Available Files
microtiter_data0001.csv
microtiter_data0002.csv
microtiter_data0003.csv
microtiter_data0004.csv
microtiter_data0005.csv
Add Files
Plate Browser
Summary Tables
Select Files
Current File: microtiter_data0001.csv
Microplate Plot
EC50 Curves
% Signal
Log [Compound]
Previous
Next
Clear selection
File | Compound Nr | NegControl | Conc1 | Conc2 | Conc3 | Conc4 | Conc5 | Conc6 | Conc7 | Conc8
microtiter_data0001.csv | 1 | -0.0741 | 0.3564 | 9.8759 | 56.8743 | 91.7323 | 96.7084 | 97.1532 | 97.1910 | 97.1940
microtiter_data0001.csv | 2 | -0.0143 | -0.5044 | -0.5044 | -0.5044 | -0.5044 | -0.5044 | -0.5043 | -0.4544 | 17.0436
microtiter_data0001.csv | 3 | 0.0054 | -0.4702 | 3.1998 | 52.9698 | 97.5746 | 100.5006 | 100.6086 | 100.6086 | 100.6086
microtiter_data0001.csv | 4 | 0.1096 | 0.2325 | 0.2385 | 0.3712 | 3.2339 | 41.1060 | 94.7343 | 100.6591 | 100.9487
microtiter_data0001.csv | 5 | -0.0572 | -0.7461 | 1.7104 | 26.8872 | 84.5134 | 99.2335 | 100.4717 | 100.5601 | 100.5700
microtiter_data0001.csv | 6 | 0.0667 | 0.0146 | 0.1713 | 1.9726 | 19.0989 | 73.6380 | 97.3556 | 100.1063 | 100.3510
microtiter_data0001.csv | 7 | 0.0044 | -0.3527 | -0.3527 | -0.3527 | -0.3527 | -0.3417 | 9.2696 | 101.9774 | 103.0170
microtiter_data0001.csv | 8 | -0.0385 | 0.8921 | 0.8921 | 0.8922 | 0.9478 | 21.3156 | 99.9212 | 100.7580 | 100.7580
Show Log


Stateflow (chart) State_Machine/State_Machine - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
C CODE
STATE
State_Machine
Charging
en:
BMS_State = BMS_State_Enum.BMS_Charging;
Init_Mode
en:
ChargeModeReq = Charge_Mode_Enum.Init_Mode;
ChargeCurrentReq = noCurrent;
[StateRequest ~= SRE.Charging]
[StateRequest == SRE.Charging && ... MaxCellVolt < voltThreshold]
CC_Mode
en:
ChargeModeReq = Charge_Mode_Enum.CC_Mode;
du:
ChargeCurrentReq = min(I_cc,ChargeCurrentLimit);
[StateRequest ~= SRE.Charging || ... ChargeCurrentReq <= (I_cc/currentFactor)]
[MaxCellVolt>=... MaxCellVoltThrsld]
CV_Mode
en:
ChargeModeReq = Charge_Mode_Enum.CV_Mode;
du:
ChargeCurrentReq = ChargeCurrentReq - CV_Gain*(MaxCellVolt - MaxCellVoltThrsld);
ChargeCurrentReq = min(ChargeCurrentReq, ChargeCurrentLimit);
[FaultPresent]{ChargeCurrentReq = single(0);}
Code
State_Machine.c (14)
Search
Highlighting: <S1>:419
5 / 14
57 /* Function for Chart: '<Root>/State_Machine' */
58 static void State_Machine_MainStateMachine(void)
59 {
60 SRE tmp_0;
61 boolean_T tmp;
62 switch (State_Machine_DW.is_MainStateMachine) {
63 case State_Machine_IN_Charging:
64 if (State_Machine_DW.FaultPresent) {
65 /* Outport: '<Root>/ChargeCurrentReq' */
66 State_Machine_Y.ChargeCurrentReq = 0.0F;
67 State_Machine_DW.is_Charging = State_Machine_IN_NO_ACTI
68 State_Machine_DW.is_MainStateMachine = State_Machine_IN_
69
70 /* Outport: '<Root>/BMS_State' */
71 State_Machine_Y.BMS_State = BMS_Fault;
72 } else {
73 /* Inport: '<Root>/StateRequest' */
74 /* Inport: '<Root>/ChargeCurrentLimit' incorporates:
Ln 74 Col 45
Code Mappings - C
Ready
100%
FixedStepDiscrete





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