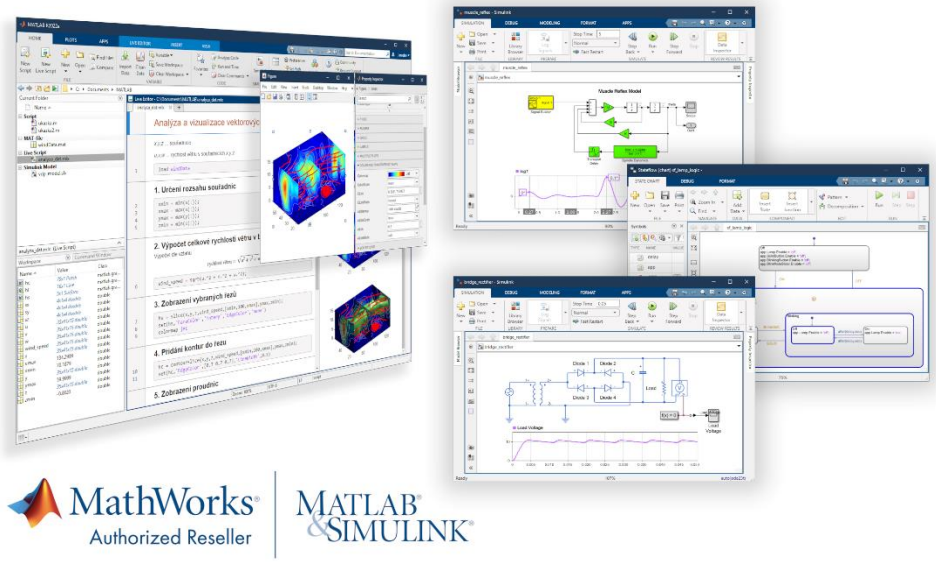
HUMUSOFT

Novinky v prostredí MATLAB v roku 2023



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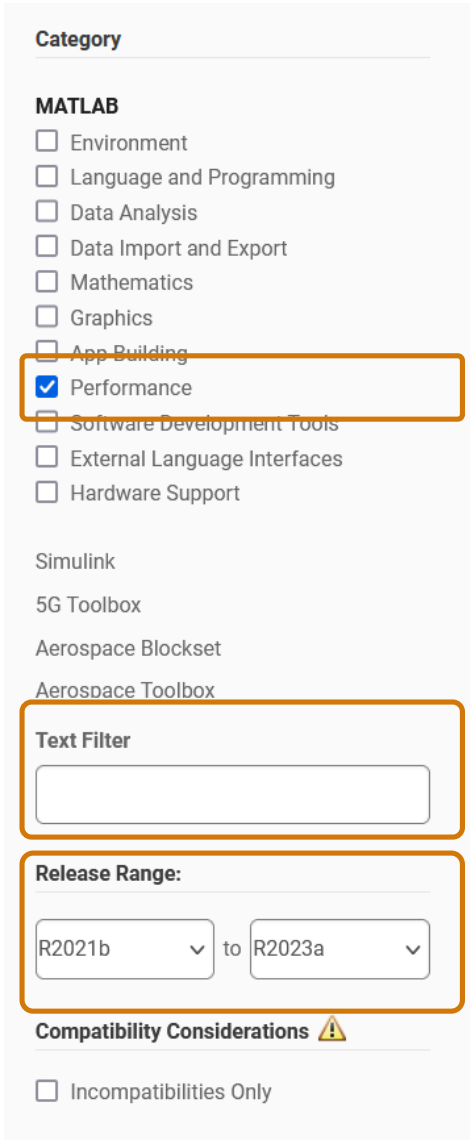
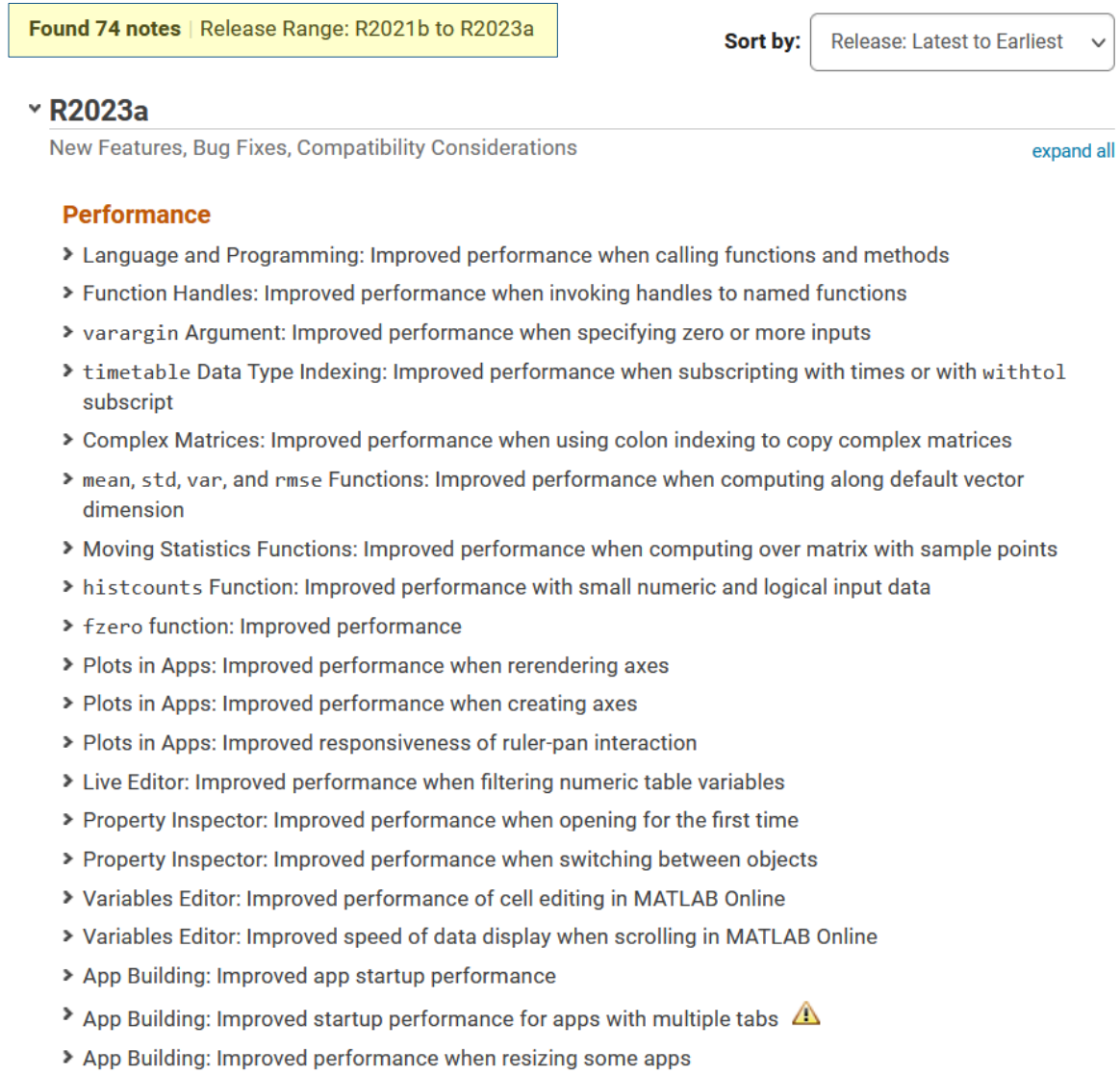
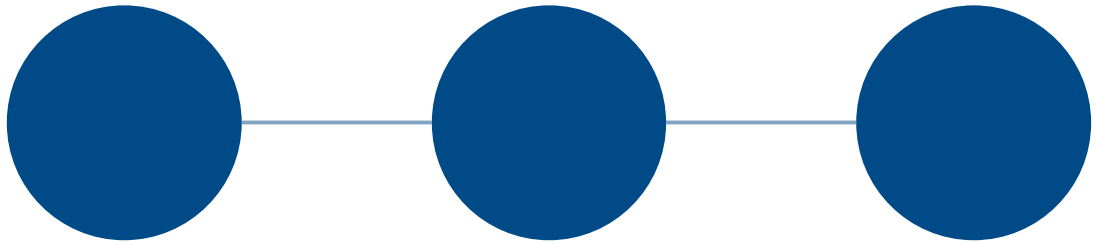
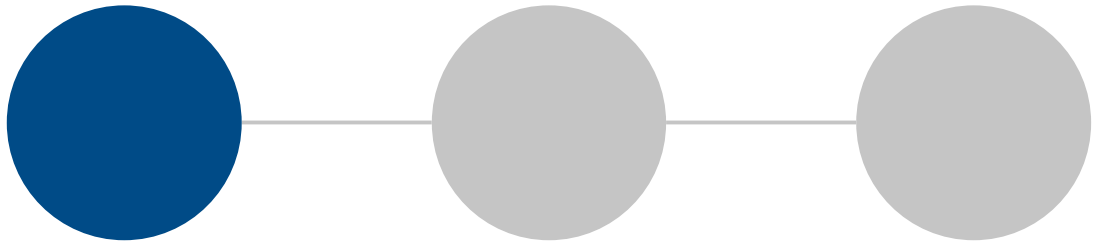
Zoznam noviniek

- Release notes
- Filtrovanie výsledkov
  - Kategórie
  - Kľúčové slová
  - Rozsah verzií






Práca
Vývoj softvéru
Integrácia


Práca
Vývoj softvéru
Integrácia

double

739136

```
>> datestr(739136)

ans =

    '07-Sep-2023'

>>
```

```
>> dnes = datetime('today')

dnes =

  datetime

   07-Sep-2023

>> pred_tyzdnom = datetime - 7

pred_tyzdnom =

  datetime

   31-Aug-2023

>>
```

categorical

table

datetime

duration

calendarDuration

timetable

string

table

patients

100x9 table

	1 LastName	2 Age	3 Location	4 Height	5 Weight	6 Smoker	7 Systolic	8 Diastolic	9 SelfAssessedHealthStatus
1	"Smith"	38	County General Hospital	71	176	"true"	124	93	Excellent
2	"Johnson"	43	VA Hospital	69	163	"false"	109	77	Fair
3	"Williams"	38	St. Mary's Medical Center	64	131	"false"	125	83	Good
4	"Jones"	40	VA Hospital	67	133	"false"	117	75	Fair
5	"Brown"	49	County General Hospital	64	119	"false"	122	80	Good
6	"Davis"	46	St. Mary's Medical Center	68	142	"false"	121	70	Good
7	"Miller"	33	VA Hospital	64	142	"true"	130	88	Good
8	"Wilson"	40	VA Hospital	68	180	"false"	115	82	Good
9	"Moore"	28	St. Mary's Medical Center	68	183	"false"	115	78	Excellent
10	"Taylor"	31	County General Hospital	66	132	"false"	118	86	Excellent
11	"Anderson"	45	County General Hospital	68	128	"false"	114	77	Excellent

table

```
>> scaledScores = testScores .* .25

scaledScores =

  7x3 table

    Test1   Test2   Test3
    _____   _____   _____

     22.5   21.75   23.25
    21.75   21.25   20.75
     21.5   21.25      22
    18.75      20      18
    22.25    21.5   21.75
       24      23    24.5
     19.5   18.75   19.25

>> meanScores = mean(scaledScores)

meanScores =

  1x3 table

    Test1   Test2   Test3
    ______  ______  ______

    21.464  21.071  21.357

>>
```

table

Region	Color	Units
North	Red	10
North	Green	25
North	Red	45
South	Green	35
South	Green	15
South	Red	60
East	Red	80
East	Green	55
East	Green	30
West	Red	90
West	Green	75
West	Red	45

pivot

Region	Green	Red
North	25	55
South	50	60
East	85	80
West	75	135

timetable

```
>> weatherData

weatherData =

  12×2 timetable with

                Time          Temperature    Humidity
            ____________    ____________    ________

            01-Nov-2022         36             45
            02-Nov-2022         31             76
            03-Nov-2022         37             43
            04-Nov-2022         36             46
            05-Nov-2022         38             72
            06-Nov-2022         32             54
            07-Nov-2022         35             50
            08-Nov-2022         34             45
            09-Nov-2022         32             72
            10-Nov-2022         30             58
            11-Nov-2022         39             54
            12-Nov-2022         34             58

>> snowEvents = weatherData(eventfilter("Snow"),:)

snowEvents =

  1×2 timetable with 4 events

                Time          Temperature    Humidity
            ____________    ____________    ________

    Snow    08-Nov-2022         34             45

>>
```

dictionary

```
>> starsDictionary = dictionary(hrStars.ID, hrStars.Name)

starsDictionary =

  dictionary (double --> string) with 332 entries:

    897  --> "Acamar"
    472  --> "Achernar"
    219  --> "Achird"
    5984 --> "Acrab"
     :          :
    4357 --> "Zosma"
    5531 --> "Zubenelgenubi"
    5787 --> "Zubenelhakrabi"
    5685 --> "Zubeneschamali"

>> starsDictionary([897 4301 6812 4357]')

ans =

  4×1 string array

    "Acamar"
    "Dubhe"
    "Polis"
    "Zosma"

>>
```

Types


Bus

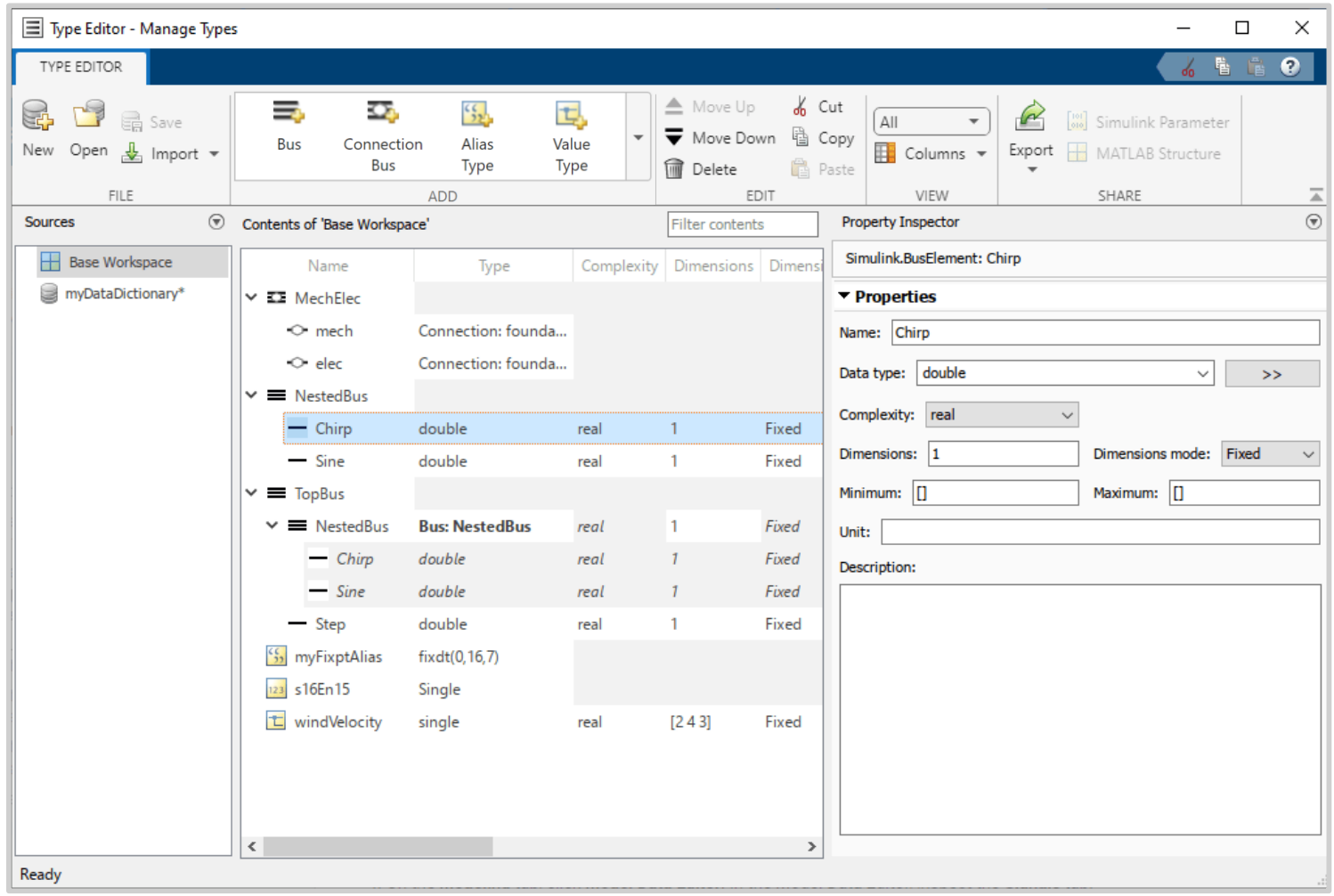

Connection Bus


Value Type

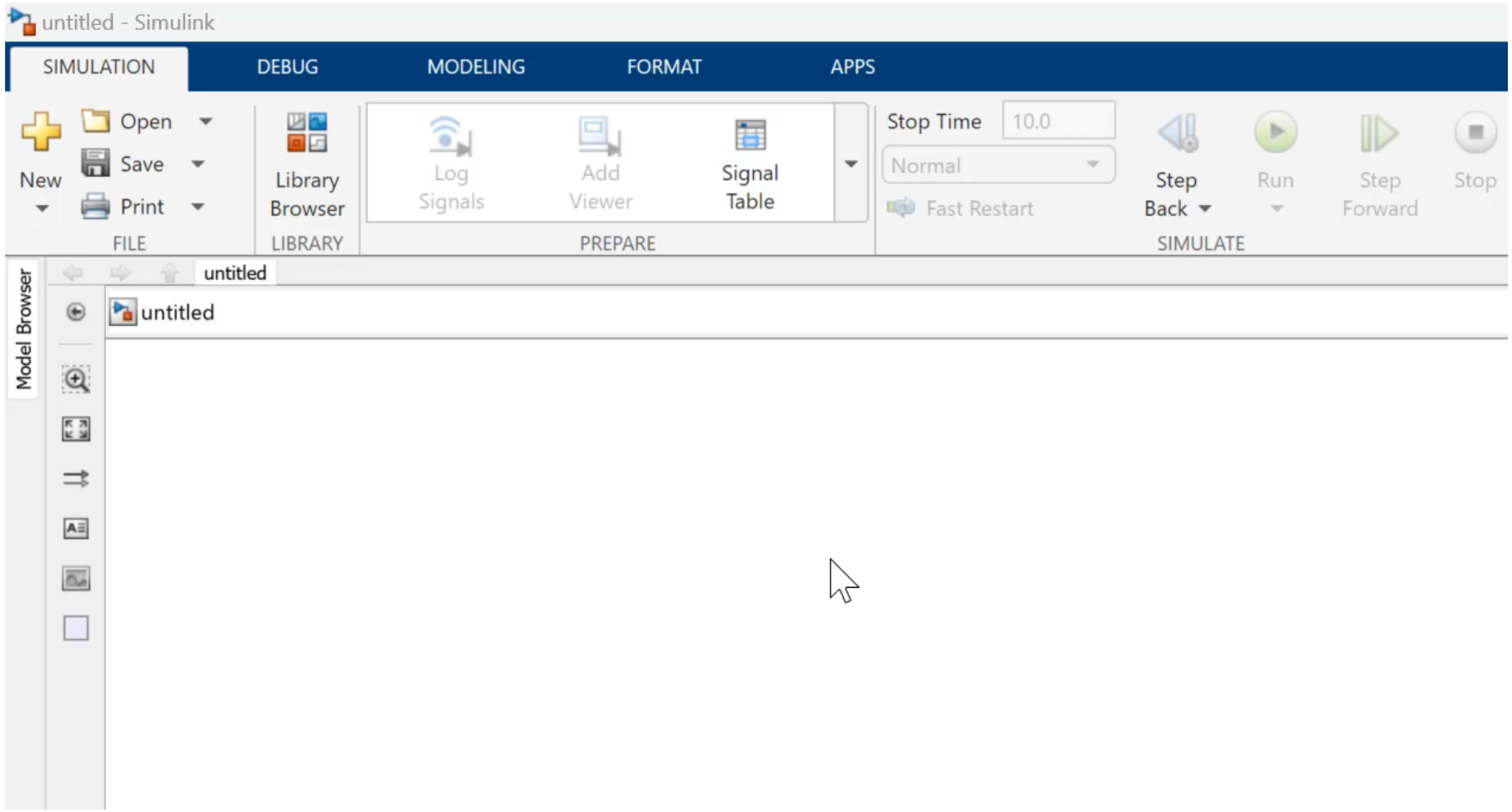

Alias Type

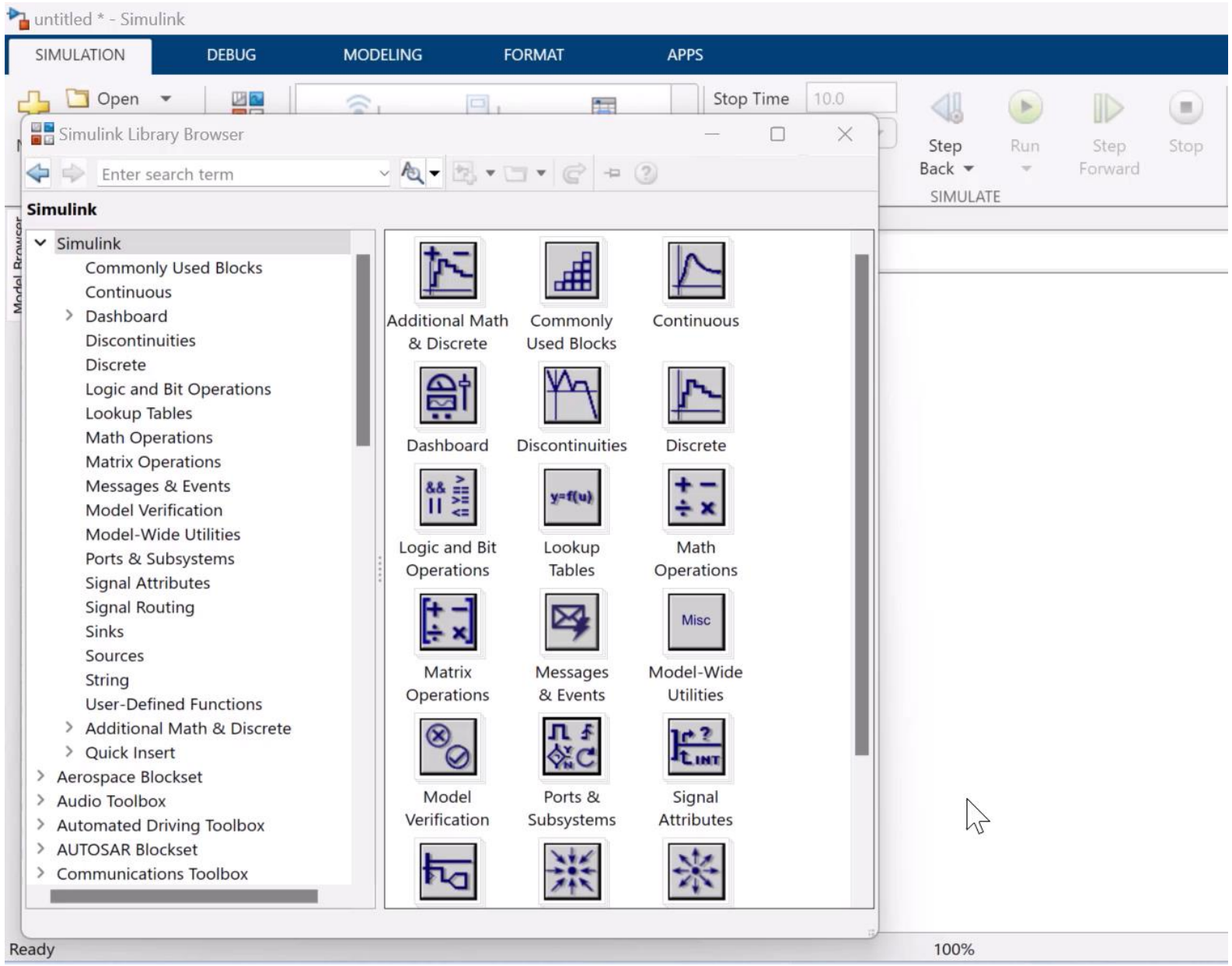
Numeric Type

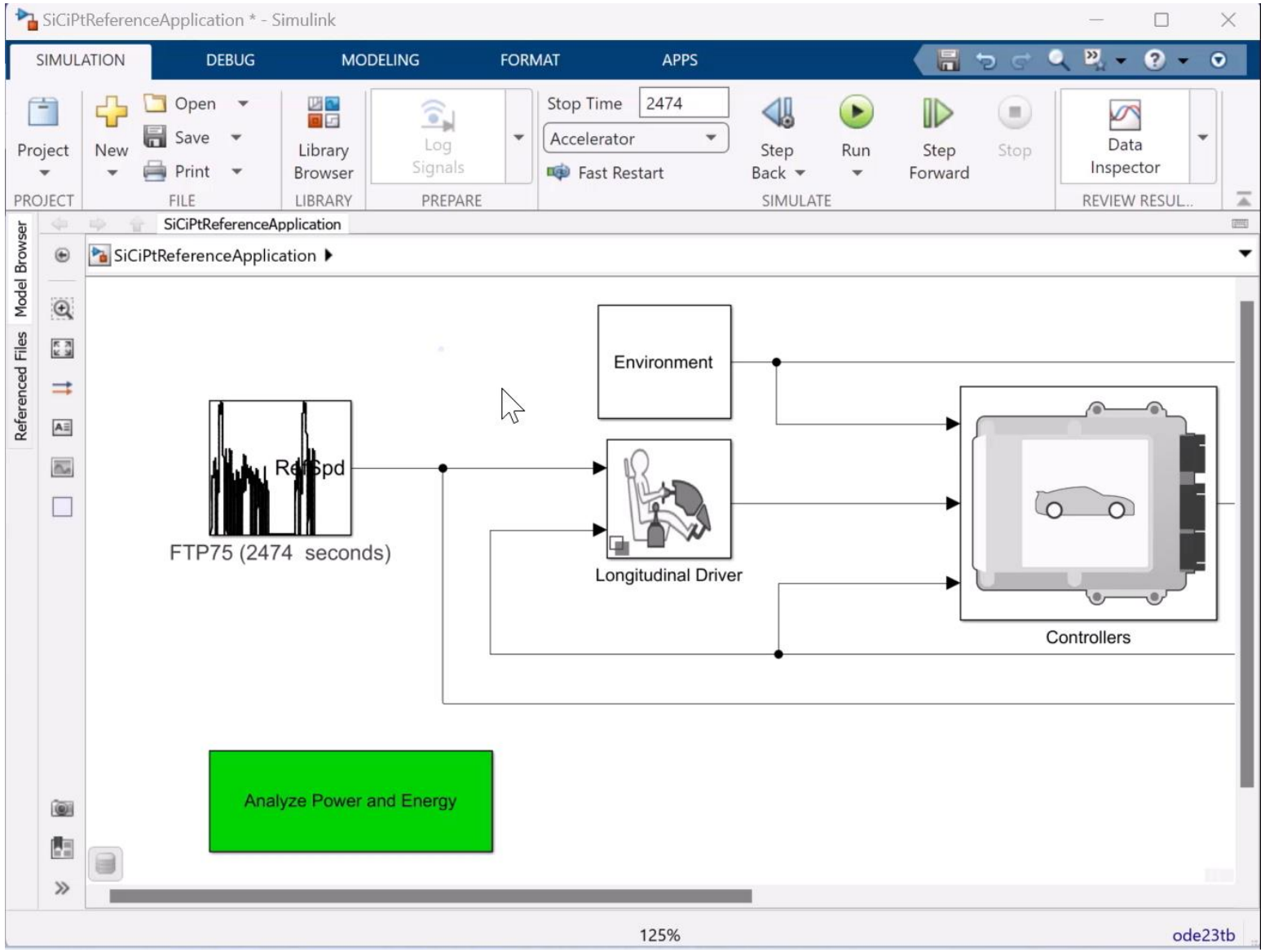

Enum Type


Type Editor - Manage Types
TYPE EDITOR
New
Open
Save
Import
FILE
Bus
Connection Bus
Alias Type
Value Type
ADD
Move Up
Move Down
Delete
Cut
Copy
Paste
EDIT
All
Columns
VIEW
Export
Simulink Parameter
MATLAB Structure
SHARE
Sources
Base Workspace
myDataDictionary*
Contents of 'Base Workspace'
Filter contents
Name
Type
Complexity
Dimensions
MechElec
mech
Connection: founda...
elec
Connection: founda...
NestedBus
Chirp
double
real
1
Fixed
Sine
double
real
1
Fixed
TopBus
NestedBus
Bus: NestedBus
real
1
Fixed
Chirp
double
real
1
Fixed
Sine
double
real
1
Fixed
Step
double
real
1
Fixed
myFixptAlias
fixdt(0,16,7)
s16En15
Single
windVelocity
single
real
[2 4 3]
Fixed
Property Inspector
Simulink.BusElement: Chirp
Properties
Name: Chirp
Data type: double
>>
Complexity: real
Dimensions: 1
Dimensions mode: Fixed
Minimum: []
Maximum: []
Unit:
Description:
Ready

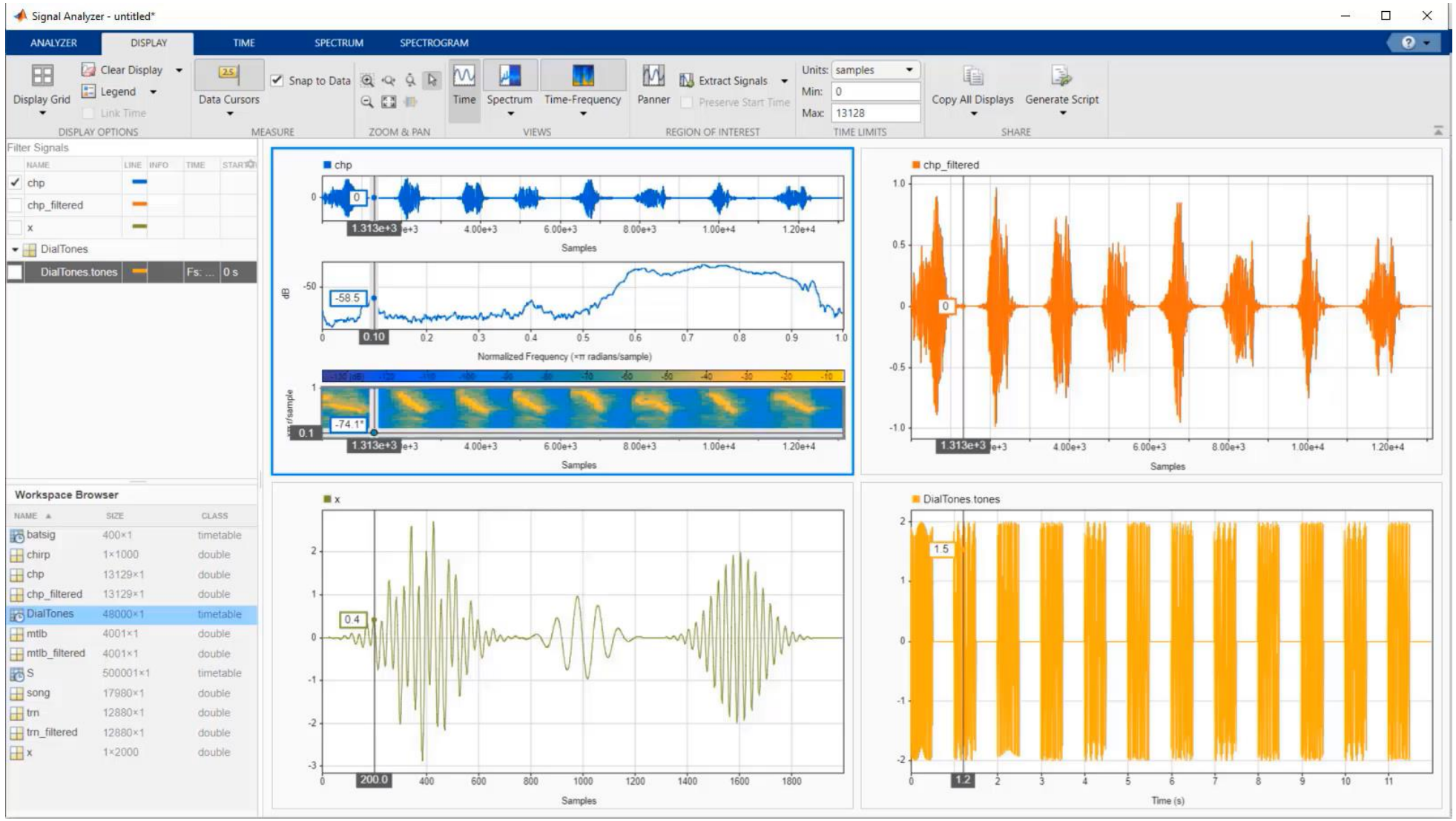
Zjednodušenie práce

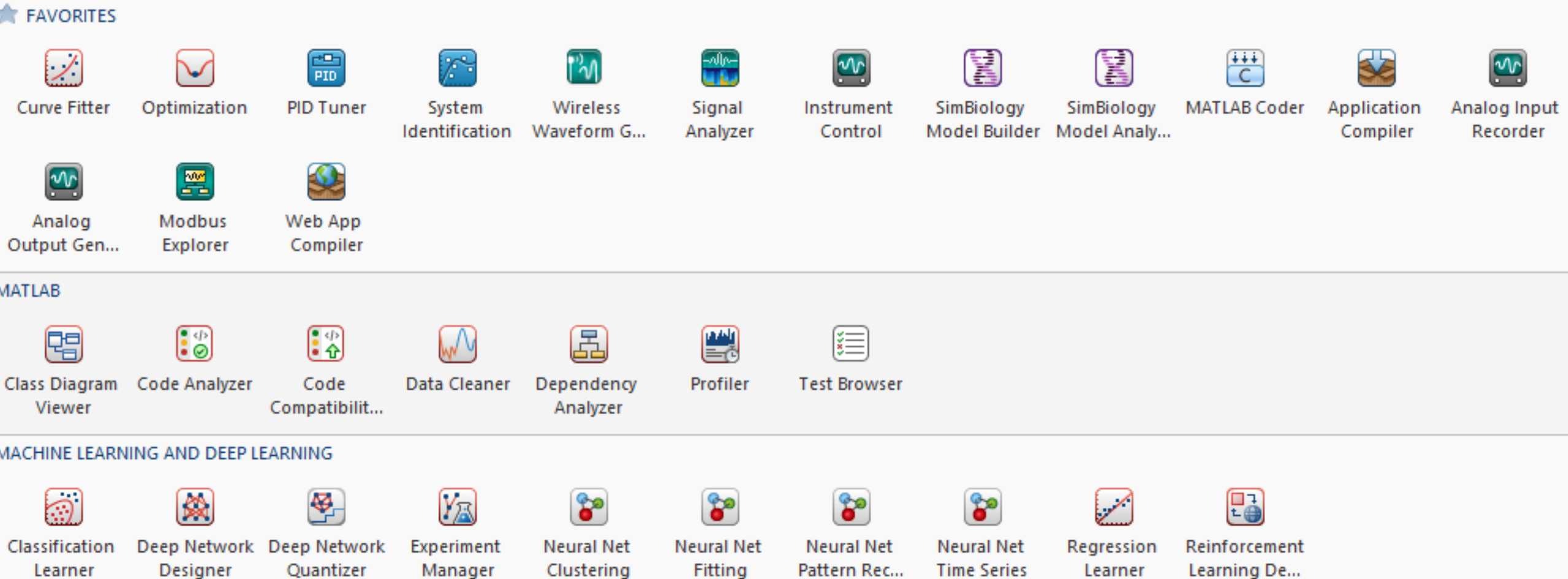



untitled * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Open
Stop Time
10.0
Step Back
Run
Step Forward
Stop
SIMULATE
Simulink Library Browser
Enter search term
Simulink
Simulink
Commonly Used Blocks
Continuous
Dashboard
Discontinuities
Discrete
Logic and Bit Operations
Lookup Tables
Math Operations
Matrix Operations
Messages & Events
Model Verification
Model-Wide Utilities
Ports & Subsystems
Signal Attributes
Signal Routing
Sinks
Sources
String
User-Defined Functions
Additional Math & Discrete
Quick Insert
Aerospace Blockset
Audio Toolbox
Automated Driving Toolbox
AUTOSAR Blockset
Communications Toolbox
Additional Math & Discrete
Commonly Used Blocks
Continuous
Dashboard
Discontinuities
Discrete
Logic and Bit Operations
Lookup Tables
Math Operations
Matrix Operations
Messages & Events
Misc
Model-Wide Utilities
Model Verification
Ports & Subsystems
Signal Attributes
Ready
100%

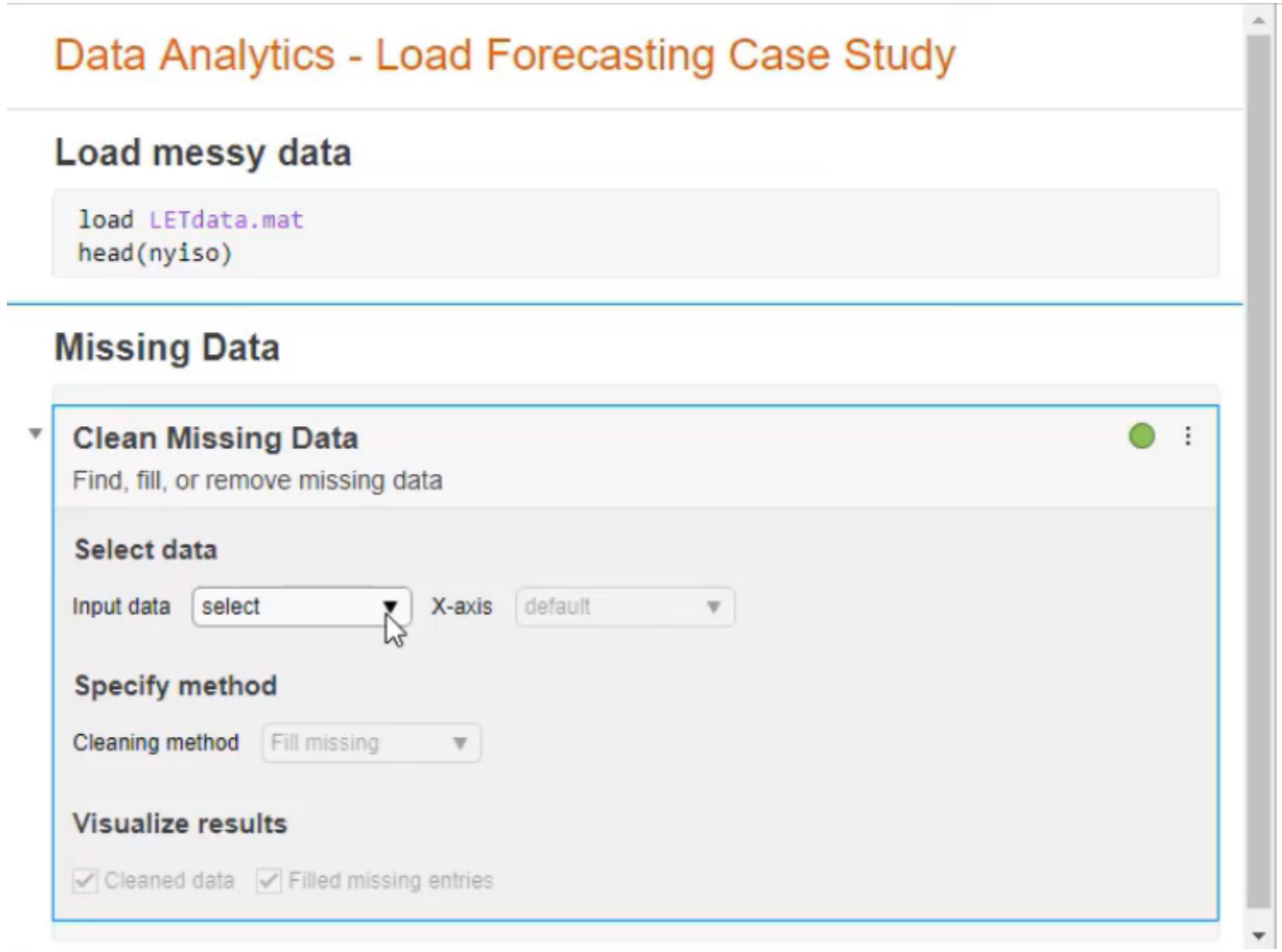

SiCiPtReferenceApplication * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Project
New
Open
Save
Print
Library Browser
Log Signals
Stop Time
2474
Accelerator
Fast Restart
Step Back
Run
Step Forward
Stop
Data Inspector
PROJECT
FILE
LIBRARY
PREPARE
SIMULATE
REVIEW RESUL..
Model Browser
Referenced Files
SiCiPtReferenceApplication
SiCiPtReferenceApplication
Environment
RefSpd
FTP75 (2474 seconds)
Longitudinal Driver
Controllers
Analyze Power and Energy
125%
ode23tb

Minimalizácia programovania




FAVORITES
Curve Fitter
Optimization
PID Tuner
System Identification
Wireless Waveform G...
Signal Analyzer
Instrument Control
SimBiology Model Builder
SimBiology Model Analy...
MATLAB Coder
Application Compiler
Analog Input Recorder
Analog Output Gen...
Modbus Explorer
Web App Compiler
MATLAB
Class Diagram Viewer
Code Analyzer
Code Compatibilit...
Data Cleaner
Dependency Analyzer
Profiler
Test Browser
MACHINE LEARNING AND DEEP LEARNING
Classification Learner
Deep Network Designer
Deep Network Quantizer
Experiment Manager
Neural Net Clustering
Neural Net Fitting
Neural Net Pattern Rec...
Neural Net Time Series
Regression Learner
Reinforcement Learning De...

Live Editor Tasks



ans = 8×11 timetable

	Date	CAPITL	CENT
1	05/01/2007 ...	981.9000	1.571
2	05/01/2007 ...	991.8000	1.568
3	05/01/2007 ...	950.1000	1.560
4	05/01/2007 ...	968.9000	1.560
5	05/01/2007 ...	968.5000	1.555
6	05/01/2007 ...	949.2000	1.564
7	05/01/2007 ...	941.6000	1.538
8	05/01/2007 ...	939.4000	1.557

Import Data

AllNumbers = Table with 7 columns imported from **AllNumbers.xlsx**

Select source

File C:\Users\qnazir\Downloads\App_Datasets\AllNumbers Browse...

Type: Microsoft Excel Worksheet, **Size:** 10 KB

Sheet Sheet1

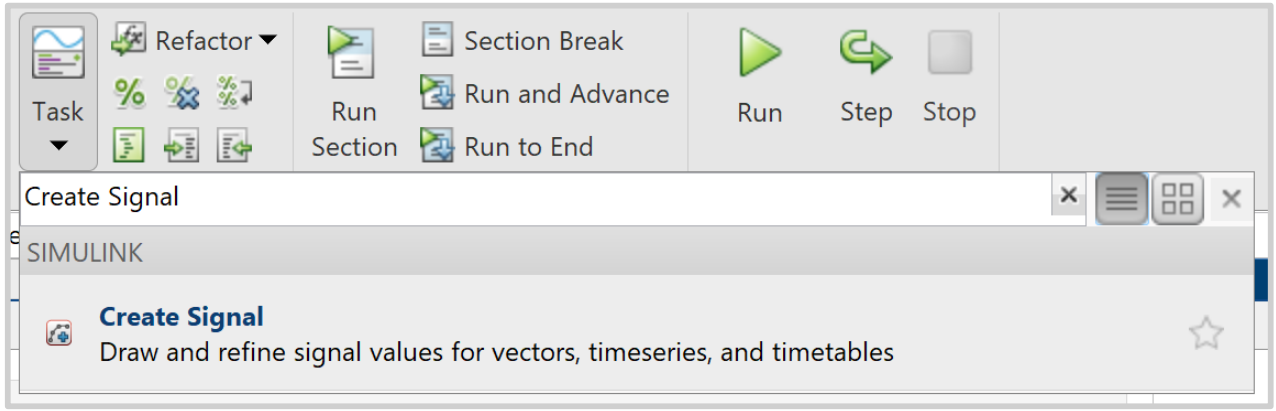
Specify imported variable type

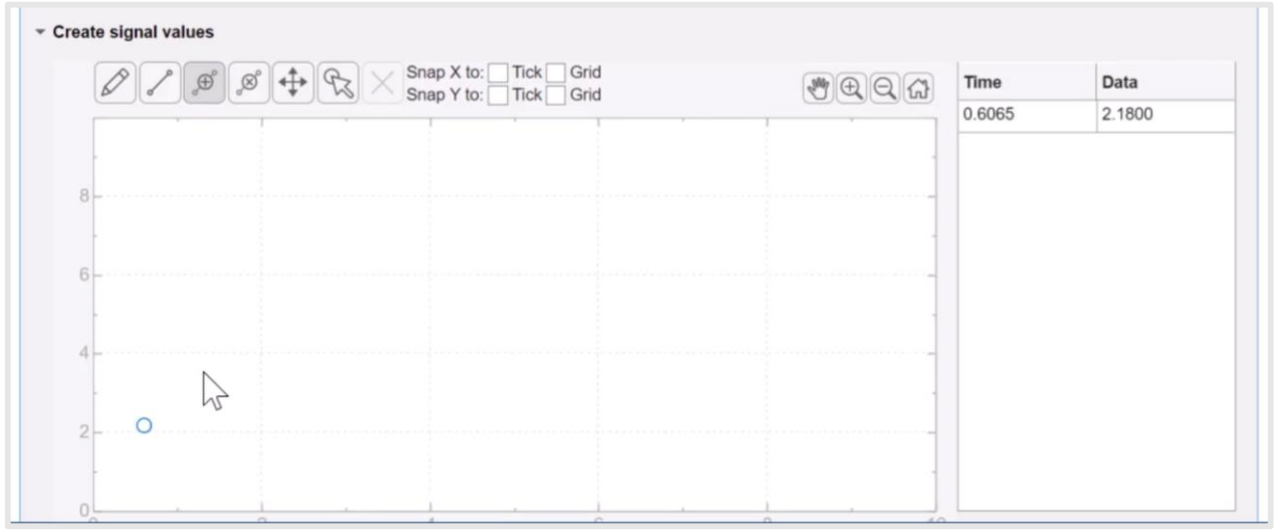
Type Table

Display results

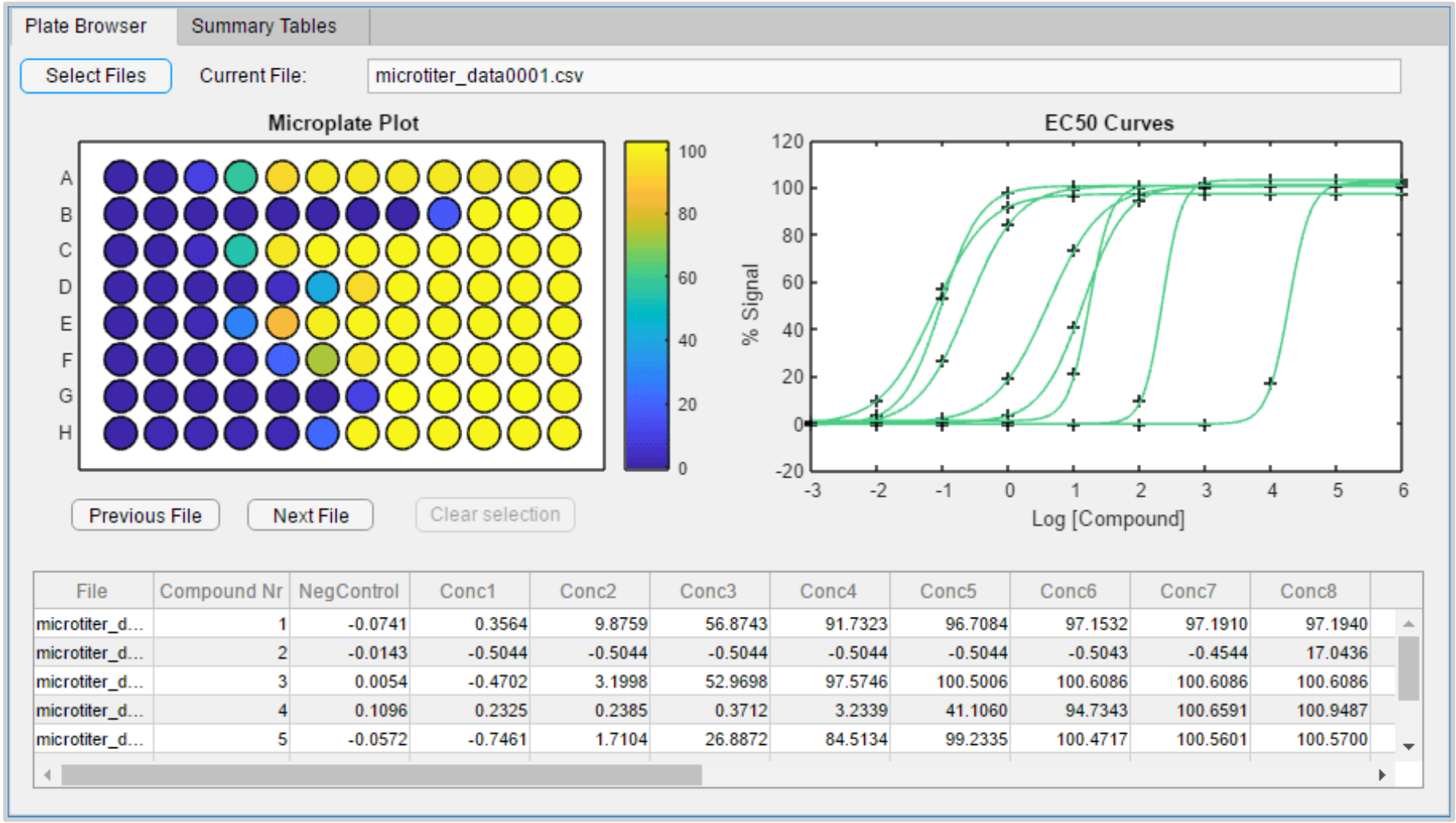
AllNumbers = *29×7 table*

	Var1	Var2	Var3	Var4	Var5	Var6	Var7
1	1	1	6	7	0	52.6900	-8.7600
2	1	1	7	7	0	55.3400	-8.0400
3	1	1	8	7	0	57.9500	-8.2000
4	1	1	9	7	0	62.3800	-7.6900
5	1	1	10	7	0	66.3000	-7.0600
6	1	1	11	7	0	67.9500	-6.0900
7	1	1	12	7	0	68.4000	-5.5200
8	1	1	13	7	0	67.5000	-5
9	1	1	14	7	0	66.2000	-4.3900


Task
Refactor
Run Section
Section Break
Run and Advance
Run to End
Run
Step
Stop
Create Signal
SIMULINK
Create Signal
Draw and refine signal values for vectors, timeseries, and timetables


Create signal values
Snap X to: Tick Grid
Snap Y to: Tick Grid
Time
Data
0.6065
2.1800
8
6
4
2
0

Tvorba vlastných nástrojov



File	Compound Nr	NegControl	Conc1	Conc2	Conc3	Conc4	Conc5	Conc6	Conc7	Conc8
microtiter_d...	1	-0.0741	0.3564	9.8759	56.8743	91.7323	96.7084	97.1532	97.1910	97.1940
microtiter_d...	2	-0.0143	-0.5044	-0.5044	-0.5044	-0.5044	-0.5044	-0.5043	-0.4544	17.0436
microtiter_d...	3	0.0054	-0.4702	3.1998	52.9698	97.5746	100.5006	100.6086	100.6086	100.6086
microtiter_d...	4	0.1096	0.2325	0.2385	0.3712	3.2339	41.1060	94.7343	100.6591	100.9487
microtiter_d...	5	-0.0572	-0.7461	1.7104	26.8872	84.5134	99.2335	100.4717	100.5601	100.5700

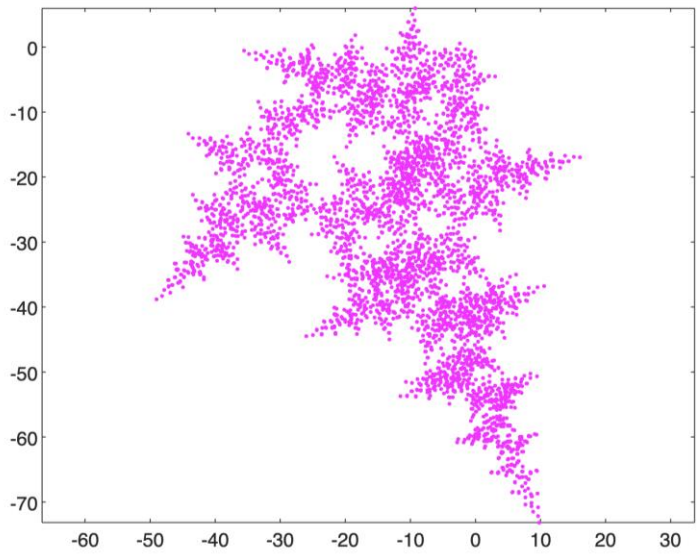
Generate Fractal Tree

z = Generate mesmerizing fractal trees

N: 0 100

Rotation: 0 2π

Color: Magenta

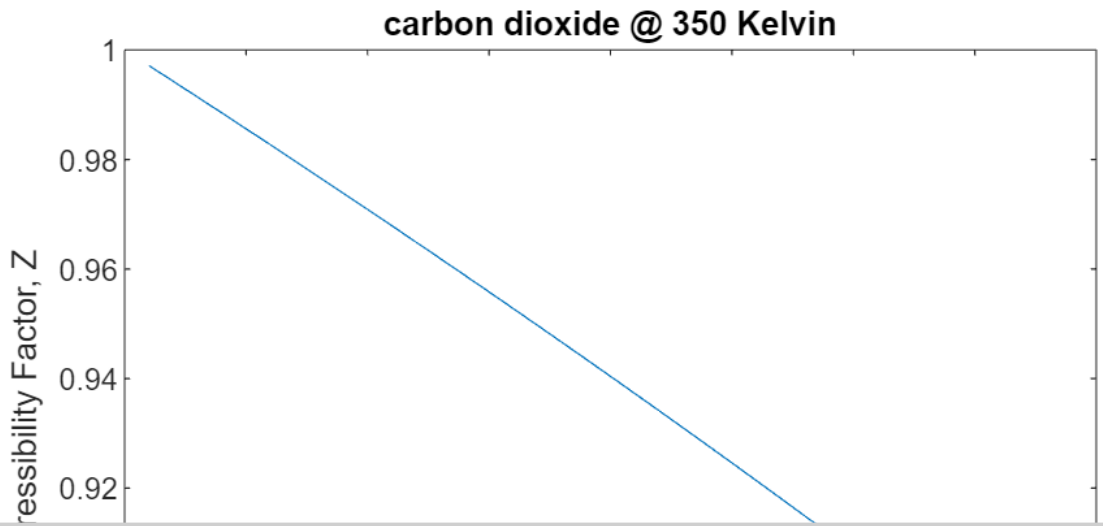


```
gas = "carbon dioxide";
T = 350
P = 1:40;

Tcrit = criticalValues{criticalValues.Gas == lower(gas),'CriticalTempK'};
Pcrit = criticalValues{criticalValues.Gas == lower(gas),'CriticalPressBar'};

Z = compressibilityFactor(Tcrit, P, T, Pcrit);

plot(P,Z)
xlabel('Pressure, bars');
ylabel('Compressibility Factor, Z');
title(strcat(gas," @ ",num2str(T)," Kelvin"));
```



```
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Pcrit = criticalValues{criticalValues.Gas == lower(gas),'CriticalPressBar'};

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plot(P,Z)
xlabel('Pressure, bars');
ylabel('Compressibility Factor, Z');
title(strcat(gas," @ ",num2str(T)," Kelvin"));
```
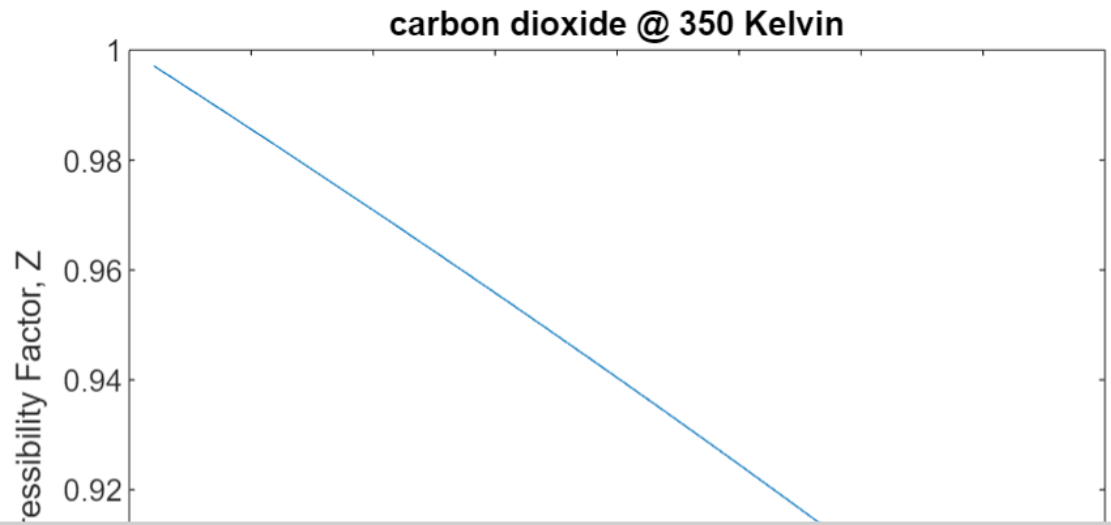
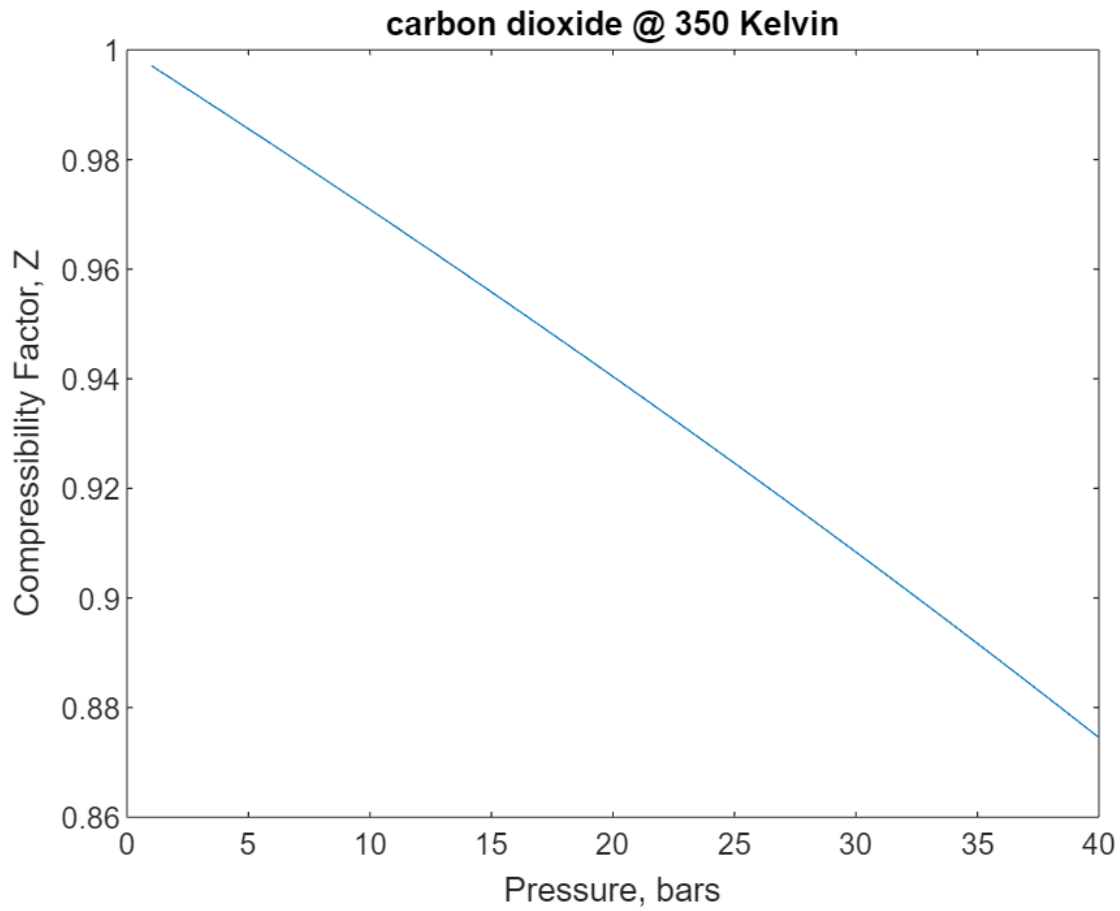
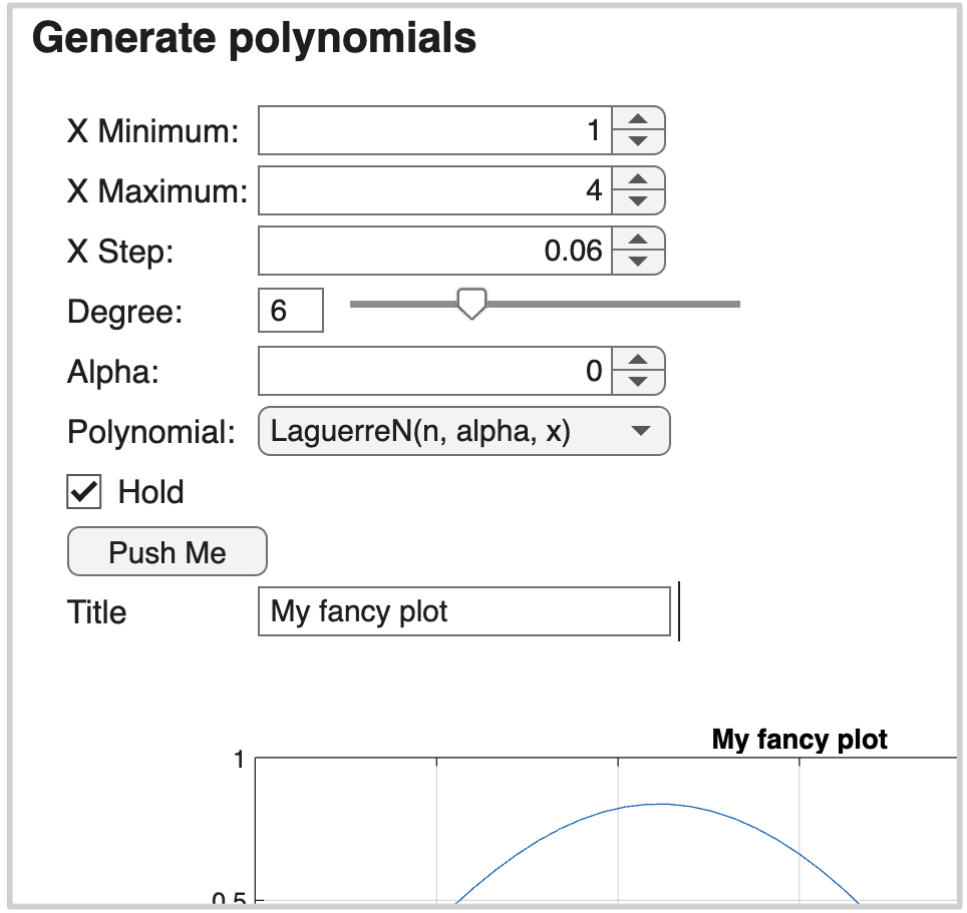



gas "carbon dioxide"

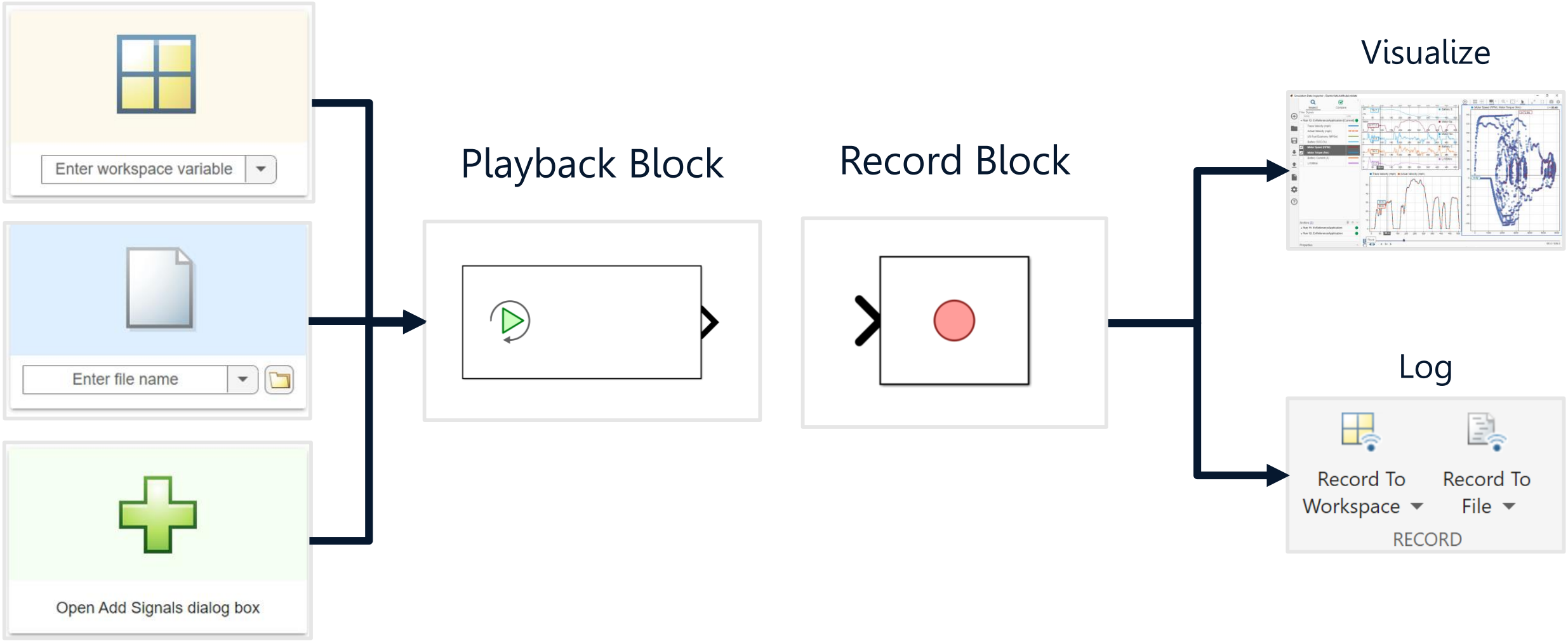
T 350

P 1:40



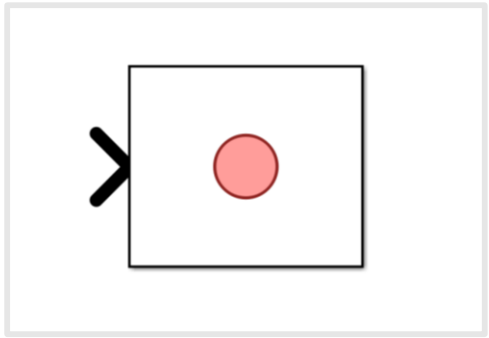

Generate polynomials
X Minimum:
1
X Maximum:
4
X Step:
0.06
Degree:
6
Alpha:
0
Polynomial:
LaguerreN(n, alpha, x)
Hold
Push Me
Title
My fancy plot
My fancy plot
1
0.5

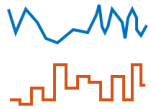

Import Patient Data
filename =
Get File
Select File


Enter workspace variable
Enter file name
Open Add Signals dialog box
Playback Block
Record Block
Visualize
Log
Record To Workspace
Record To File
RECORD

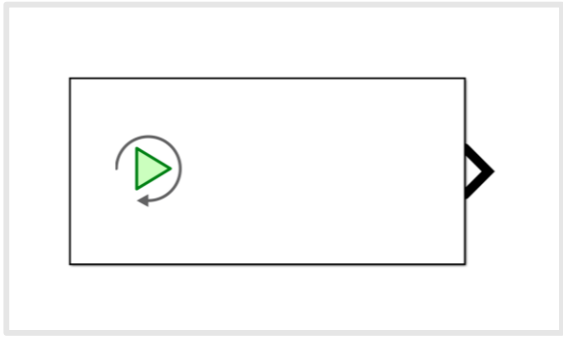
Rýchle a opakovateľné testy

Record Block





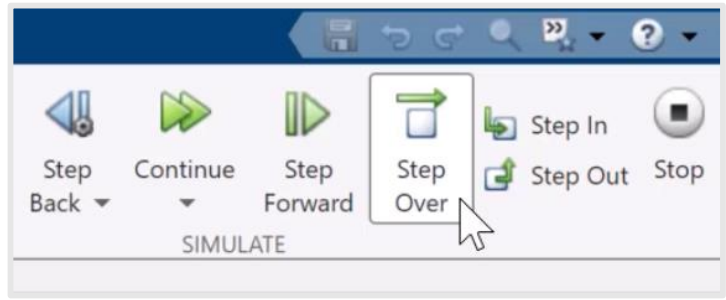
Playback Block

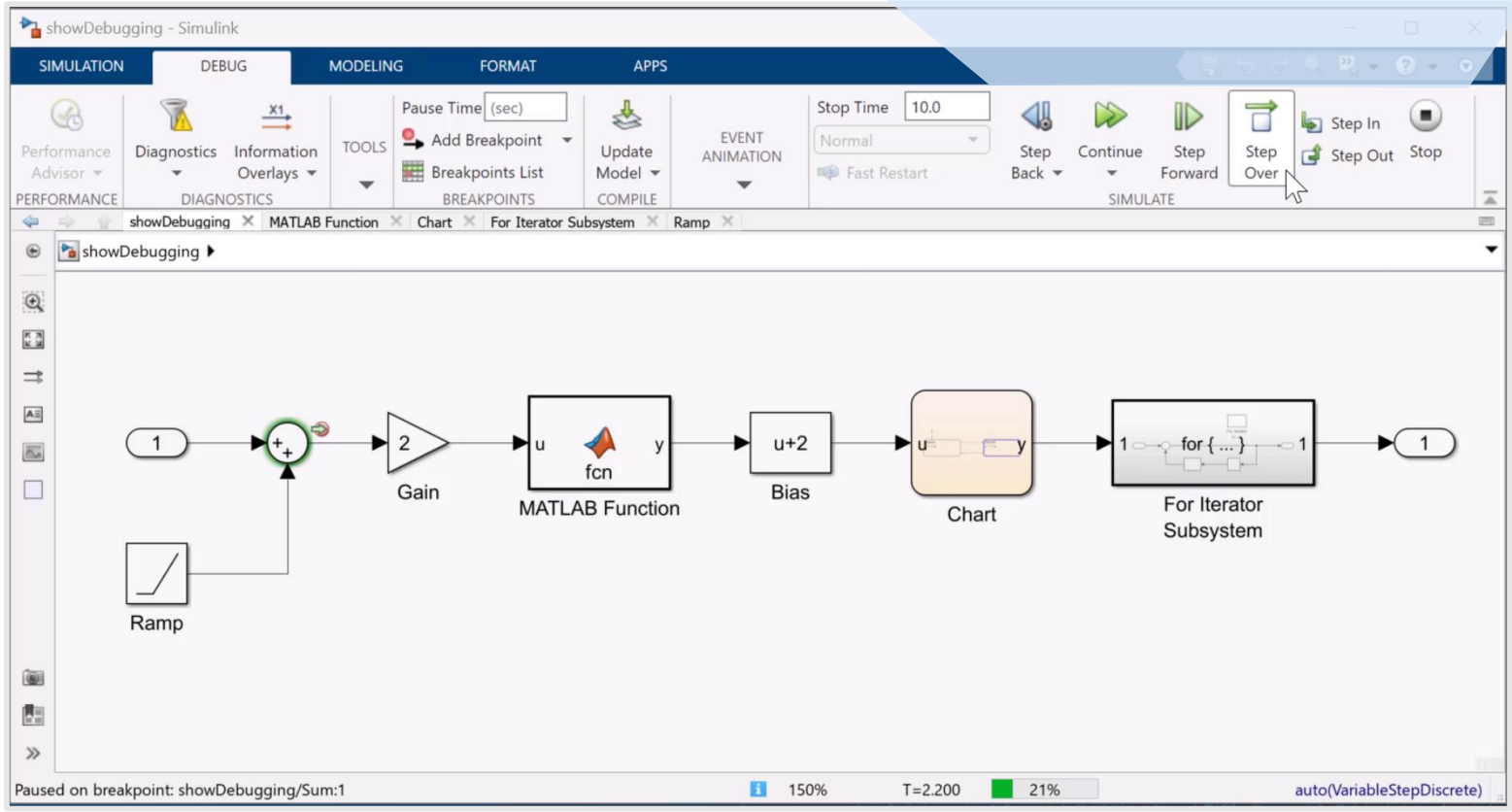


Krokovanie simulácie

Add Breakpoint

Add conditional breakpoint to selected element

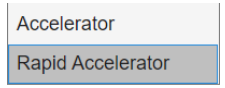




Urýchlenie simulácií

Model Referencing

Fast Restart



Accelerator Modes

Simulink Cache

Performance Advisor

Multi-Core Co-Simulation

Hardware Acceleration

Performance Advisor

1 Baseline 1 0 0 0

Create baseline

Passed Baseline generated successfully. Simulation took 00:00:00.580 seconds.

Input Parameters Selection

Name	Value
Stop Time	10
Check to view baseline signals and set their tolerances.	false

2 Simulation 2 0 2 8

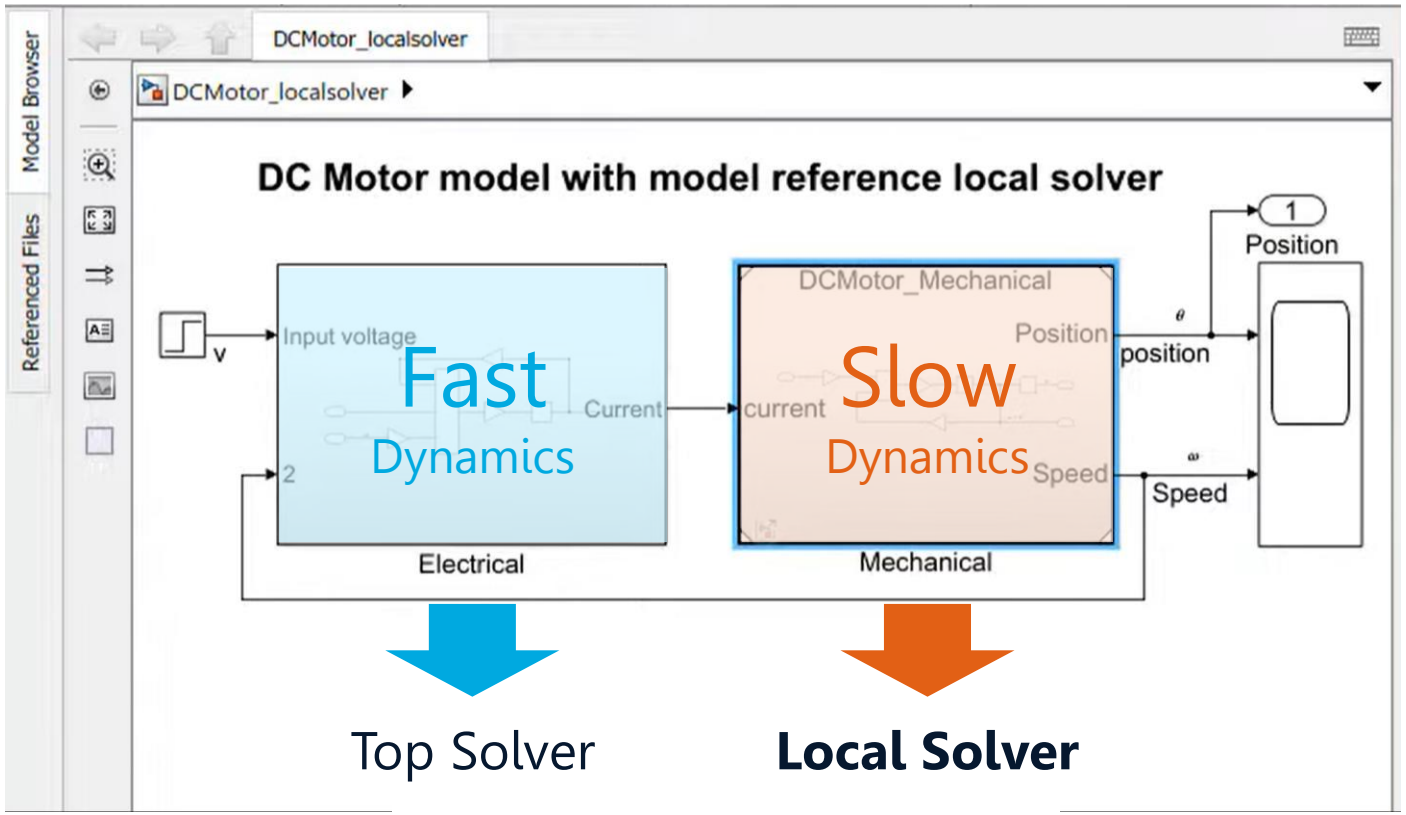
2.1 Checks Occurring Before Update 1 0 2 6

Identify resource-intensive diagnostic settings

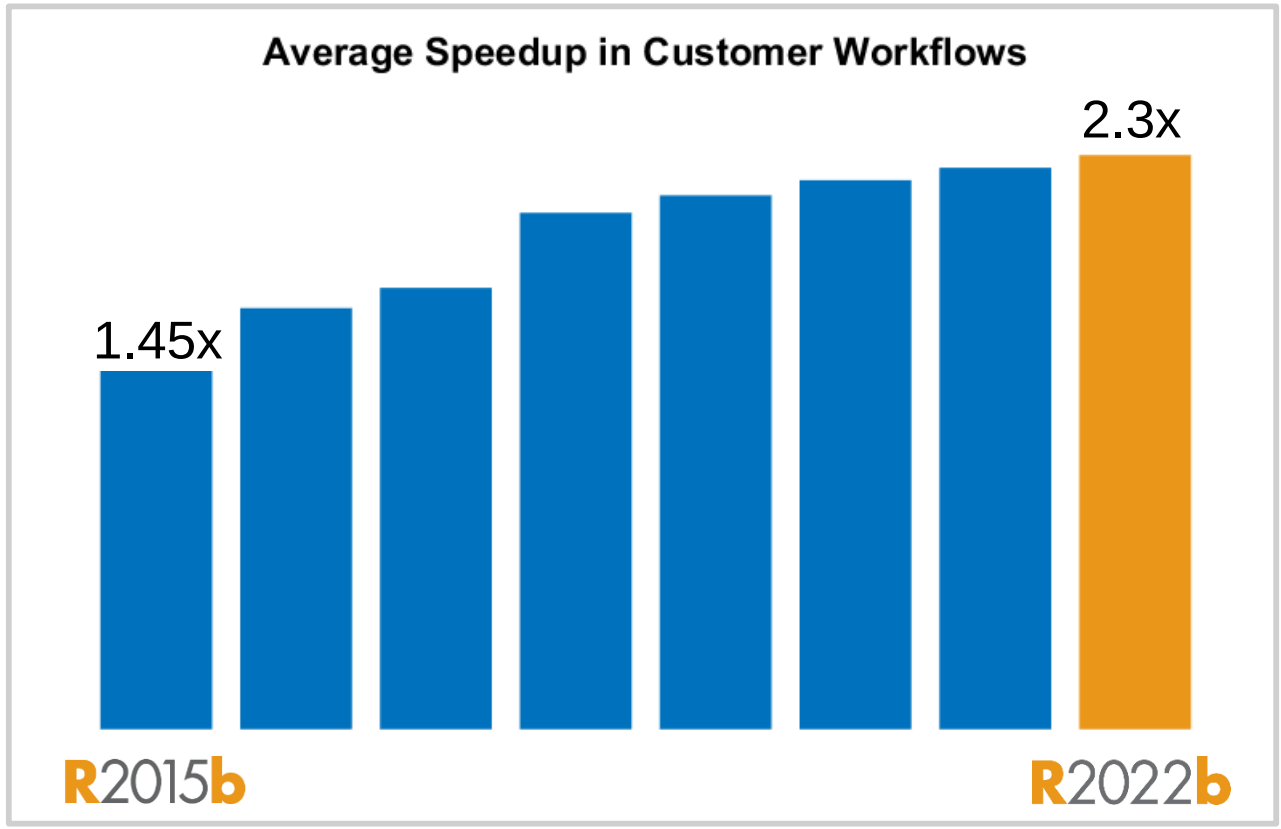
Some diagnostics incur run-time overhead during simulation. Review the following parame
for these parameters.

Click link(s) to make changes manually. Alternatively, click the 'Modify all' button below to

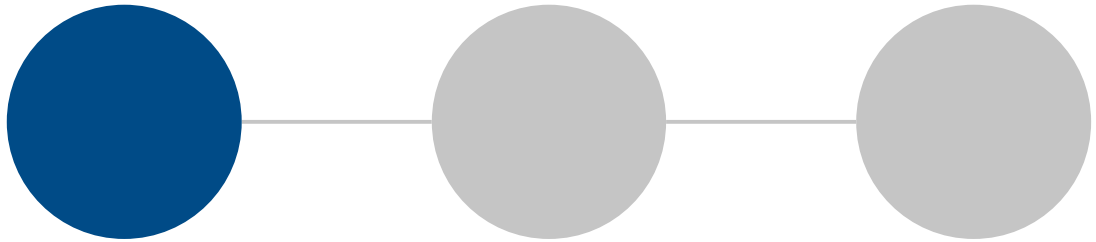
	Severity	Diagnostics checked
Solver	✓	Diagnostics > Solver data inconsistency
Signals	⚠	Diagnostics > Data Validity > Signal resolution
	✓	Diagnostics > Data Validity > Division by singular matrix
	✓	Diagnostics > Data Validity > Inf or nan block output
	✓	Diagnostics > Data Validity > Simulation range checking
	✓	Diagnostics > Data Validity > Array bounds exceeded
DSM Blocks	⚠	Diagnostics > Data Validity > Detect read before write
	⚠	Diagnostics > Data Validity > Detect write after read

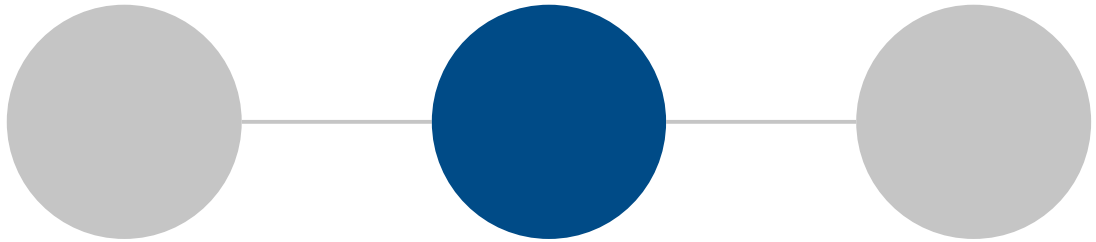

DCMotor_localsolver
DCMotor_localsolver
Model Browser
Referenced Files
DC Motor model with model reference local solver
Input voltage
V
2
Fast
Dynamics
Current
Electrical
DCMotor_Mechanical
current
Slow
Dynamics
Position
Speed
Mechanical
θ
position
ω
Speed
1
Position
Top Solver
Local Solver


Solver
Use local solver:
on
Solver:
FixedStepAuto
Fixed step:
auto
Input signal handli...
Auto
Output signal hand...
Use solver interpo
VariableStepAuto

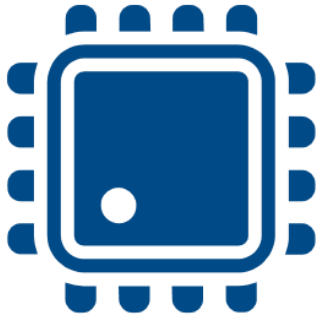


Functions	1.6x
Function handles	40x


Práca
Vývoj softvéru
Integrácia



Práca Vývoj softvéru Integrácia



Code Analyzer

The Code Analyzer identifies and addresses code issues, including problems and areas for improvement.

Overall Summary

11
total files

0
Error

8
Warning

4
Info

Select Folder /Users/mhirsch/Library/CloudStorage/OneDrive-MathWorks/mfiles/Demos/TwitterAnalysis

Rerun Analysis | Group by Severity | Filter by Severity | Filter by Issue Type

Code Health Details

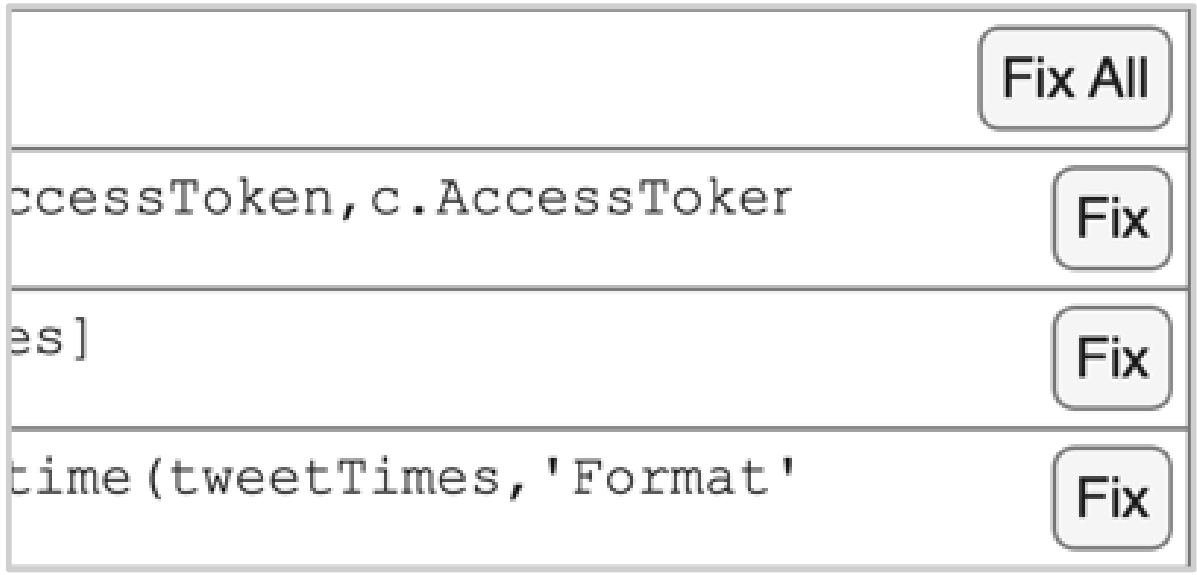
Analysis Date: 3/31/2023, 5:28:42 PM

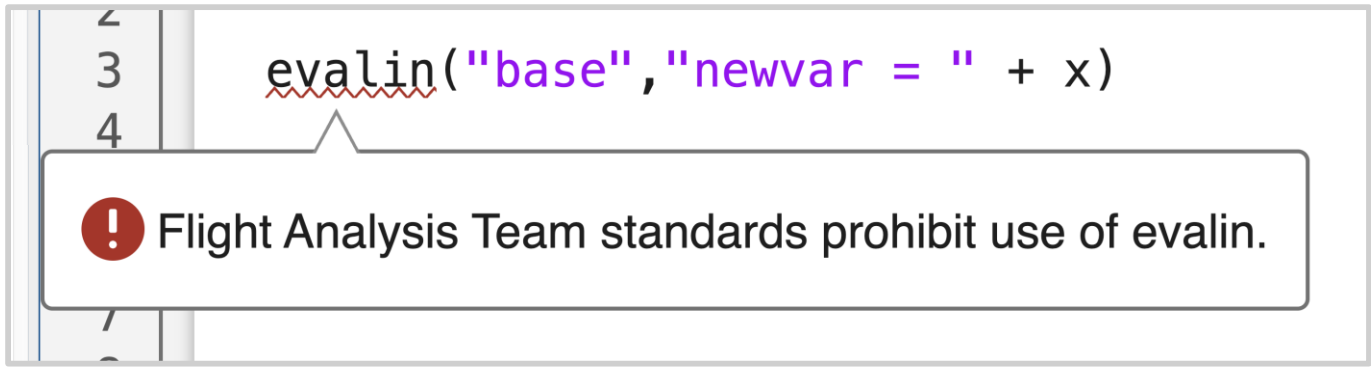
Warning (8)

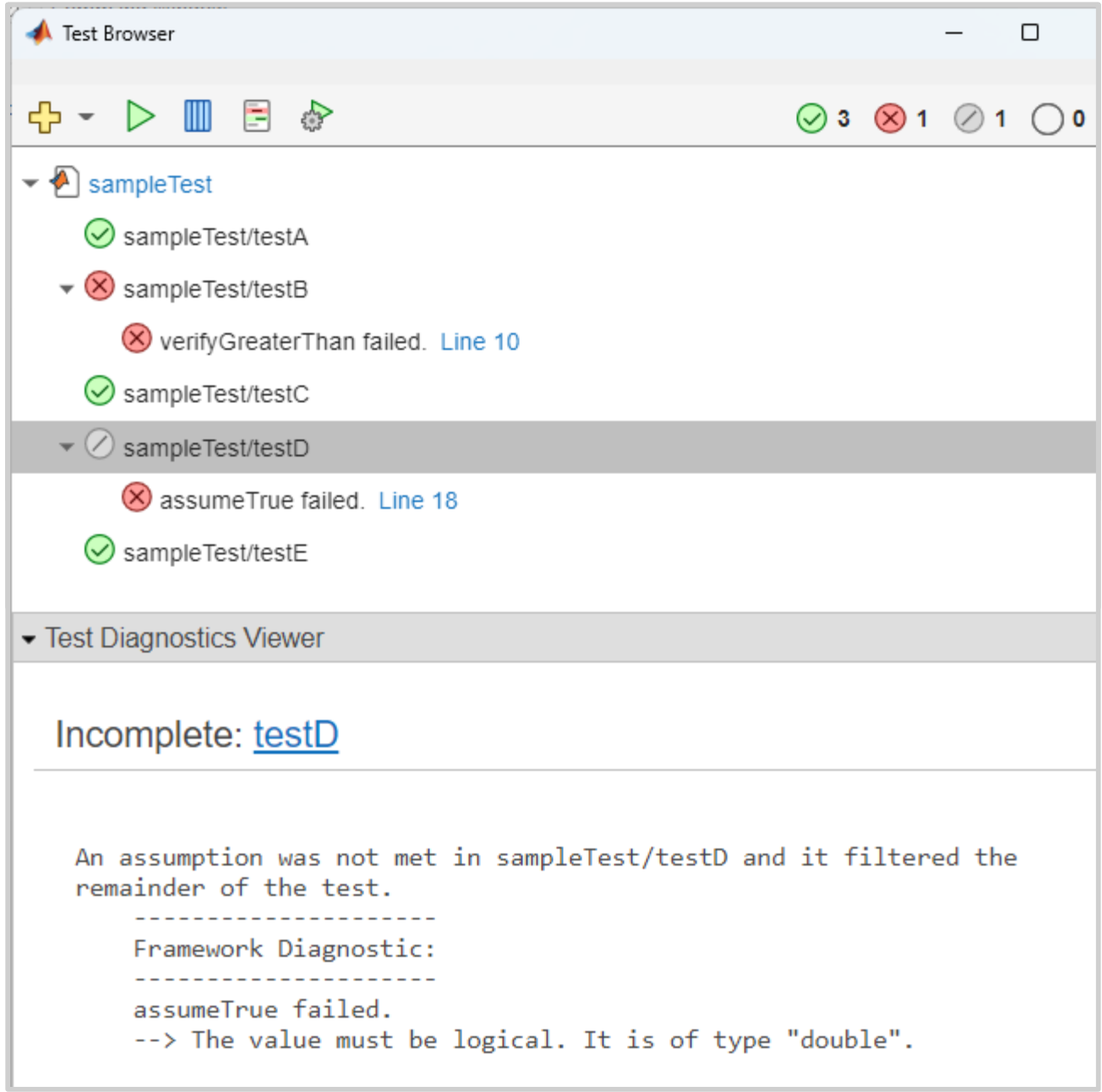
- Input argument might be unused. Consider replacing the argument with ~ instead. (3)
- To avoid conflicts with functions on the path, specify variables to load from file. (3)
- Variable might be used before it is defined. (1)
- Value assigned to variable might be unused. (1)

Info (4)

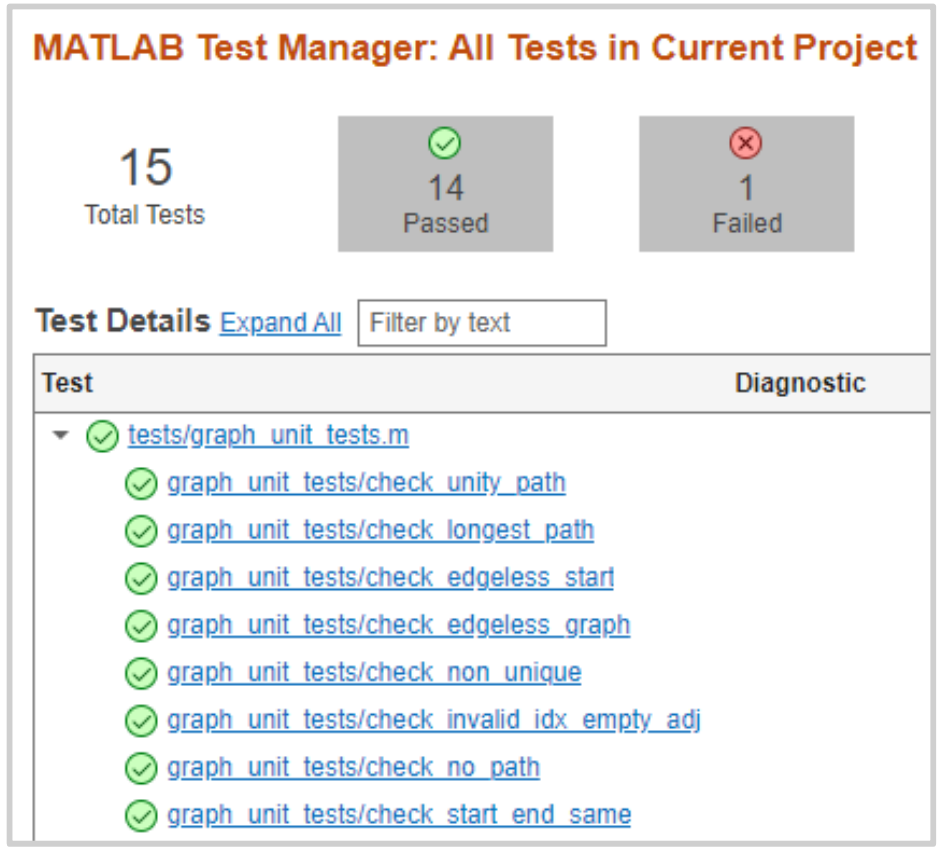
- Add a semicolon after the statement to hide the output (in a script). (3) — Fix All
  - Line 3 — Script1_ImportTwitterData.m `c = twitter(c.ConsumerKey,c.ConsumerSecret,c.AccessToken,c.AccessToker` — Fix
  - Line 14 — Script1_ImportTwitterData.m `statuses = [statuses;sRefresh.Body.Data.statuses]` — Fix
  - Line 47 — Script1_ImportTwitterData.m `tweets = timetable(tweetTexts,'RowTimes', datetime(tweetTimes,'Format'` — Fix

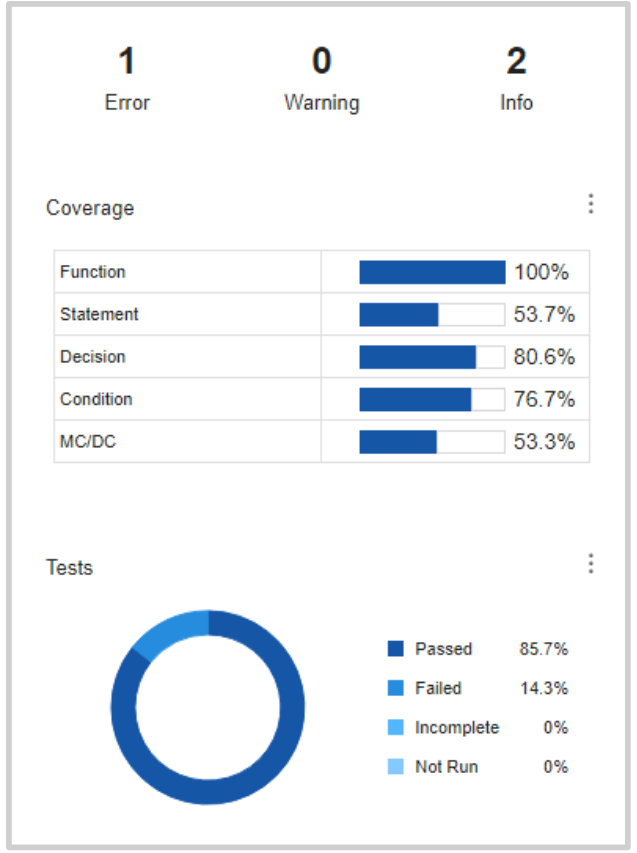

Fix All
ccessToken,c.AccessToker
Fix
es]
Fix
time(tweetTimes,'Format'
Fix


3
evalin("base","newvar = " + x)
4
Flight Analysis Team standards prohibit use of evalin.


Test Browser
3
1
1
0
sampleTest
sampleTest/testA
sampleTest/testB
verifyGreaterThan failed. Line 10
sampleTest/testC
sampleTest/testD
assumeTrue failed. Line 18
sampleTest/testE
Test Diagnostics Viewer
Incomplete: testD
An assumption was not met in sampleTest/testD and it filtered the remainder of the test.

Framework Diagnostic:
---
assumeTrue failed.
--> The value must be logical. It is of type "double".

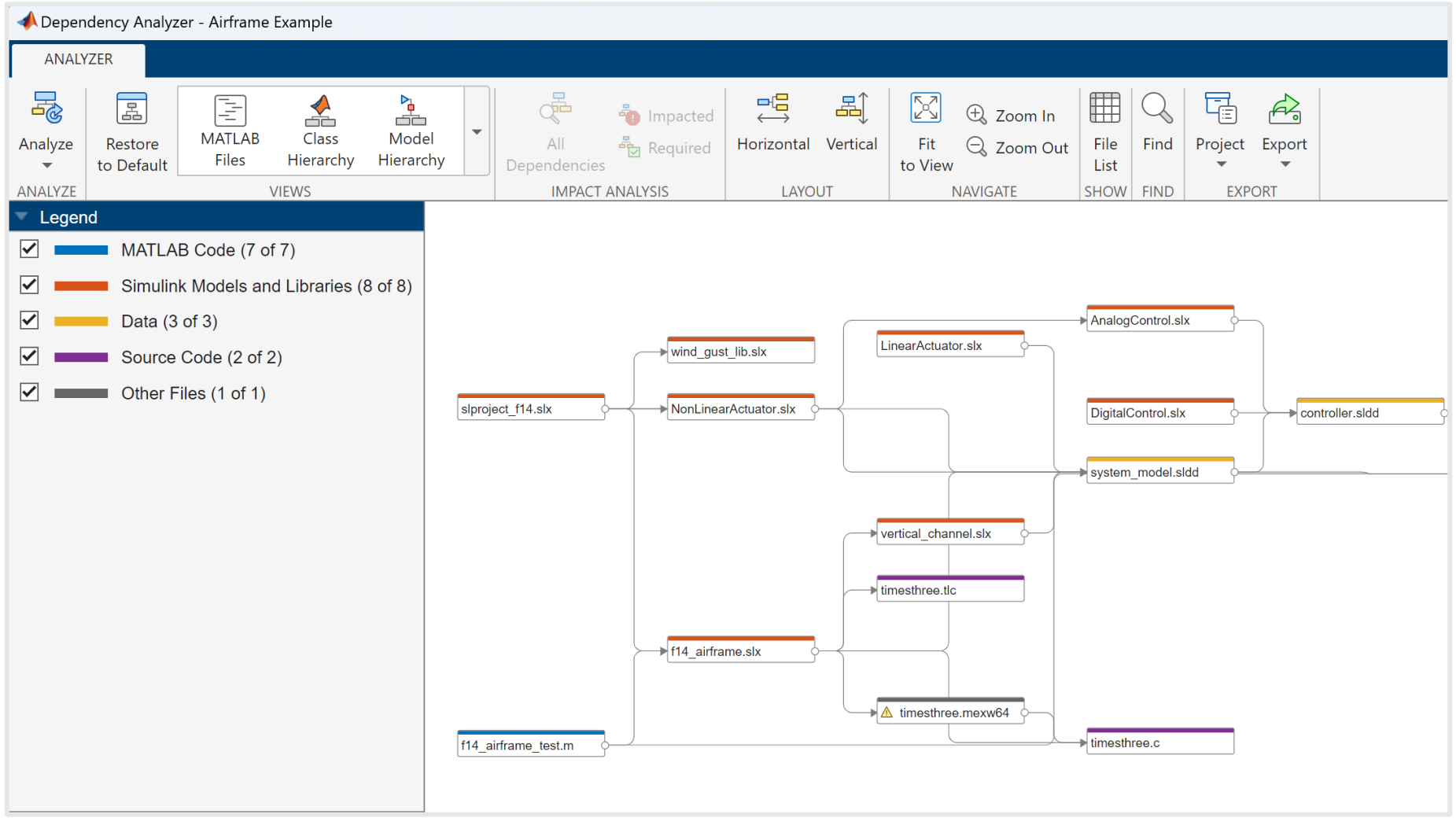

MATLAB Test Manager: All Tests in Current Project
15
Total Tests
14
Passed
1
Failed
Test Details
Expand All
Filter by text
Test
Diagnostic
tests/graph_unit_tests.m
graph_unit_tests/check_unity_path
graph_unit_tests/check_longest_path
graph_unit_tests/check_edgeless_start
graph_unit_tests/check_edgeless_graph
graph_unit_tests/check_non_unique
graph_unit_tests/check_invalid_idx_empty_adj
graph_unit_tests/check_no_path
graph_unit_tests/check_start_end_same


1
Error
0
Warning
2
Info
Coverage
Function 100%
Statement 53.7%
Decision 80.6%
Condition 76.7%
MC/DC 53.3%
Tests
Passed 85.7%
Failed 14.3%
Incomplete 0%
Not Run 0%

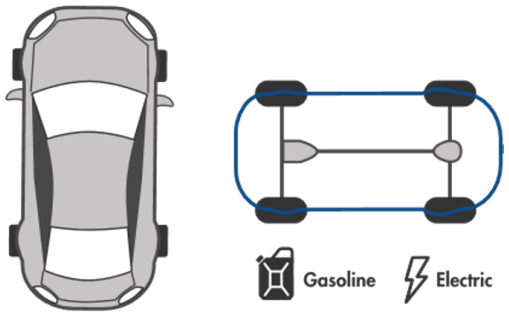
MATLAB Test

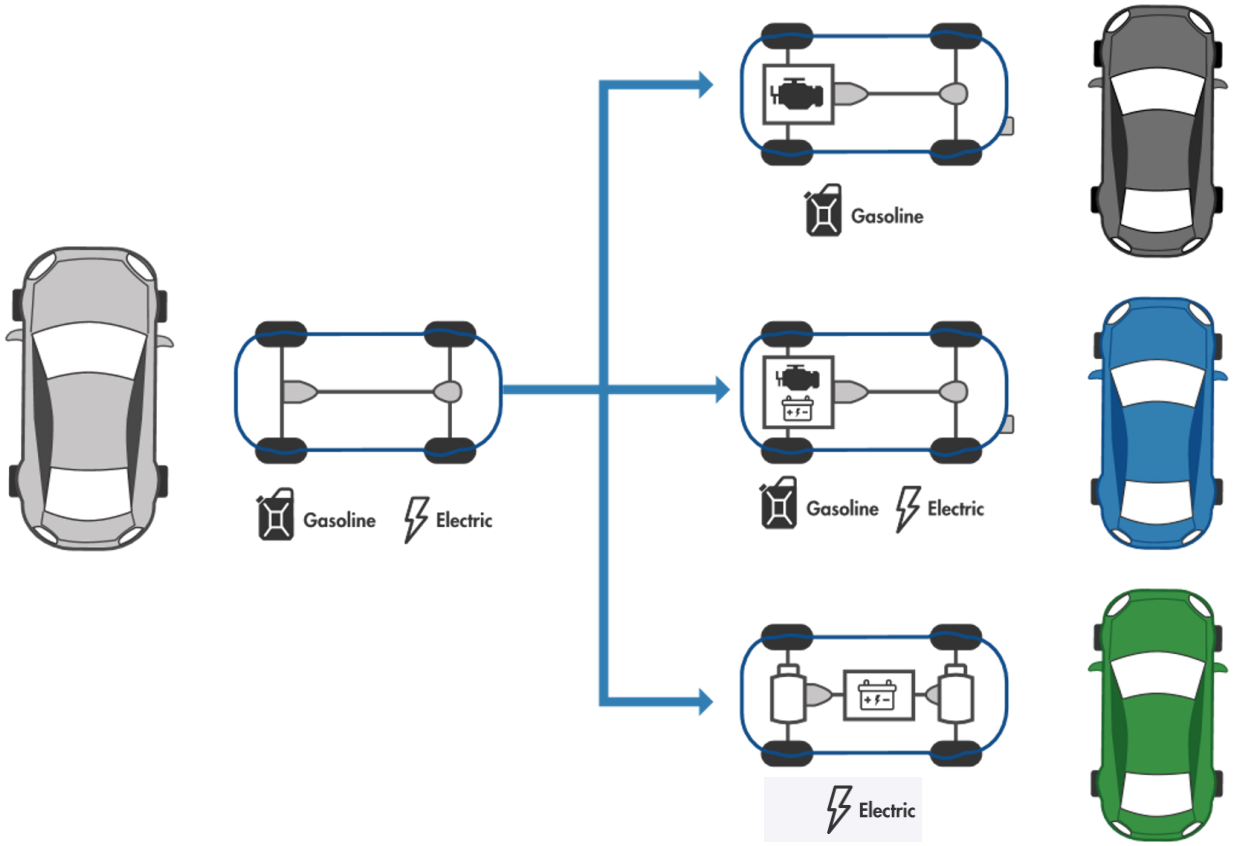
```
>> buildtool -tasks
check   - Identify code issues
test    - Run unit tests
Toolbox - Package Toolbox

>> buildtool
** Starting check
** Finished check

** Starting test
** Finished test

** Starting toolbox
** Finished toolbox
>>
```

Projekty


Dependency Analyzer - Airframe Example
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 (7 of 7)
Simulink Models and Libraries (8 of 8)
Data (3 of 3)
Source Code (2 of 2)
Other Files (1 of 1)
slproject_f14.slx
wind_gust_lib.slx
NonLinearActuator.slx
LinearActuator.slx
AnalogControl.slx
DigitalControl.slx
controller.sldd
system_model.sldd
vertical_channel.slx
timesthree.tlc
f14_airframe.slx
timesthree.mexw64
f14_airframe_test.m
timesthree.c


sldemo_mdlref_heat2cost.slx
Model
sldemo_mdlref_heater.slx
Model
sldemo_mdlref_house.slx
Model
sldemo_mdlref_outdoor_temp.slx
Model
Properties
Products
MATLAB
Simulink
Blocks
Impacted
Required
All Dependencies
Blocks in sldemo_mdlref_heat2cost have no dependencies


Gasoline
Electric

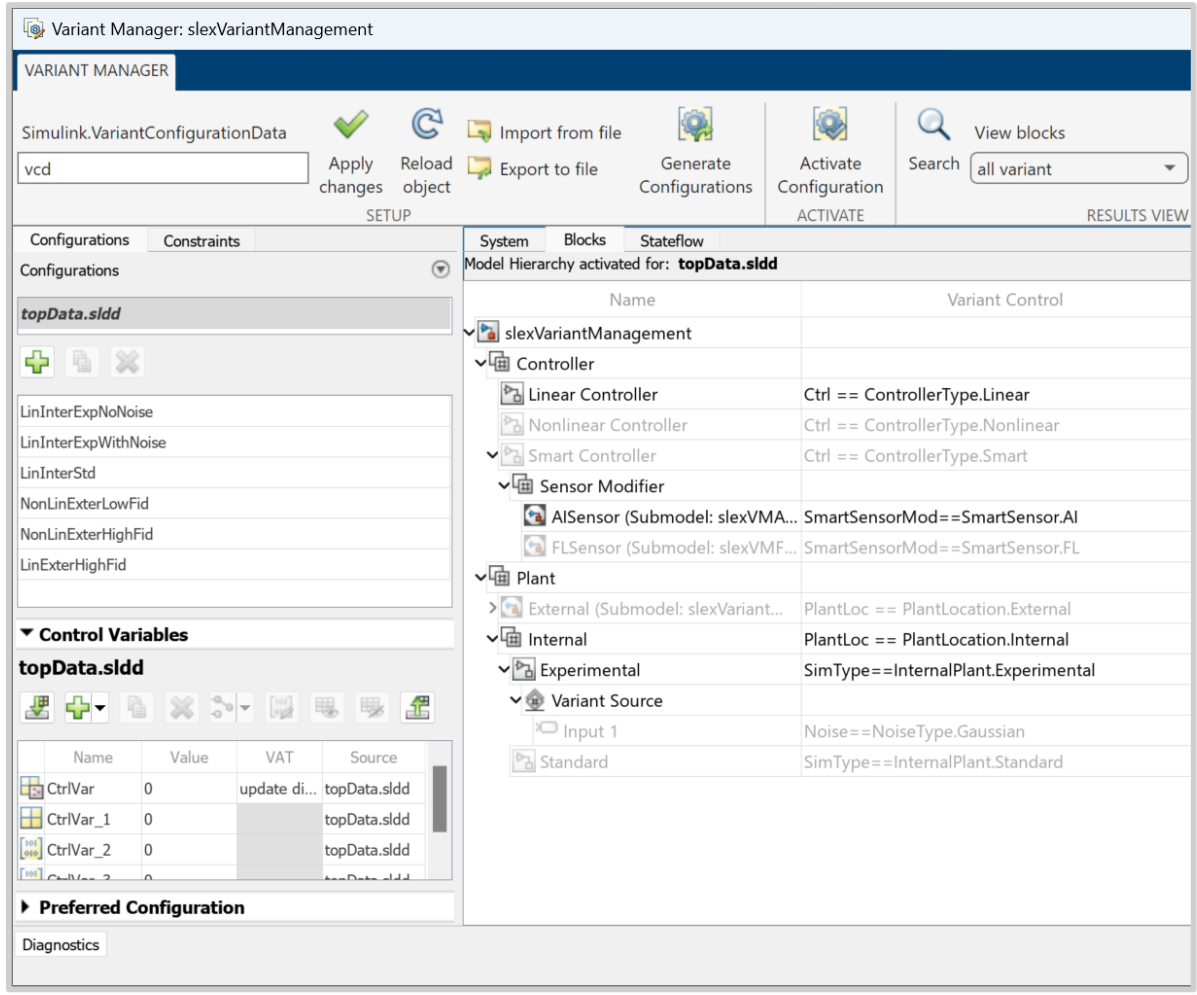

Gasoline
Electric
Gasoline
Gasoline
Electric
Electric

Variant Manager Support Package

Správa

Analýza

Redukcia

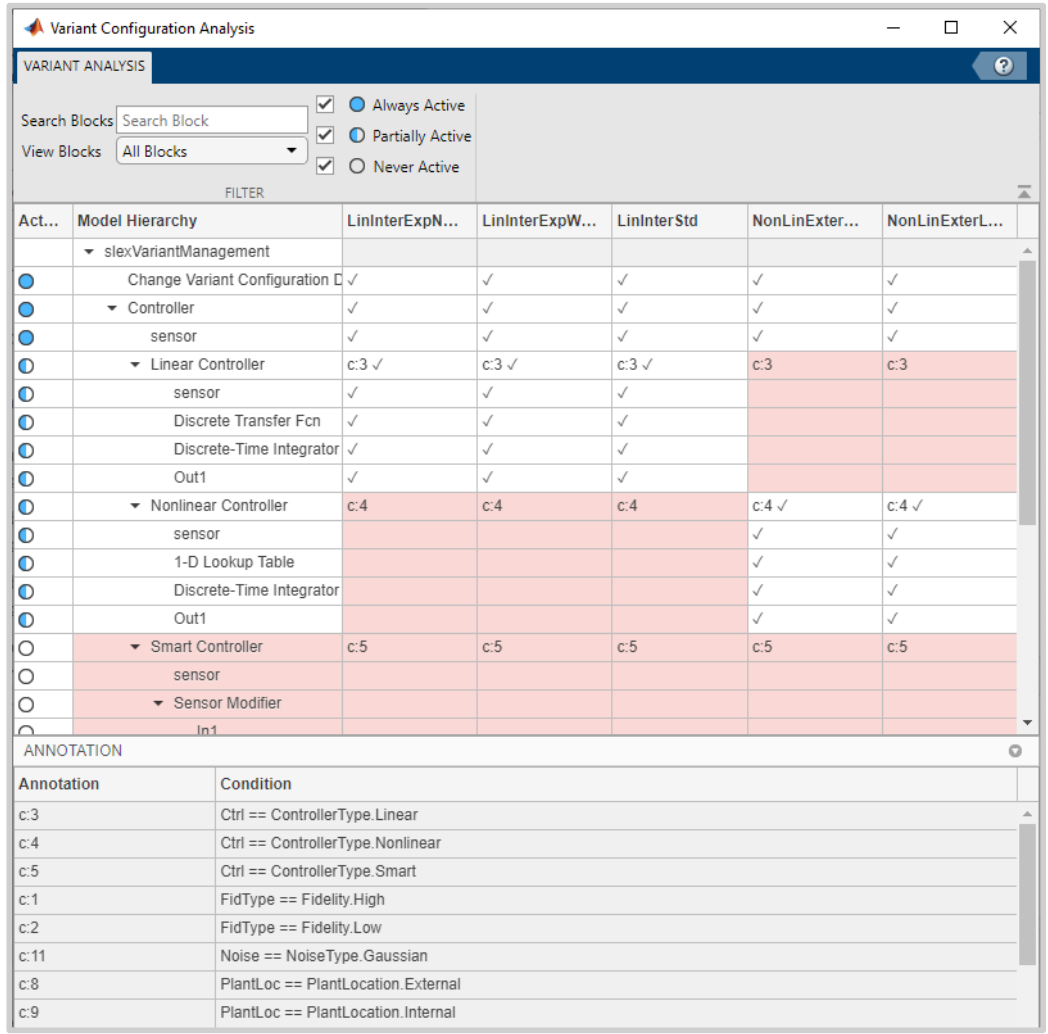


Variant Manager Support Package

Správa

Analýza

Redukcia

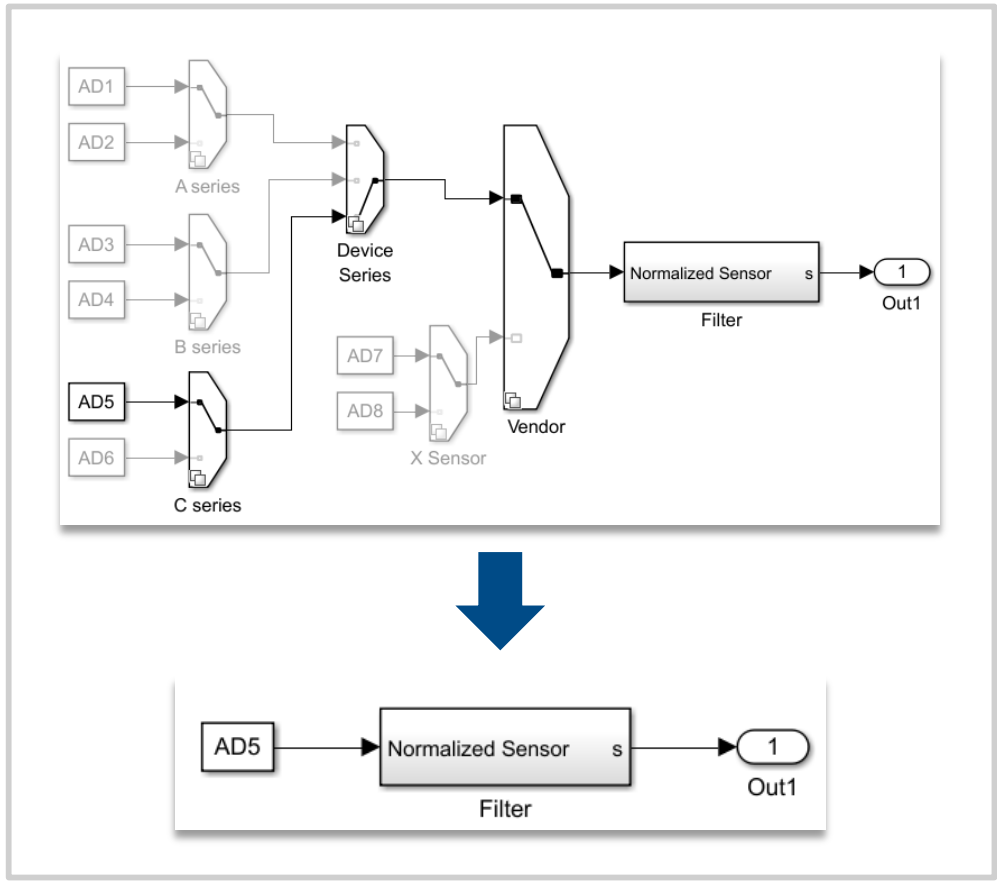


Variant Manager Support Package

Správa

Analýza

Redukcia



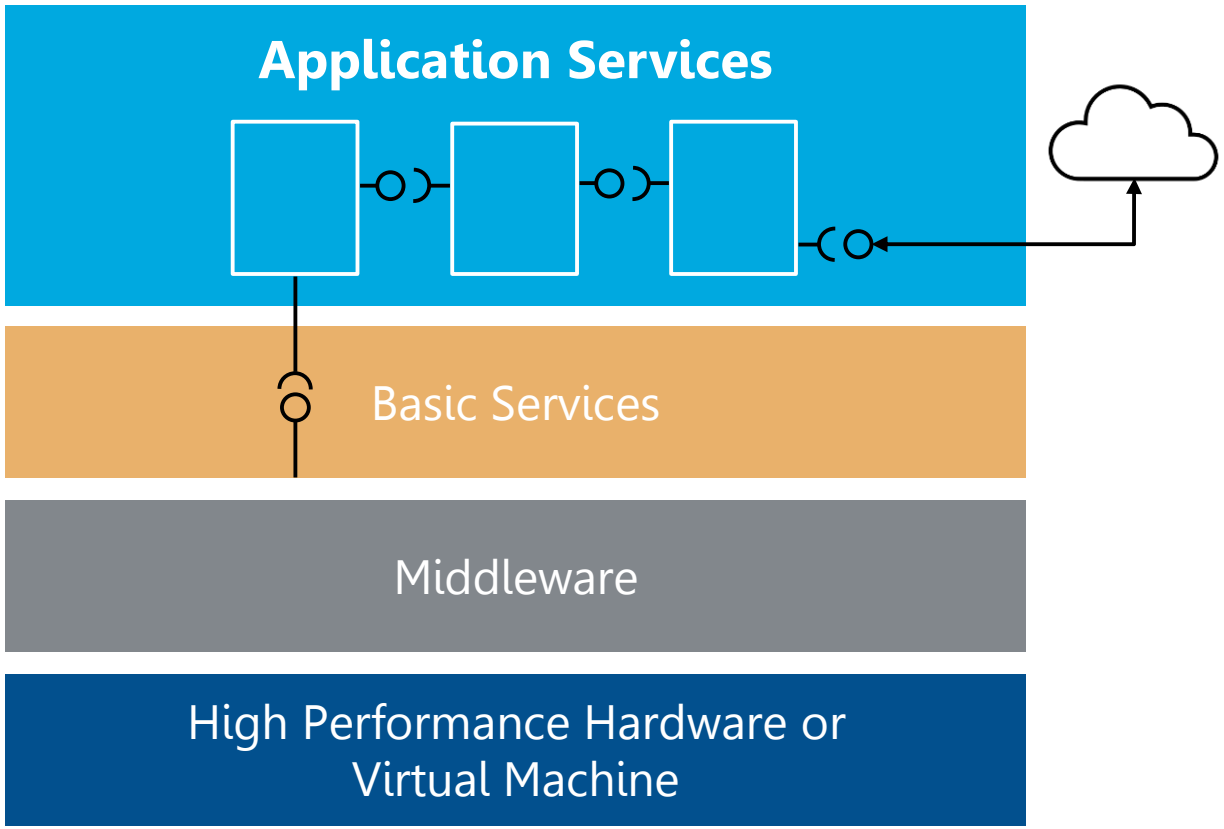

VOYAGE


VOYAGE
AI & Autonomy

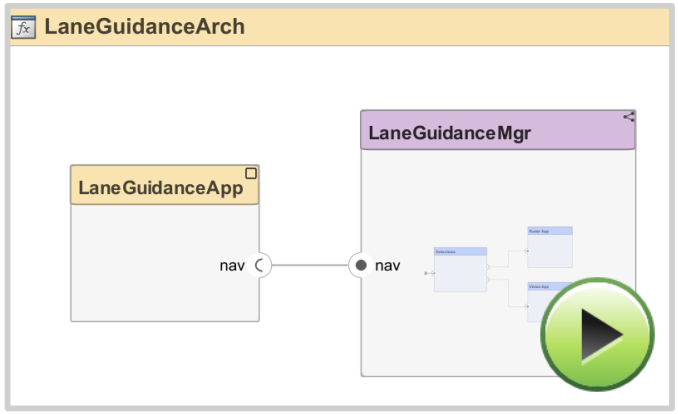

Electrification


Connectivity

Service-Oriented Architecture (SOA)

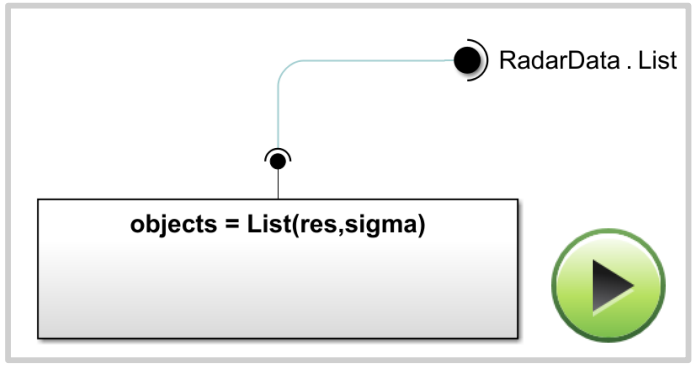


Od **architectúry** k **návrhu**



Popis architektúry

Od **návrhu** ku **kódu**



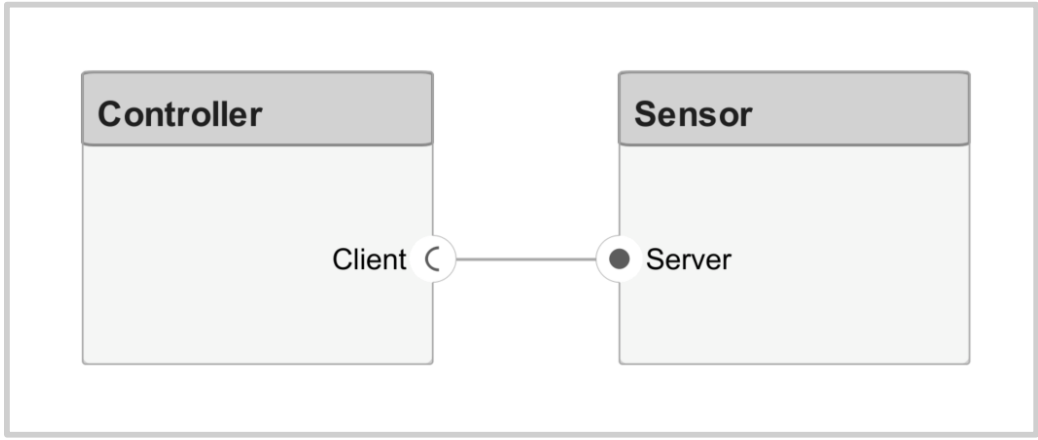
Implementácia návrhu

```
36  class scServiceInterfaceExample final
37  {
38    // public data and function members
39  public:
40    // Block signals (default storage)
41    struct B_scServiceInterfaceExample_T {
42      real_T fetchData_b;
43      real_T reset_d;
44      real_T fetchData_m;
45      real_T reset_p;
46    };
47
```

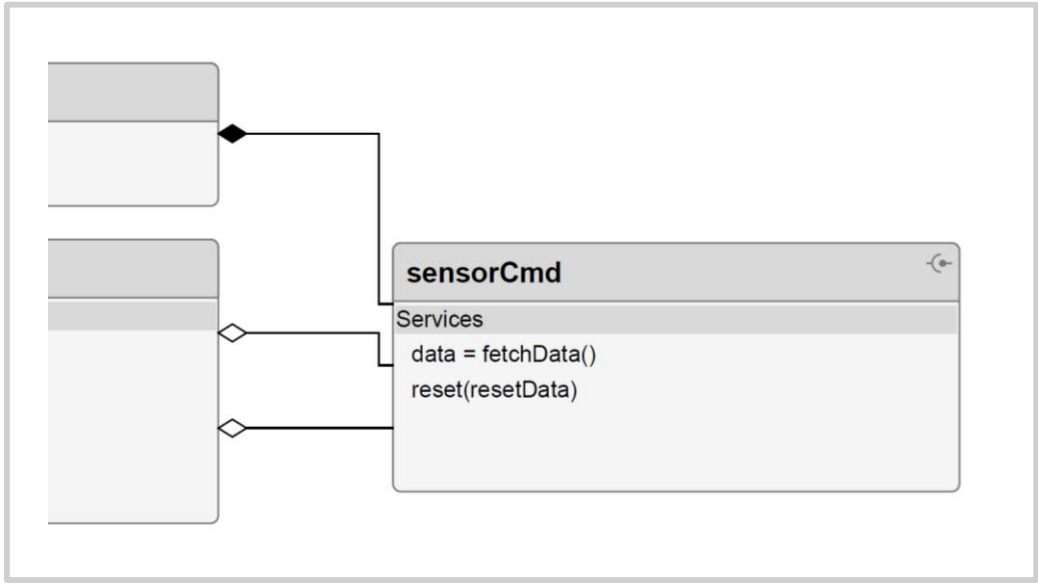
Generovanie C++ kódu

Popis architektúry

Definícia

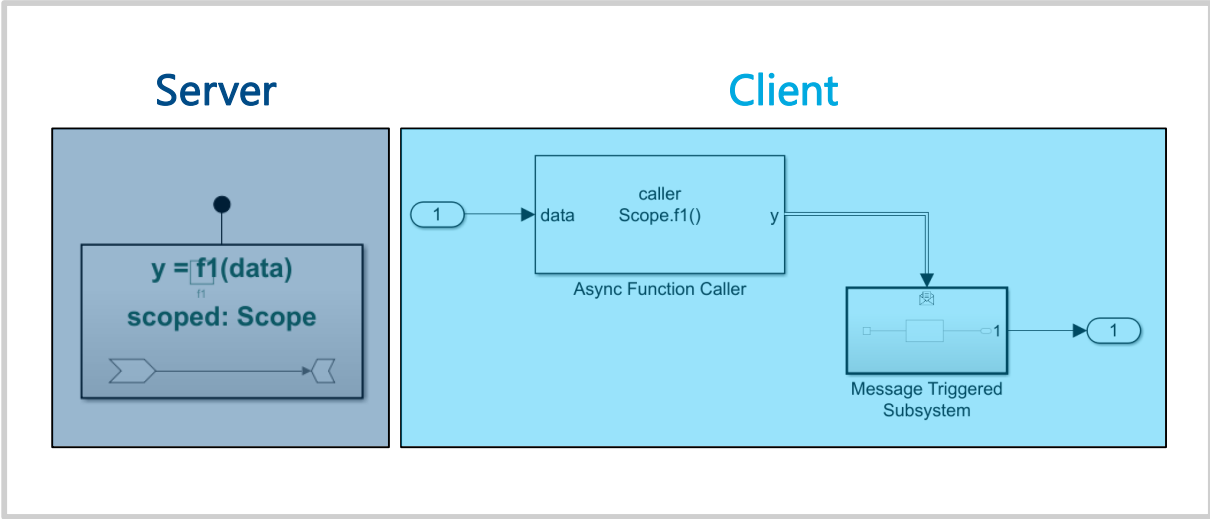


Vizualizácia

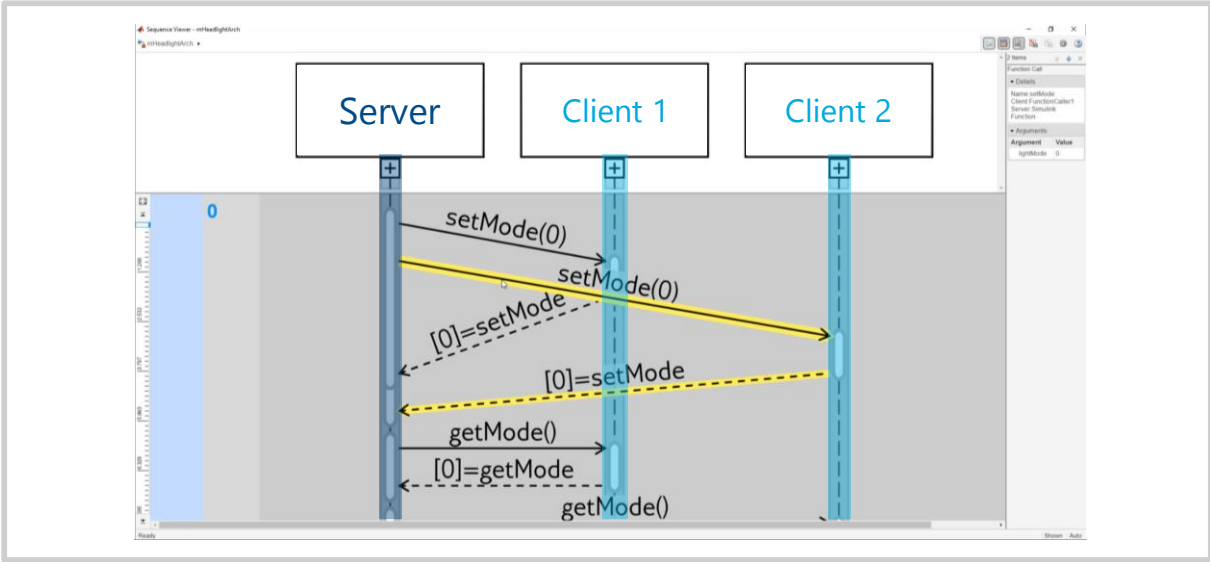


Implementácia návrhu

Modelovanie

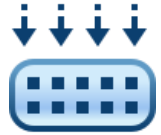


Simulácia



Generovanie kódu

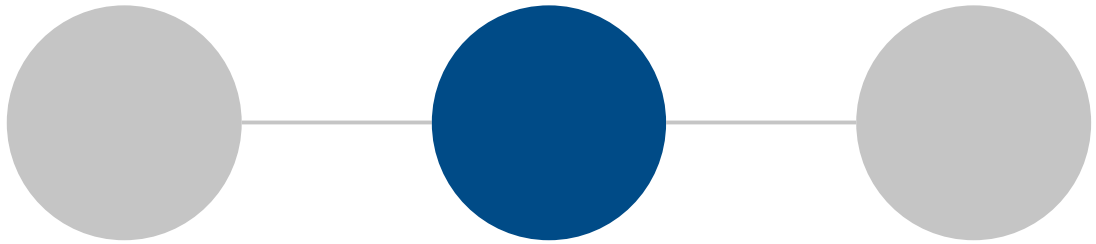
```
36  class scServiceInterfaceExample final
37  {
38    // public data and function members
39  public:
40    // Block signals (default storage)
41    struct B_scServiceInterfaceExample_T {
42      real_T fetchData_b;                // '<Root>/Sensor1'
43      real_T reset_d;                    // '<Root>/Sensor1'
44      real_T fetchData_m;                // '<Root>/Sensor2'
45      real_T reset_p;                    // '<Root>/Sensor2'
46    };
```



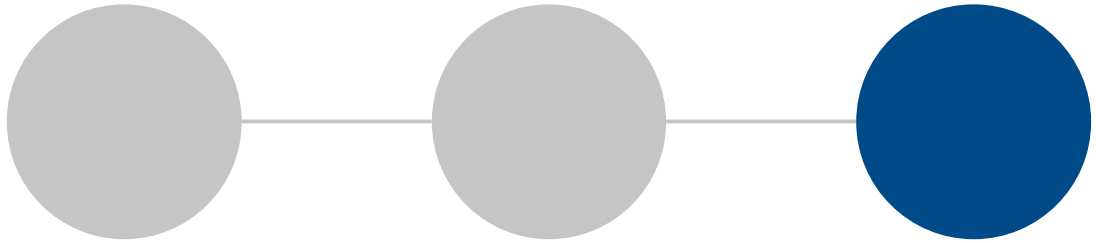
AUTOSAR

DDS™

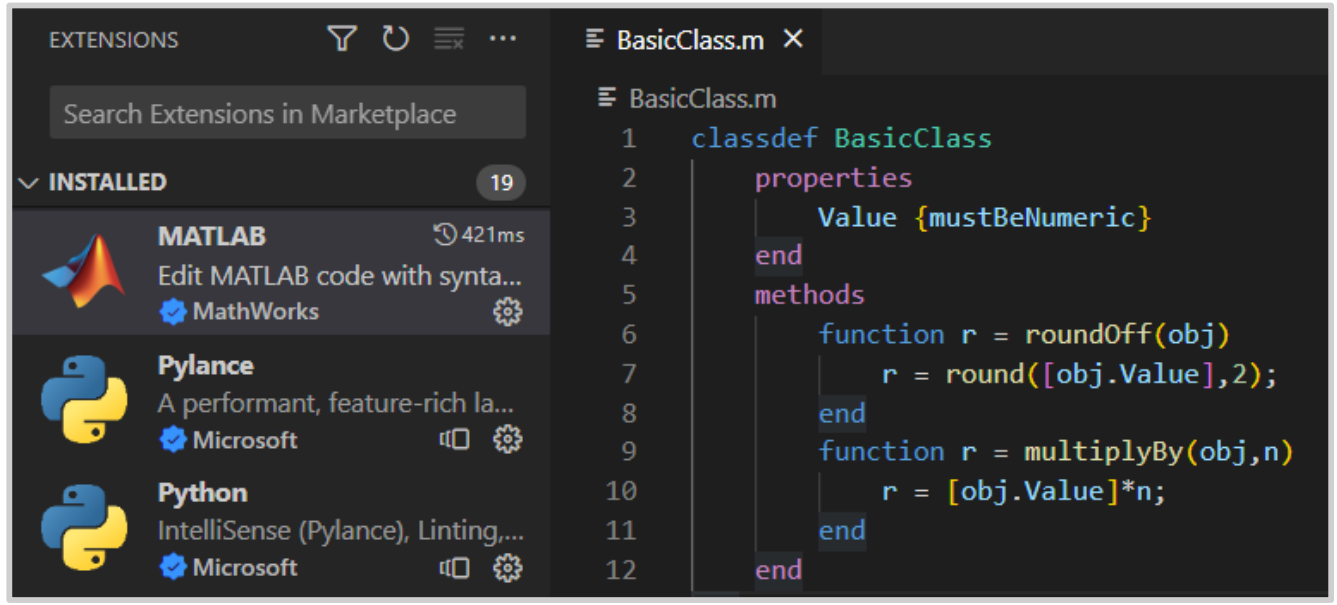
ROS



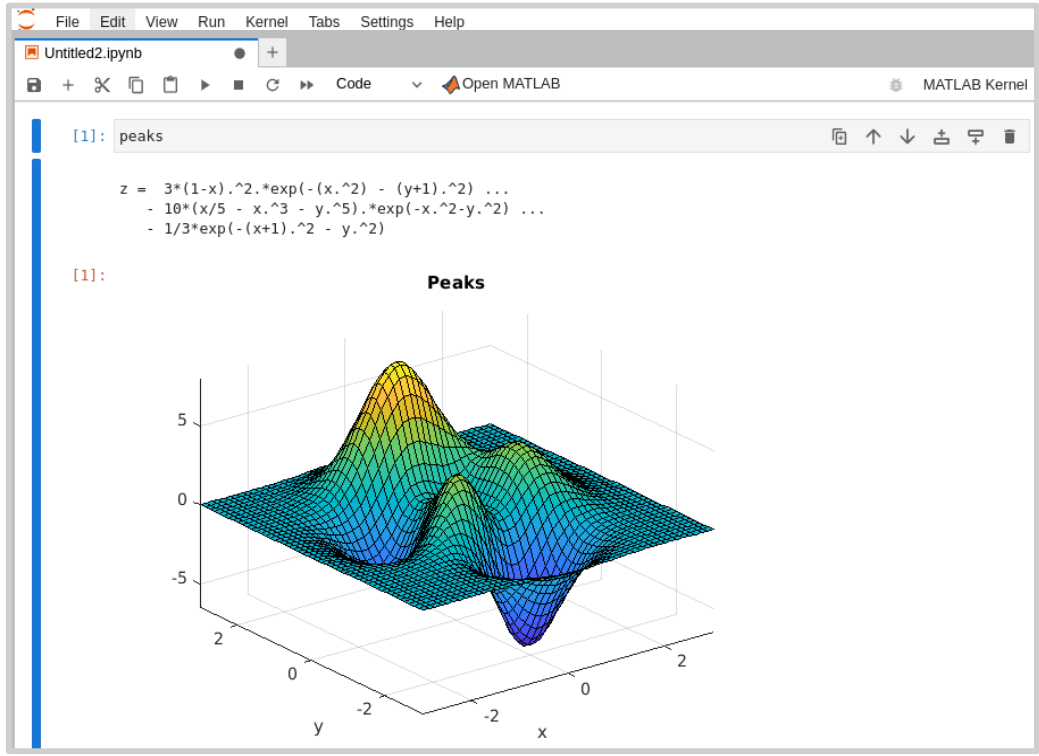
Práca Vývoj softvéru Integrácia



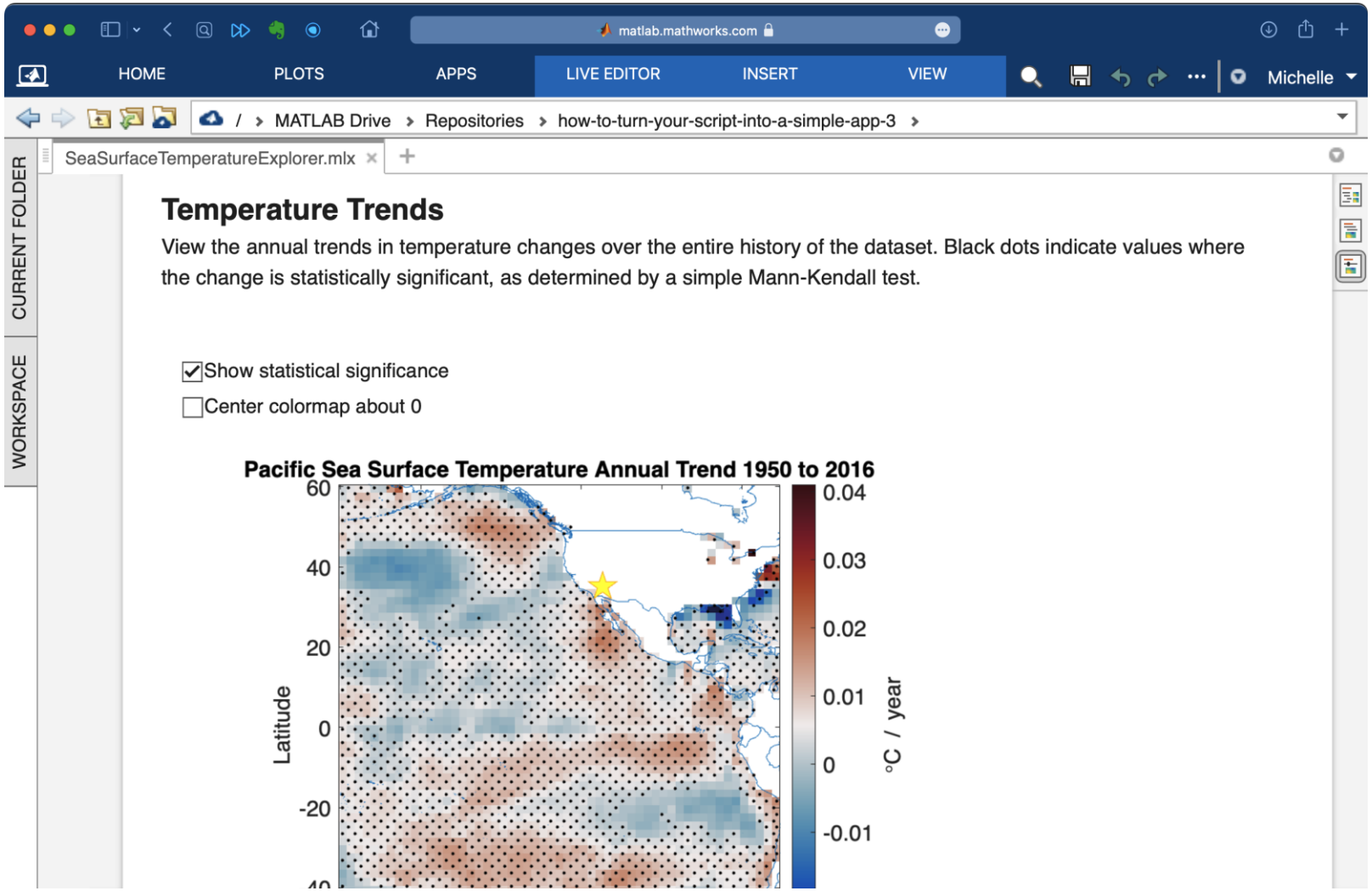
Práca Vývoj softvéru **Integrácia**

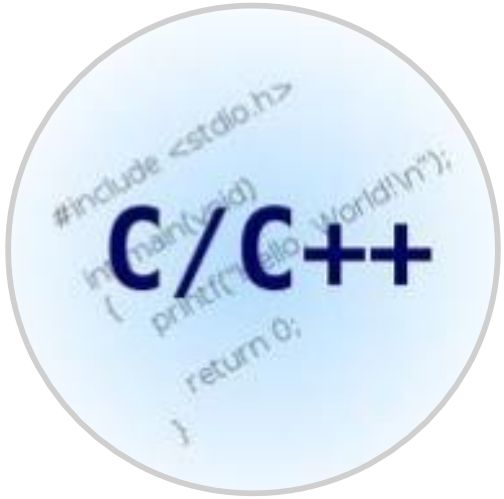


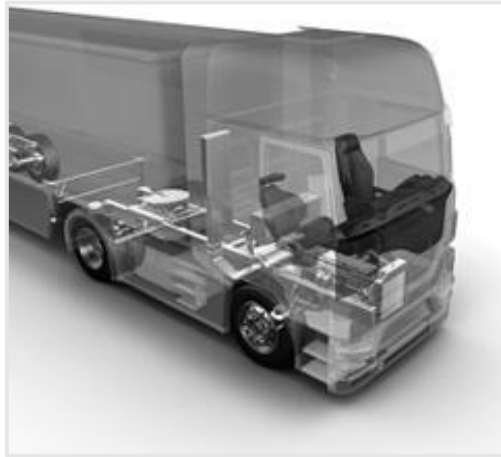
Visual Studio Code



Jupyter


matlab.mathworks.com
HOME
PLOTS
APPS
LIVE EDITOR
INSERT
VIEW
Michelle
/ › MATLAB Drive › Repositories › how-to-turn-your-script-into-a-simple-app-3 ›
CURRENT FOLDER
WORKSPACE
SeaSurfaceTemperatureExplorer.mlx
Temperature Trends
View the annual trends in temperature changes over the entire history of the dataset. Black dots indicate values where the change is statistically significant, as determined by a simple Mann-Kendall test.
Show statistical significance
Center colormap about 0
Pacific Sea Surface Temperature Annual Trend 1950 to 2016
Latitude
60
40
20
0
-20
0.04
0.03
0.02
0.01
0
-0.01
°C / year


C/C++




HEBI
ROBOTICS

R2017b

FMU Import

FMU Import

R2018b

<FunctionName>

C Caller

R2020a

C

C Function

R2021a

Code Importer

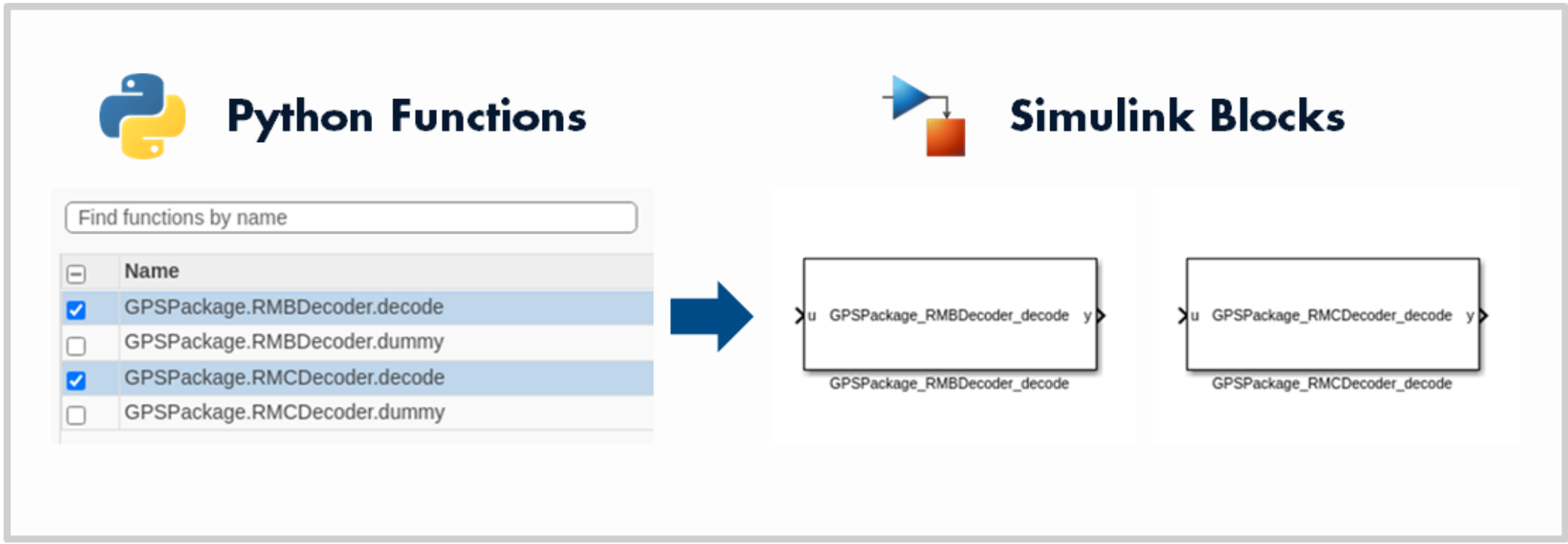
R2022a

C

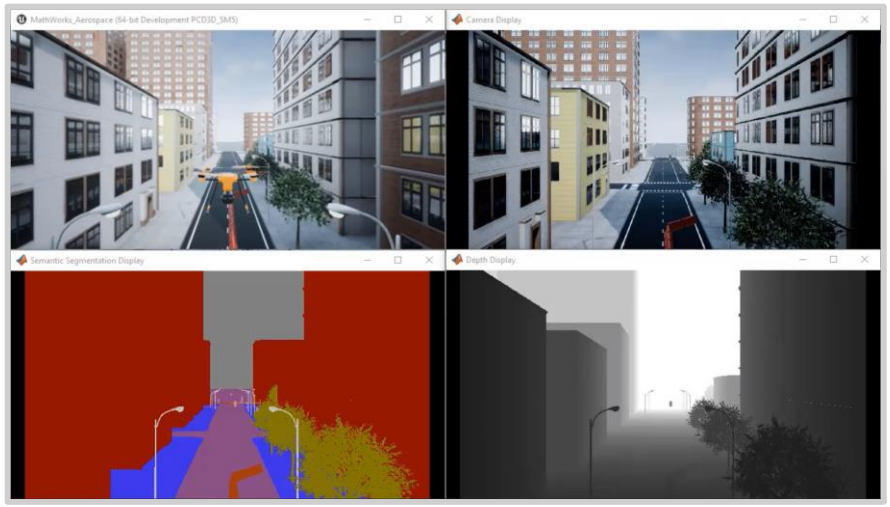
C Function
Supports C++

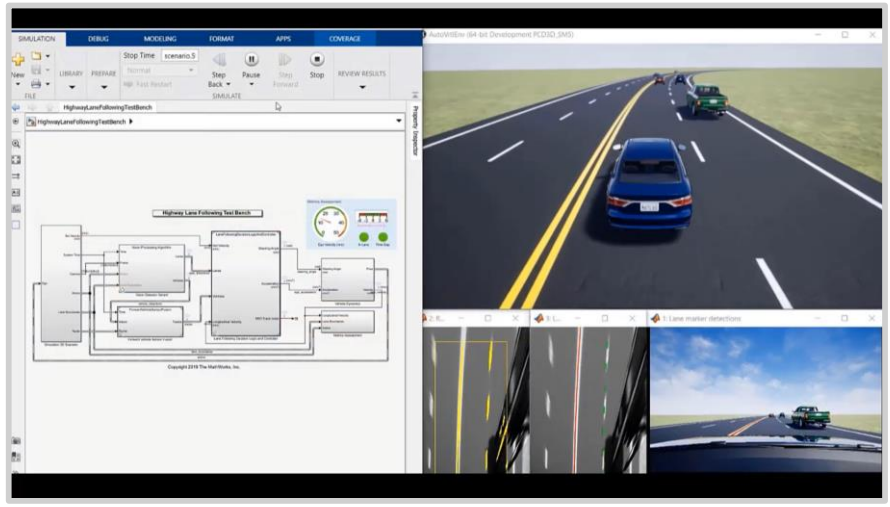
R2023a

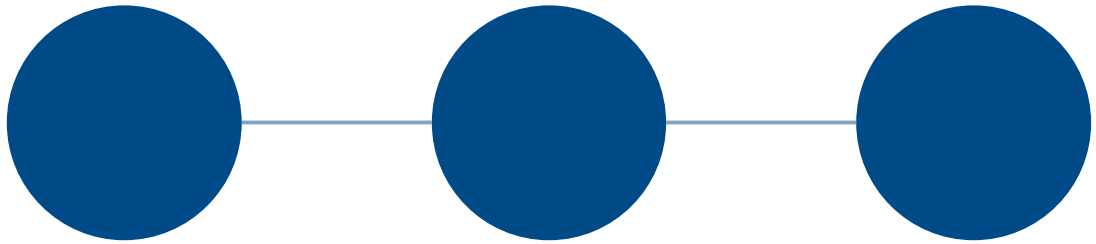
Python Importer


Python Functions
Simulink Blocks
Find functions by name
Name
GPSPackage.RMBDecoder.decode
GPSPackage.RMBDecoder.dummy
GPSPackage.RMCDecoder.decode
GPSPackage.RMCDecoder.dummy
u GPSPackage_RMBDecoder_decode y
GPSPackage_RMBDecoder_decode
u GPSPackage_RMCDecoder_decode y
GPSPackage_RMCDecoder_decode

3D Vizualizácia





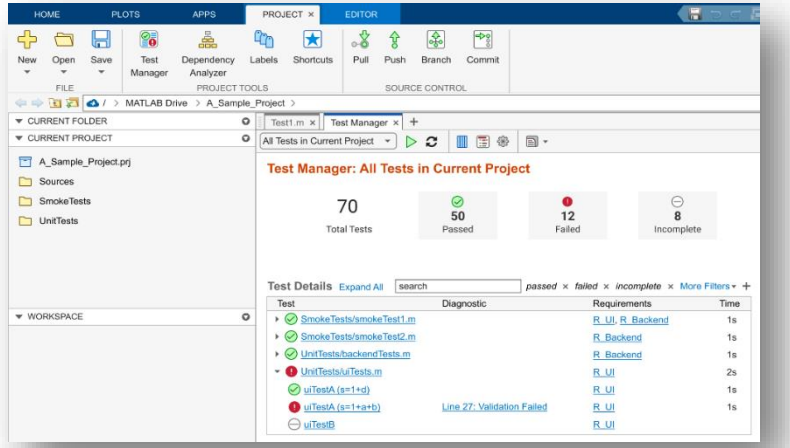

Práca
Vývoj softvéru
Integrácia

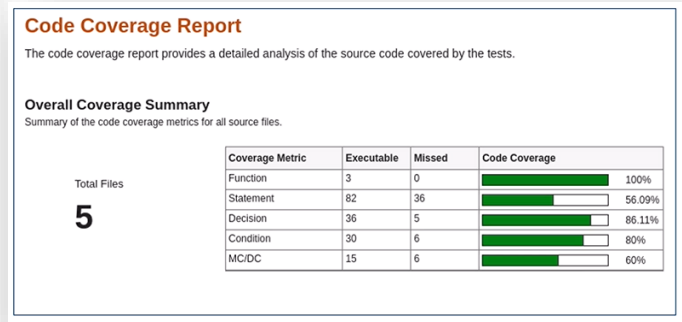

MATLAB®
PRODUCT FAMILY

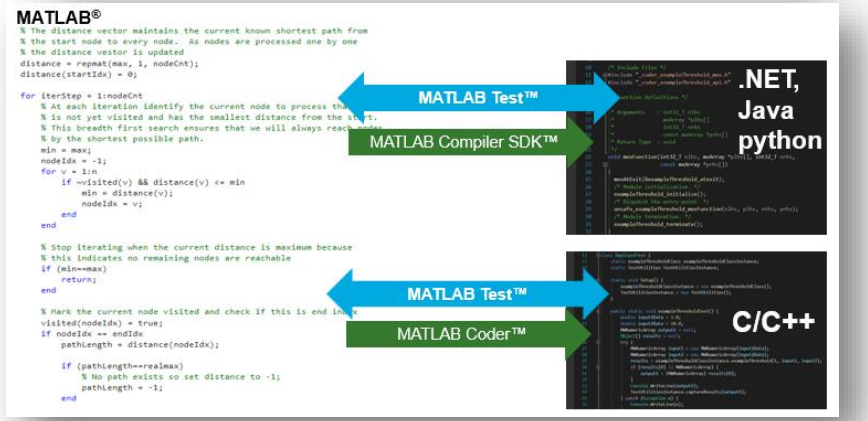

SIMULINK®
PRODUCT FAMILY

Testovanie aplikácií v MATLABe

- Test Manager
  - škálovateľnosť testov, tagy
- Pokrytie kódu
  - MC/DC, Decision, Condition
- Testovanie ekvivalencie
  - originál vs. generovaný kód
- Code Quality Dashboard
  - prehľad a vplyv na požiadavky
- IEC Certification Kit
  - v R2023a TÜV SÜD certifikoval časť MATLAB Testu pre vývoj s ISO 26262 a derivátmi
  - v R2022b TÜV SÜD predkvalifikoval niektoré nástroje pre štandardy funkčnej bezpečnosti

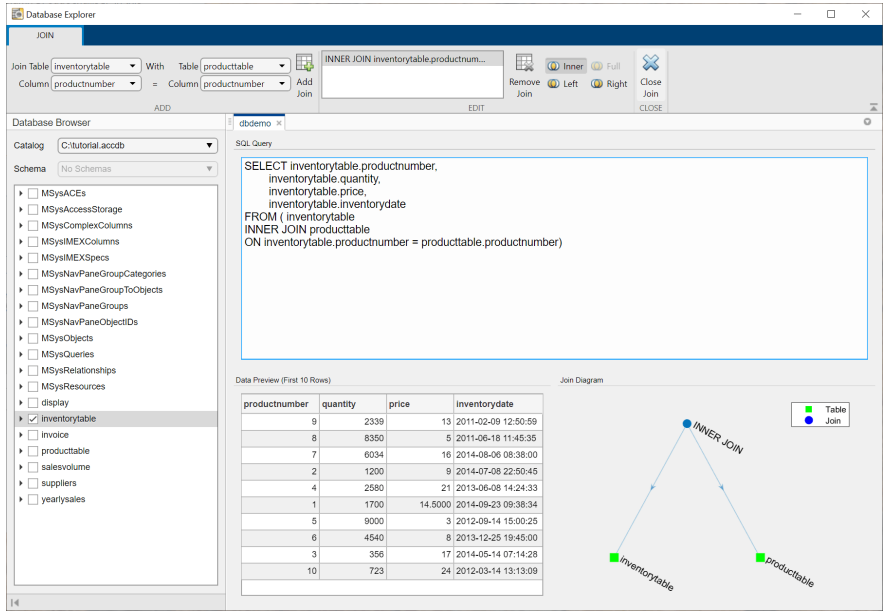


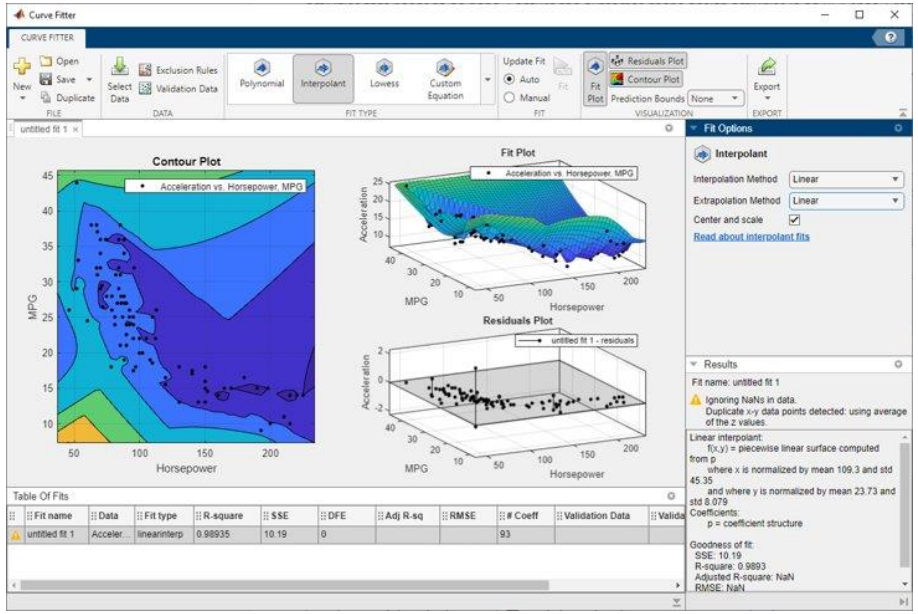




Práca s dátami

- Databázy
  - ovládače pre často používané DB
  - row filter – efektívnejší spôsob filtrovania
- Fitovanie
  - pridanie extrapolačných metód
  - export fitovania do Simulink (Lookup Table)
  - aktualizovaný Results Panel
- Optimalizácia
  - fminbnd, fminsearch v problem-based optim.
  - non-uniform patternsearch

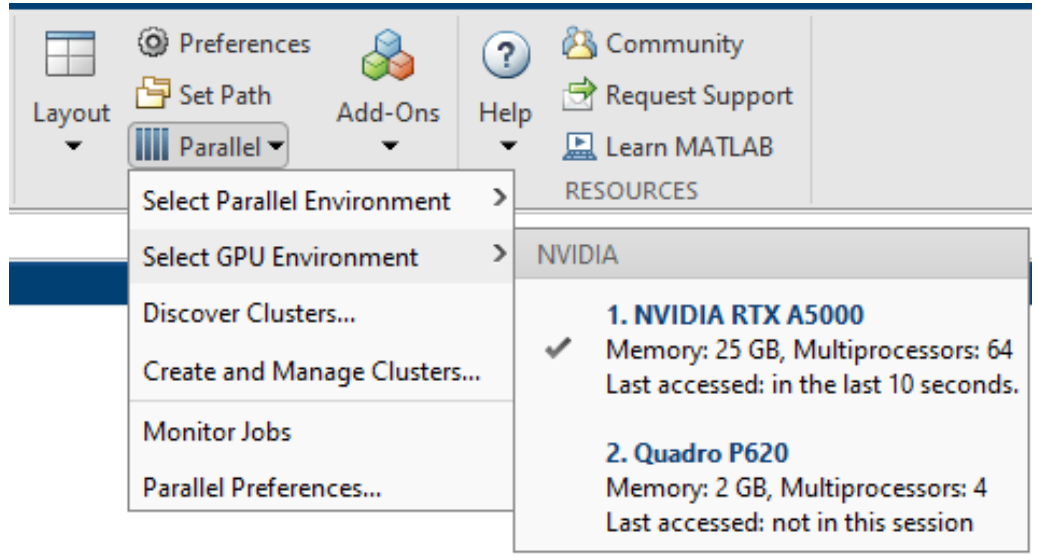


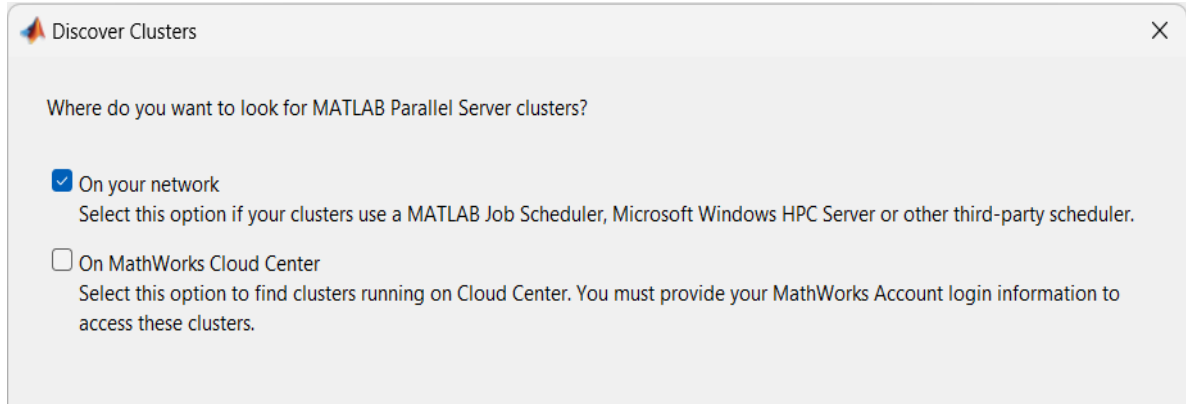


Database Toolbox, Curve Fitting Toolbox
Optimization Toolbox, Global Optimization Toolbox

Paralelné výpočty – ovládanie a integrácia

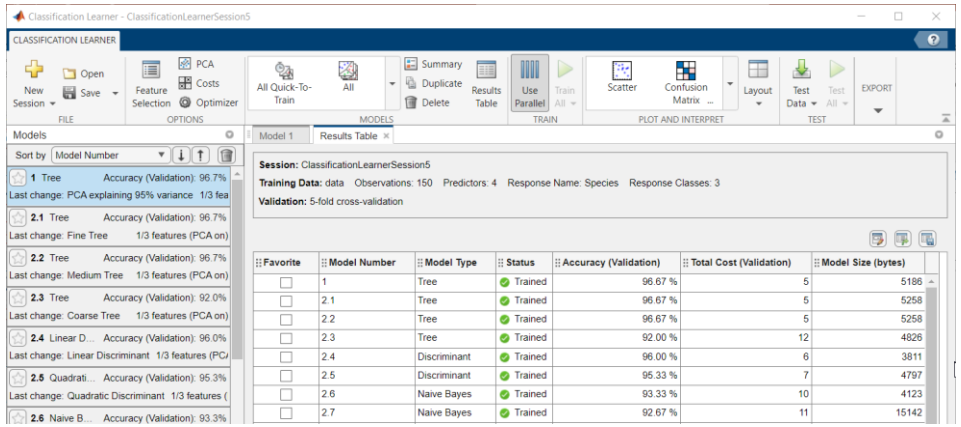
- Ovládanie
  - výber GPU z menu
  - výber medzi procesmi a vláknami
- Ďalšie funkcie s podporou
  - distribuovaných polí (viac ako 30)
  - gpuArray (viac ako 20)
- Schedulers
  - nájdenie klástra (napr. Slurm)
  - integrácia s Kubernetes
- Podpora architektúr
  - CUDA 11.8 (compute capability up to 9.x)

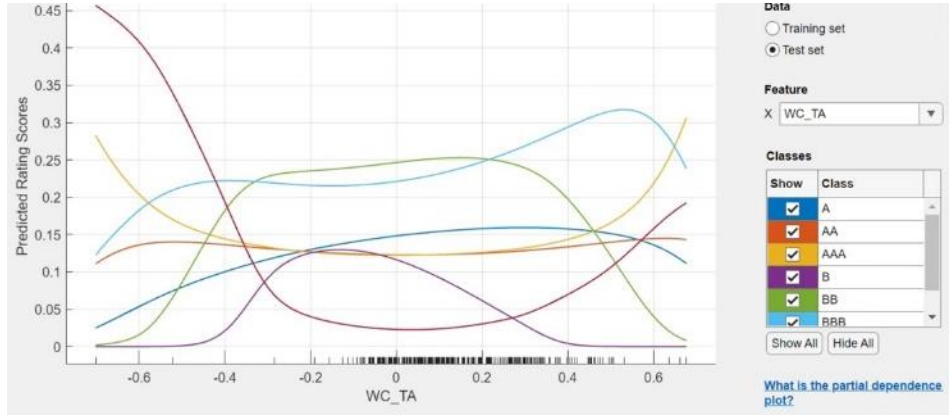


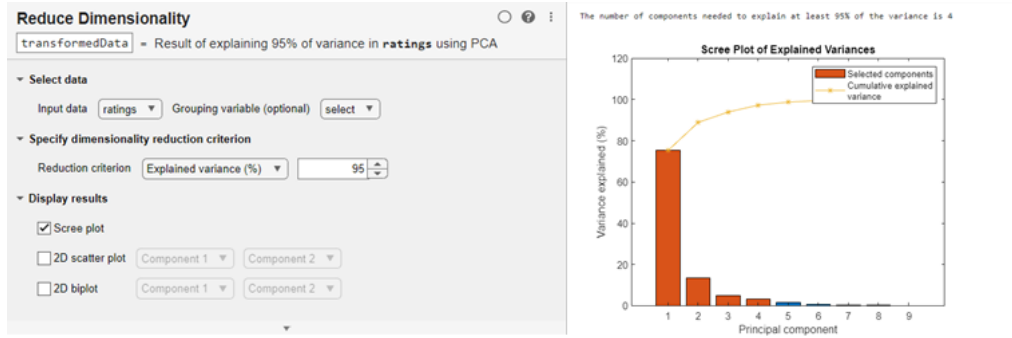


Strojové učenie jednoducho

- Classification/Regression Learner Apps
  - tabuľka výsledkov pre porovnanie
  - zobrazenie veľkosti modelu
  - partial dependency plot
  - export modelov do Experiment Managera
- Nové modely
  - Efficient Logistic Regression
  - Efficient Linear SVM
- Live Editor Tasks
  - Principal Component Analysis (PCA)

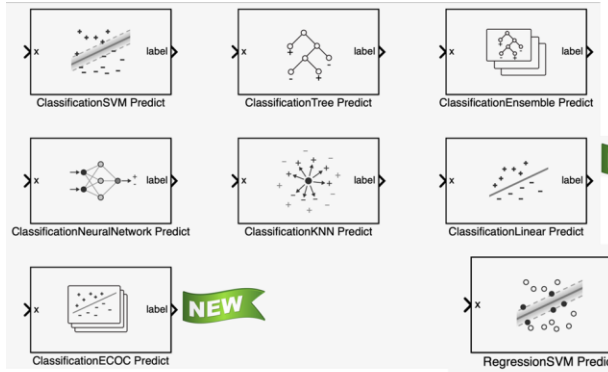


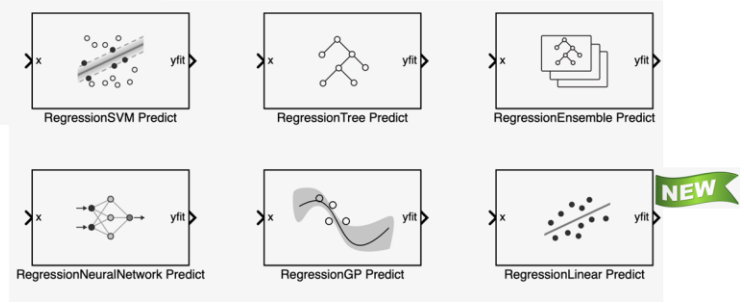


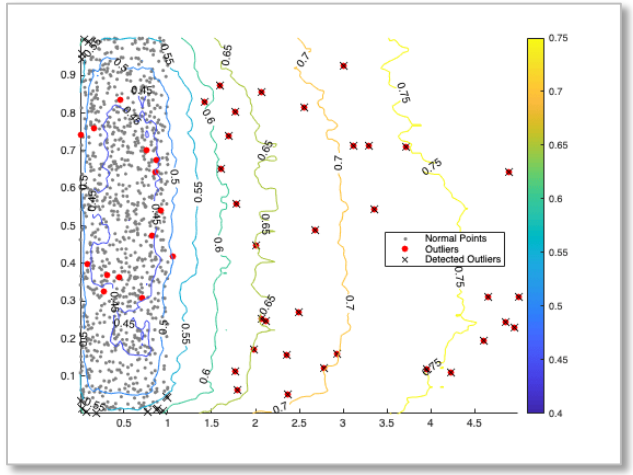


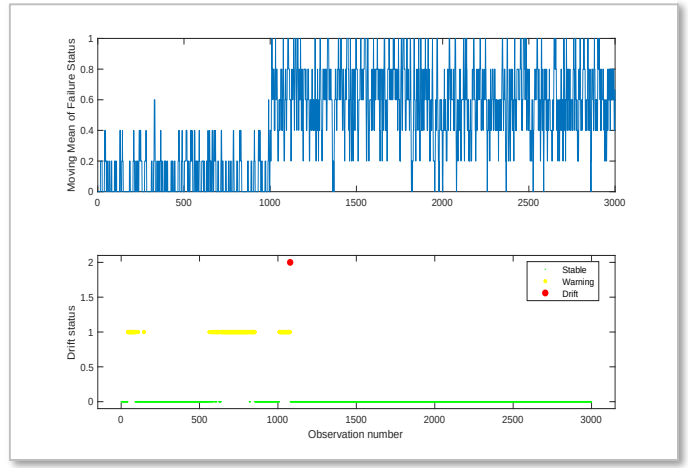
Modelovanie, simulácia a generovanie kódu

- Bloky v Simulinku
  - Classification Linear, Multiclass ECOC
  - Regression Linear, Tree Ensembles
  - SVM, Neural Nets, Gaussian Process
  - Classification KNN
- Generovanie kódu
  - Classification KNN (fixed-point)
- Detekcia anomálií a driftu
  - Robust Random Cut Forest
  - 1-Class SVM, Local Outlier Factor
  - inkrementálna detekcia anomálií a driftu



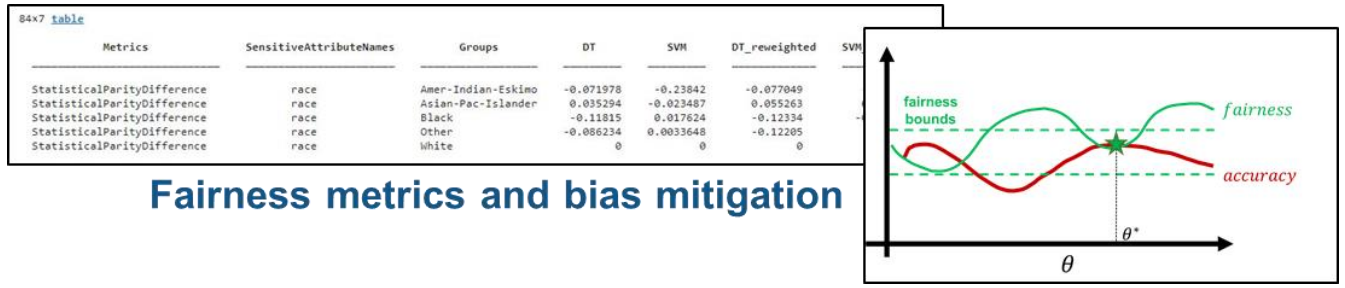




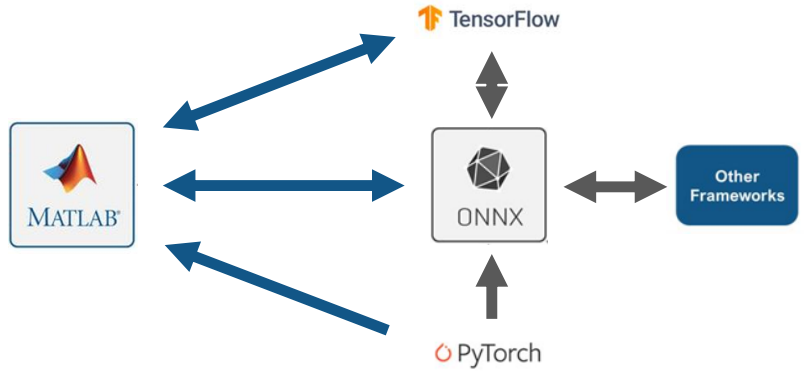


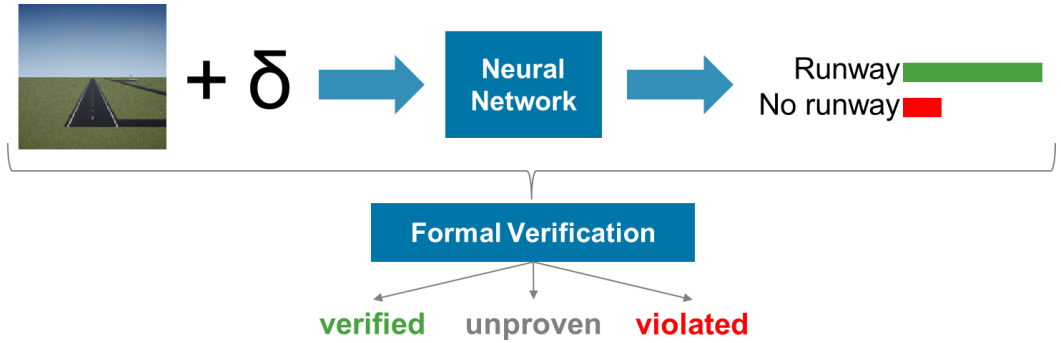
a mnoho ďalších možností

- Interperetovateľnost
  - fairnessThresholder, fairnessMetrics
  - potlačenie zaujatosti a citlivého atribútu
  - GRAD-CAM pre 1-D
- Deep Learning Toolbox Verification Library
- Zjednodušenie
  - LSTM pruning
  - YOLOv3 a YOLOv4 quantizácia
- Interopabilita
  - TFLite 2.8.0, podpora pre Windows



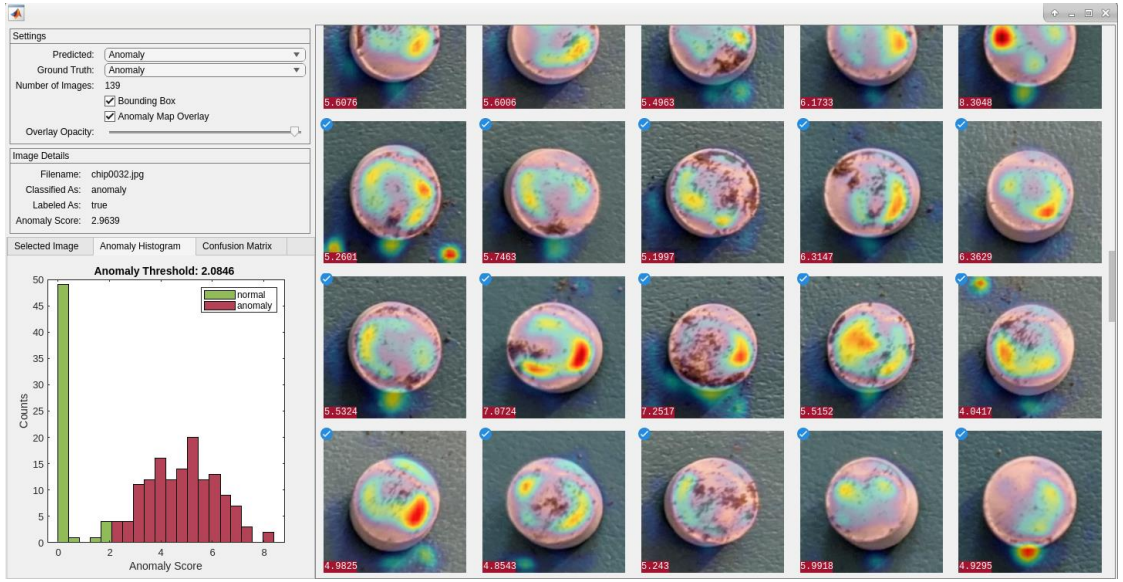
Fairness metrics and bias mitigation





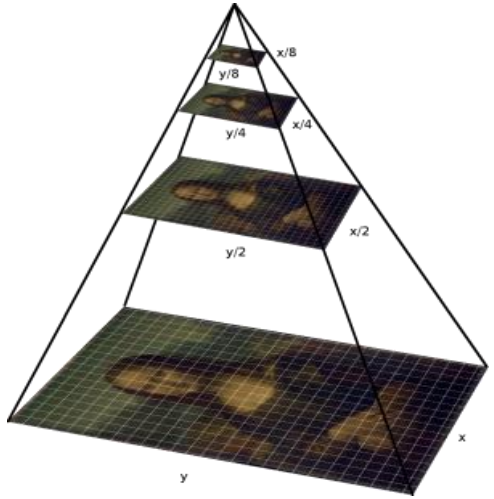
Spracovanie obrazu, počítačové videnie

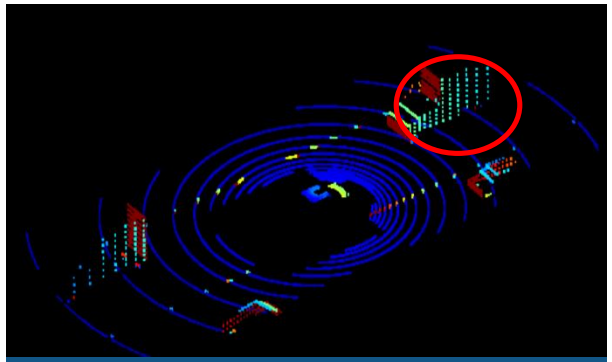
- Získavanie obrazu a videa
  - Image Acquisition Explorer
- Farebný priestor
  - čítanie formátu EXR, ProPhoto priestor
- Detekcia objektov
  - rozpoznanie 64 jazykov, digitálny display
- Automatizácia vizuálnej inšpekcia
  - Computer Vision Toolbox Automated Visual Inspection Support Package
- Generovanie kódu
  - ďalšie funkcie pre MALTAB a GPU Coder

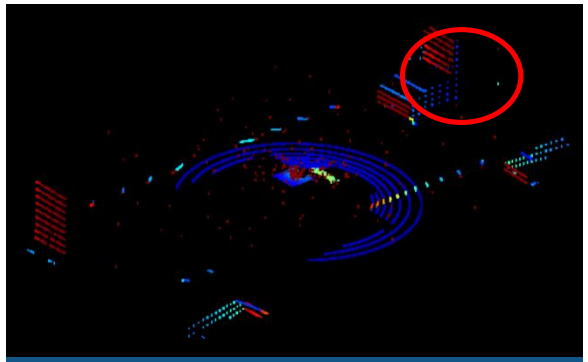


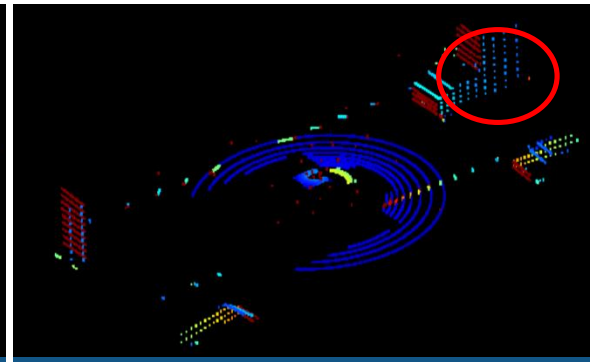
Spracovanie obrazu, počítačové videnie, práca s lidarom

- Hyperspektrálne obrázky
  - AVIRIS dáta, export pásma a masky v APP
- Spracovanie obrázkov po blokoch
  - podpora v aplikáciách, úrovne rozlíšenia
  - makeMultiLevel2D, makeMultiLevel3D
- Lidar Viewer App
  - história zmien, prekrývanie PointCloudov
  - smart voxels, výber planárnych regiónov
- Lidar sensor model
  - Blok v Simulinku, počasie – hmla, dážď

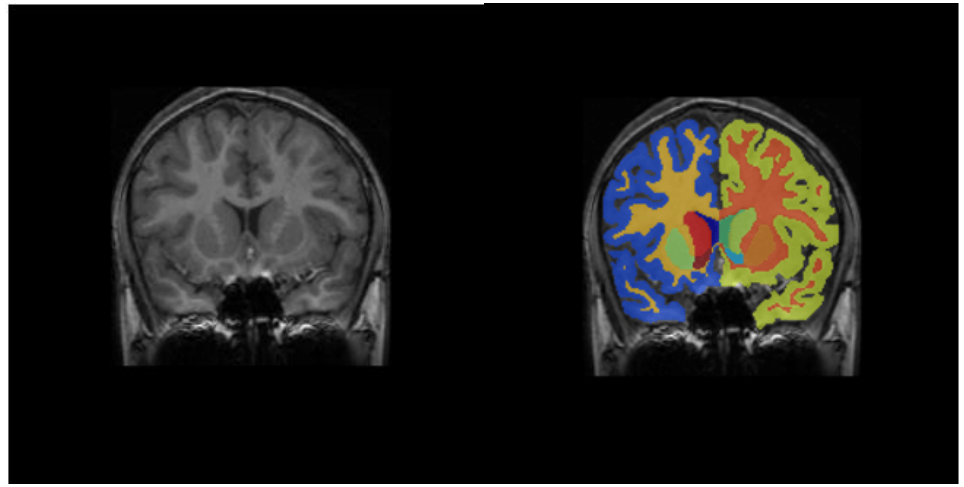



Original Point Cloud

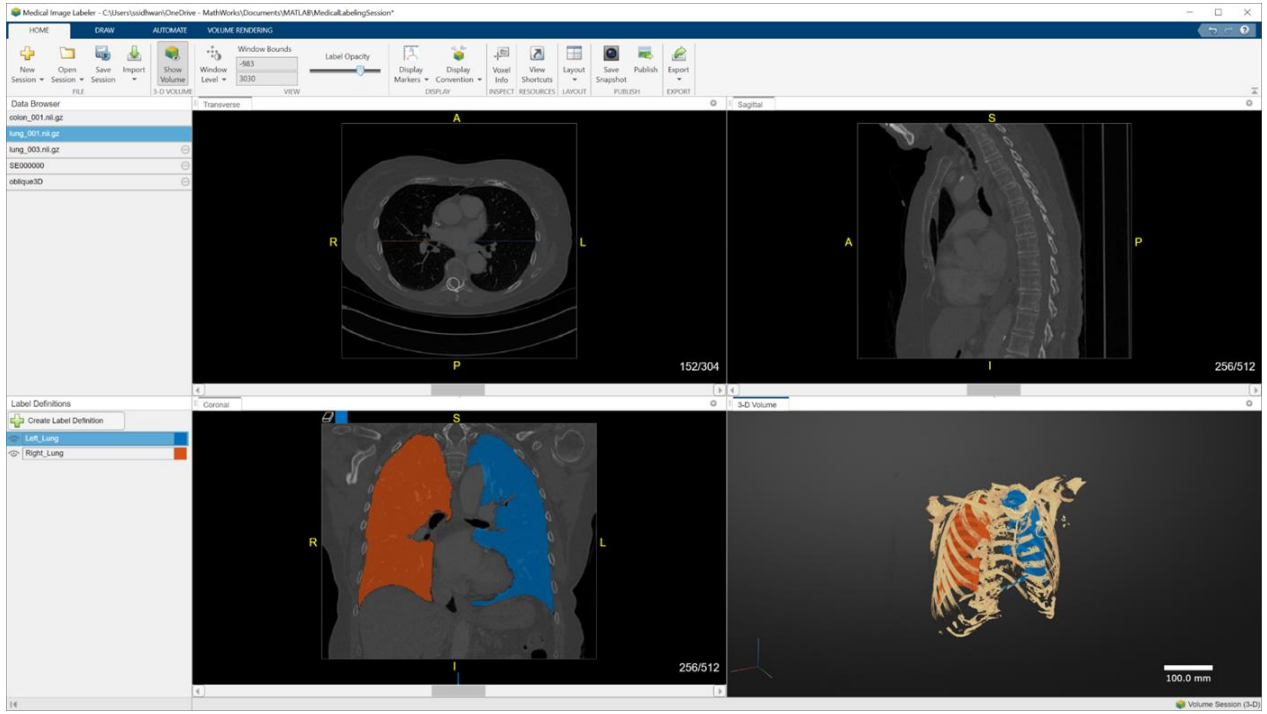

With 100m Fog Visibility


With 3mm/hour Rain

Algoritmy pre medicínske snímky

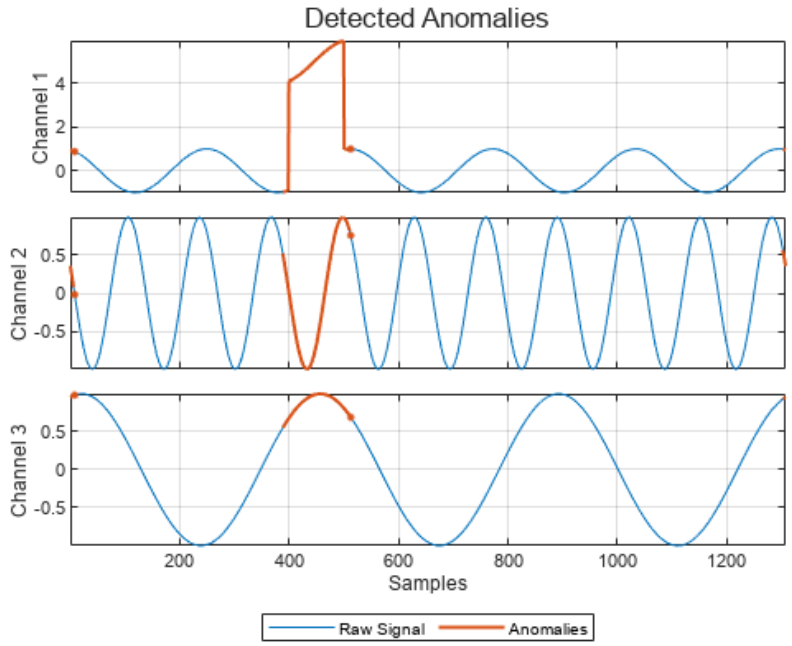


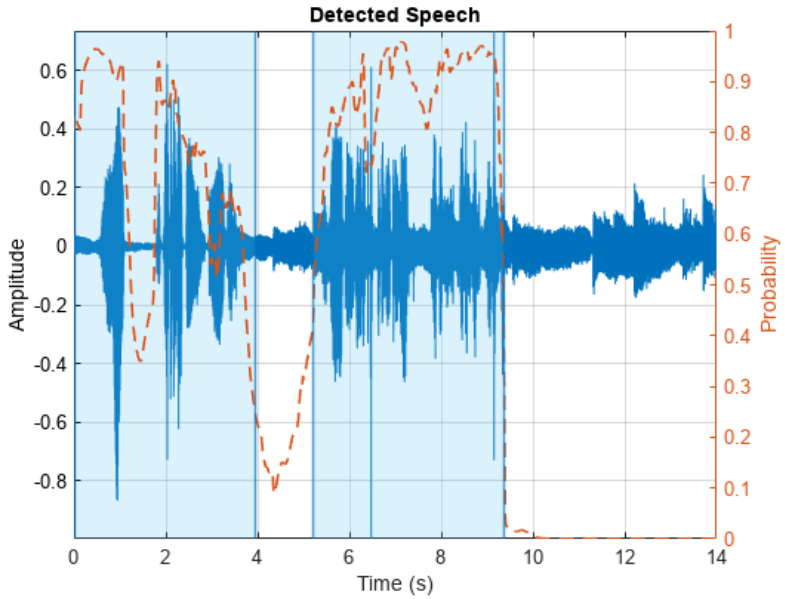
- Načítanie medicínskych snímkov
  - DICOM, NIfTI, NRRD, Analyze 7.5, Interfile
- Vizualizácia 2D obrázkov a 3D plôch
  - interaktívne nástroje, generovanie objemov
- Predspracovanie a registrácia
  - zlepšenie kvality, zarovnanie obrázkov
- Označovanie dát
  - Medical Image Labeler app
- Segmentácia
  - regióny – kosti, tumor, orgány



Spracovanie signálov a audia

- Spracovanie signálov
  - Detekcia anomalít s DL autoenkodérmi
  - hľadanie a popis vrcholov v aplikácií
  - zarovnanie signálov – peak, rising edge
  - bloky Wavelet Scattering, laditeľné IIR filtre
- Spracovanie audia
  - detekcia reči predtrénovanou sieťou
  - speech2text pomocou wav2vec 2.0 modelu
- Wavelety
  - Wavelet Signal Analyze App
  - podpora AI – vrstvy a príklady

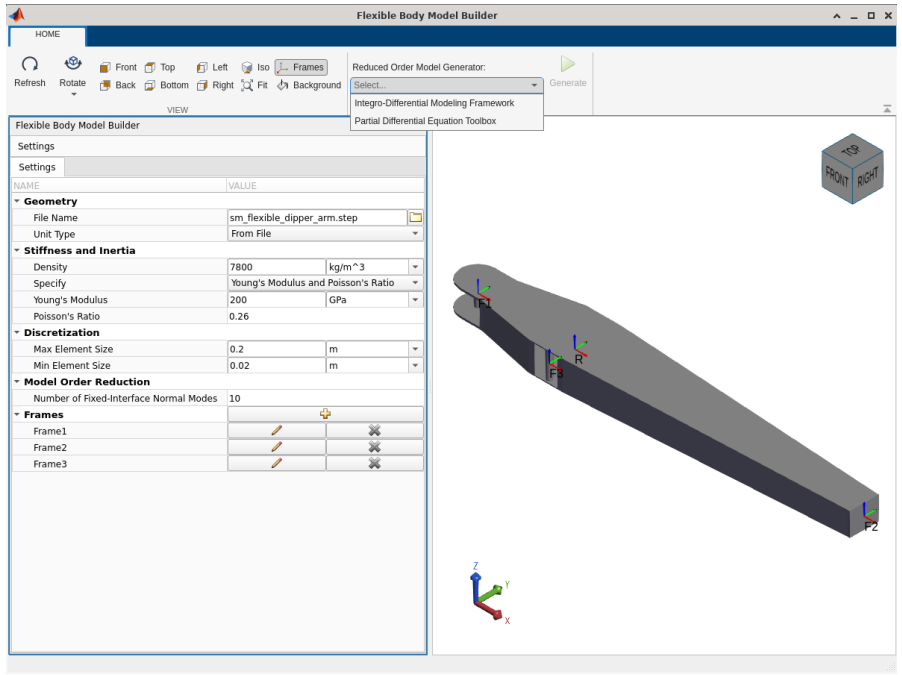


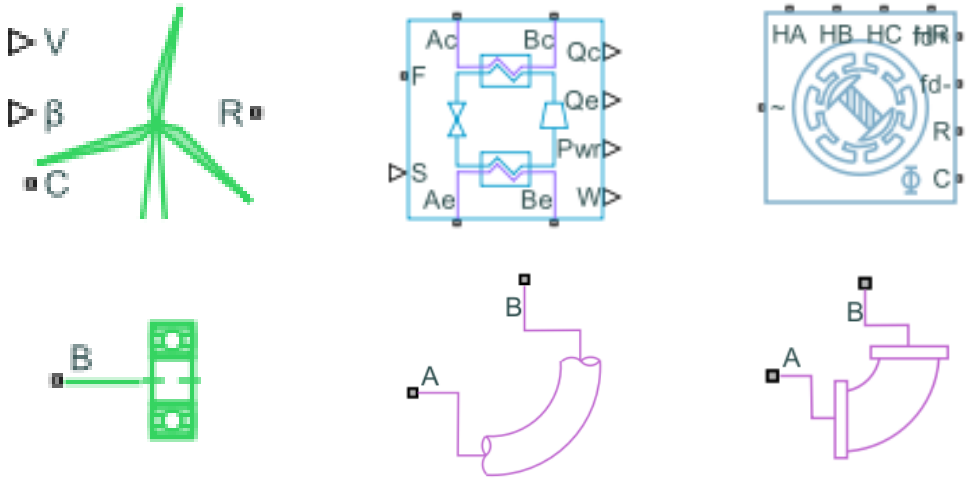


Signal Processing Toolbox
Wavelet Toolbox

Fyzikálne modelovanie

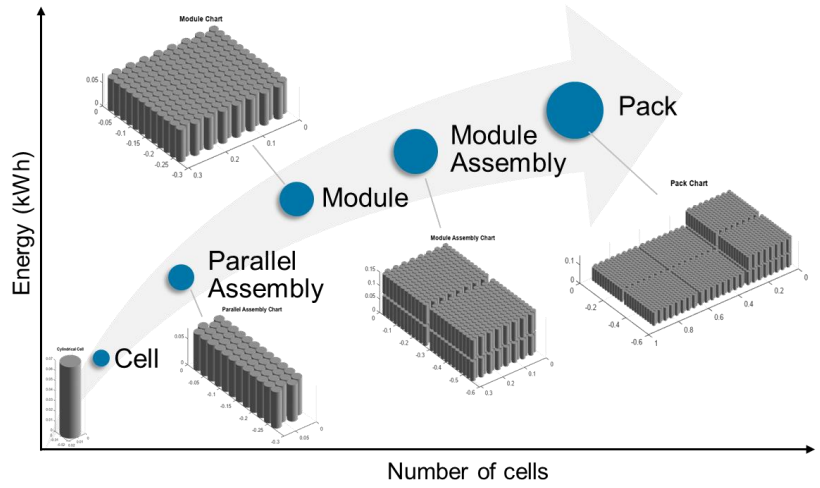
- Simscape Multibody
  - Flexible Body Model Builder app
  - ROM dáta pre pružné telesá
- Simscape Driveline
  - bloky ložisko, propelery
  - turbína s nastaviteľným sklonom lopatiek
- Simscape Fluids
  - chladiaci cyklus, ohyby rúr a kolená
- Simscape Electrical
  - indukčné a synchrónne stroje s FEM

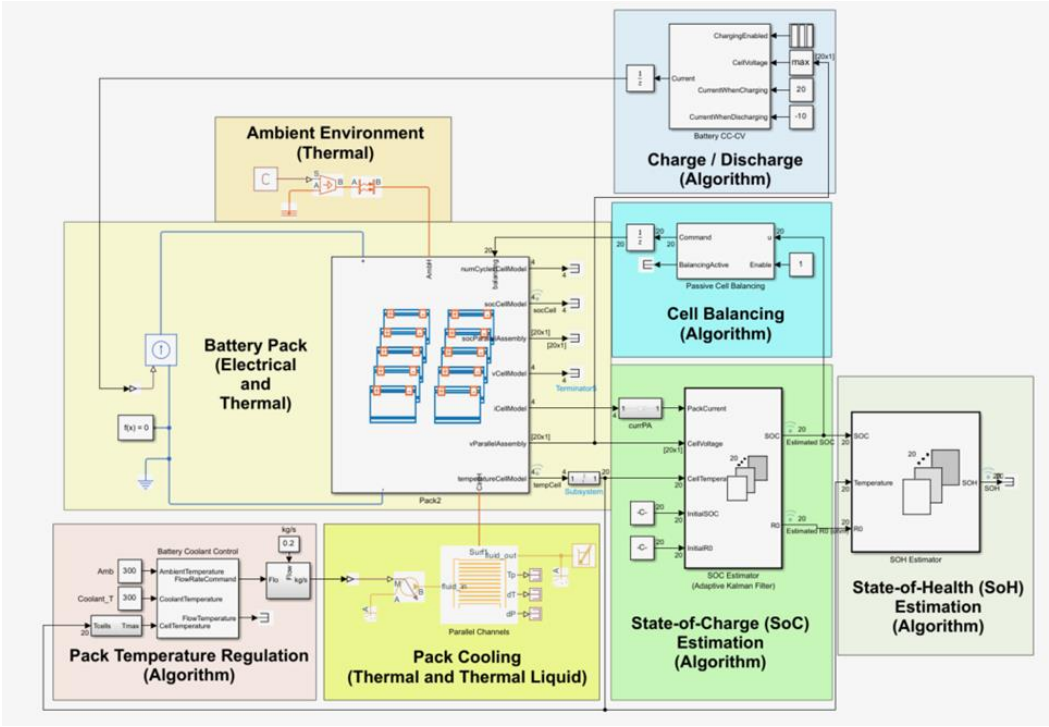




Modelovanie systémov s batériami

- Tvorba geometrie a topológií
  - bunky, moduly, bloky, export do Simulinku
  - Battery Builder App
- Teplotný manažment
  - stratégie chladenia podľa rozlíšenia modelu
- Systém správy batérií (BMS)
  - cell balancing, state-of-charge (SOC)
  - state-of-health (SOH) estimation
  - charge/discharge
- Nasadenie a testovanie

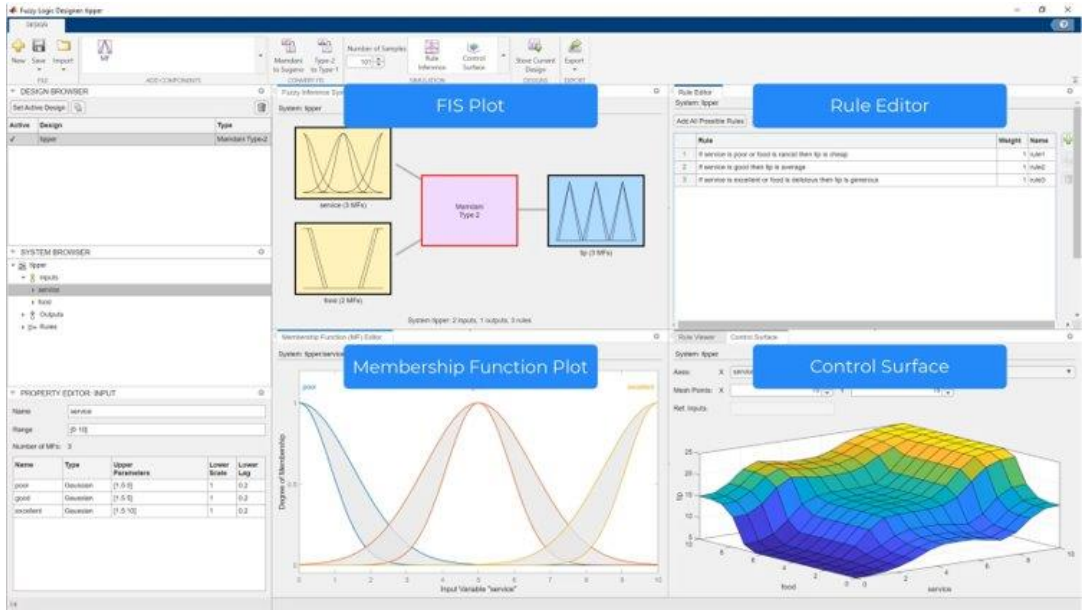


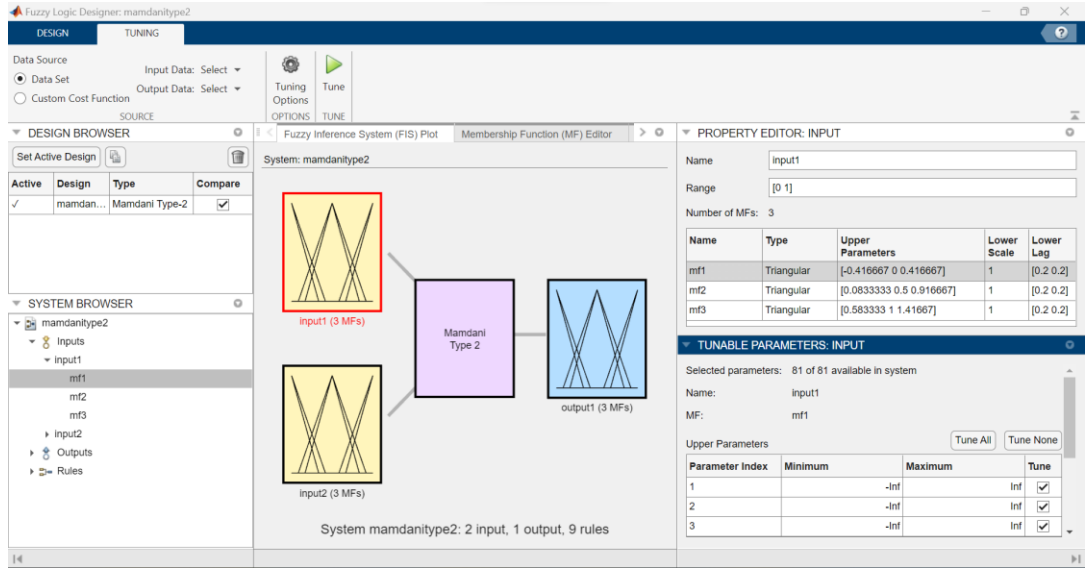


Tvorba fuzzy logiky

- Podpora type-2 fuzzy systémov
  - intervalové type-2 fuzzy inferenčné systémy
  - lepšie znášajú neurčitosti

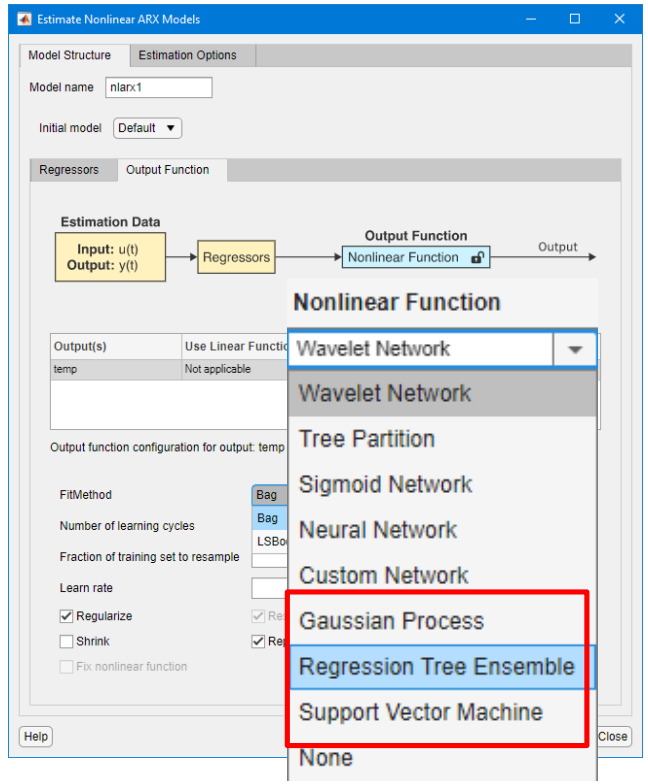
- Fuzzy Logic Designer app
  - prepracovné rozhranie
  - grafický návrh
  - návrh, analýza a simulácia inferenčného systému
  - podpora type-2 fuzzy
  - interaktívne ladenie inferenčného systému

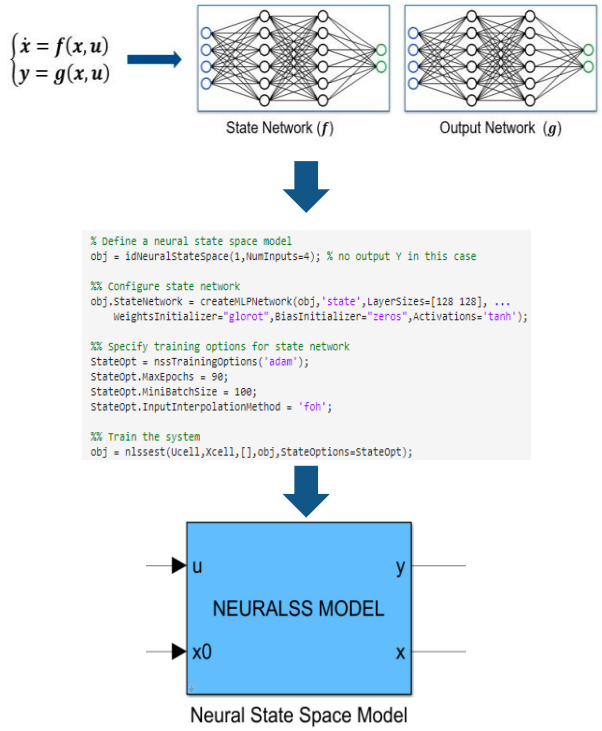




Identifikácia systémov s využitím AI

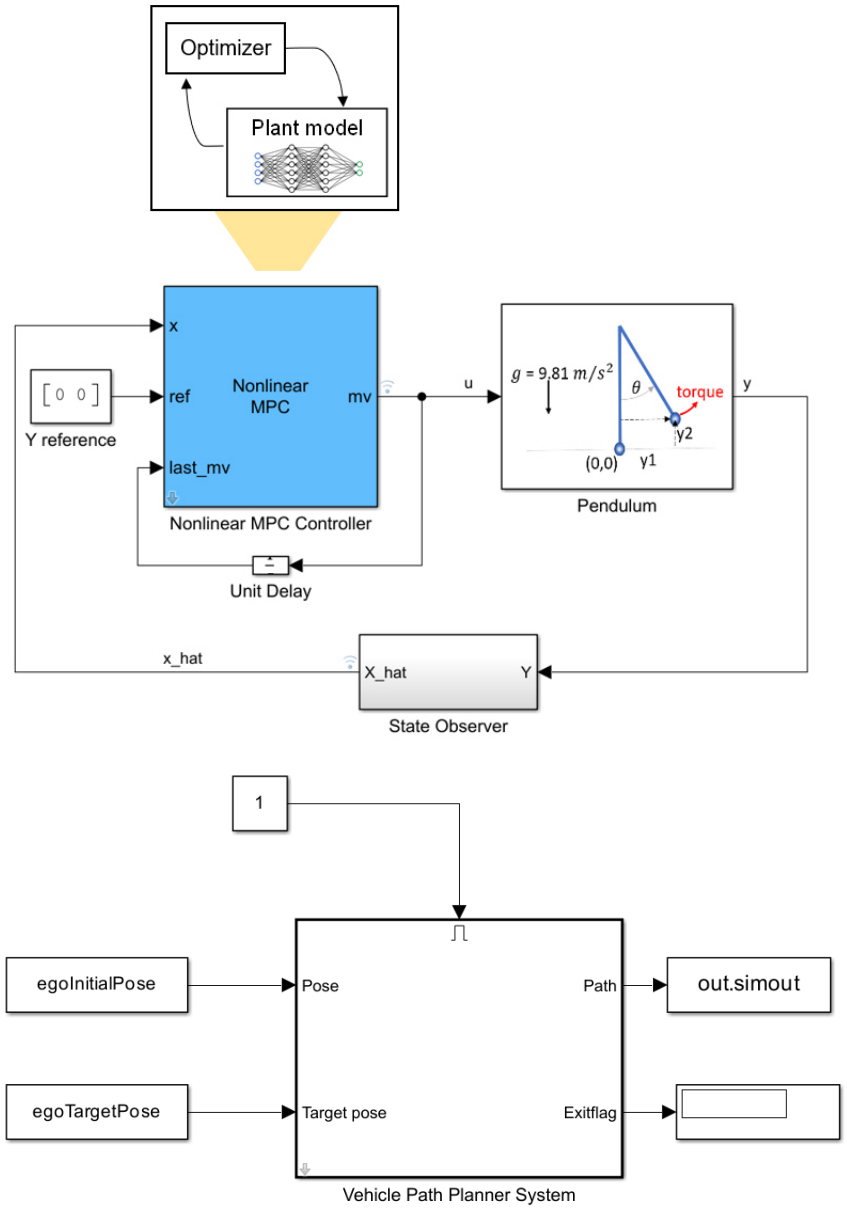
- Nelineárne ARX a Hammerstein-Wiener modely
  - nelinearity modelované strojový učením
- Neurónové stavové modely
  - stavový opis pomocou deep learningu
- Reduced Order Modeling (ROM)
- Dátové formáty
  - časové tabuľky a numerické matice





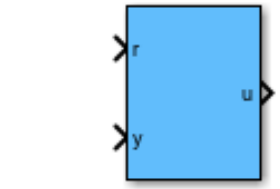
Prediktívne riadenie

- Neurónové siete v modeloch
  - predikčný model v nelineárnych MPC
  - AI reprezentuje systém
- Vehicle Path Planner blok
  - plánovanie pohybu vozidla pomocou MPC
- Automatická diferenciácia
  - generovanie analytických Jakobiánov
- Podpora štandardov
  - MISRA C 2012
  - ISO 26262

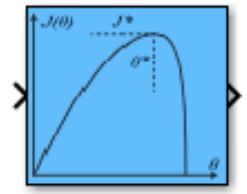


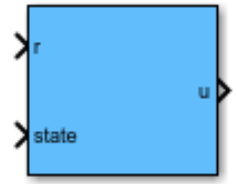
Pokročilé algoritmy riadenia

- Reprezentácia systému v MATLABe
  - linear parameter-varying, linear time-varying
- Stratégie riadenia
  - Model Reference Adaptive Control (s NN)
  - Active Disturbance Rejection Control
  - Extremum Seeking Control
  - Frequency Response Estimator blok
  - s podporou generovania kódu
- Reinforcement Learning
  - trénovanie offline z dát, blok Policy
  - Reinforcement Learning Data Viewer

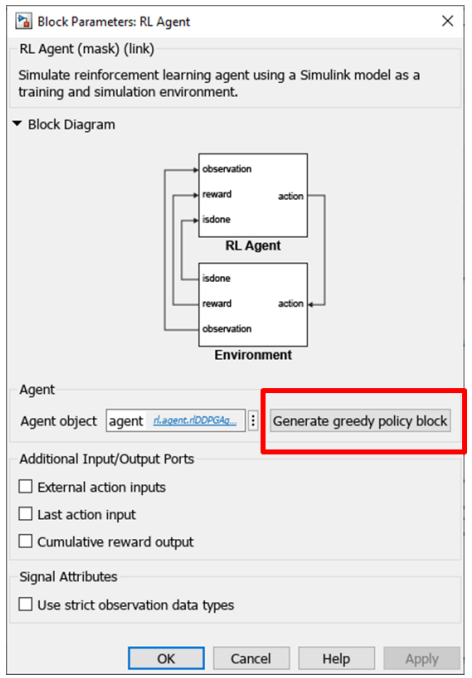


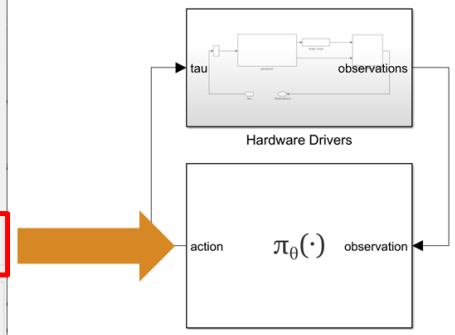
Active Disturbance Rejection Control


Extremum Seeking Control



Model Reference Adaptive Control

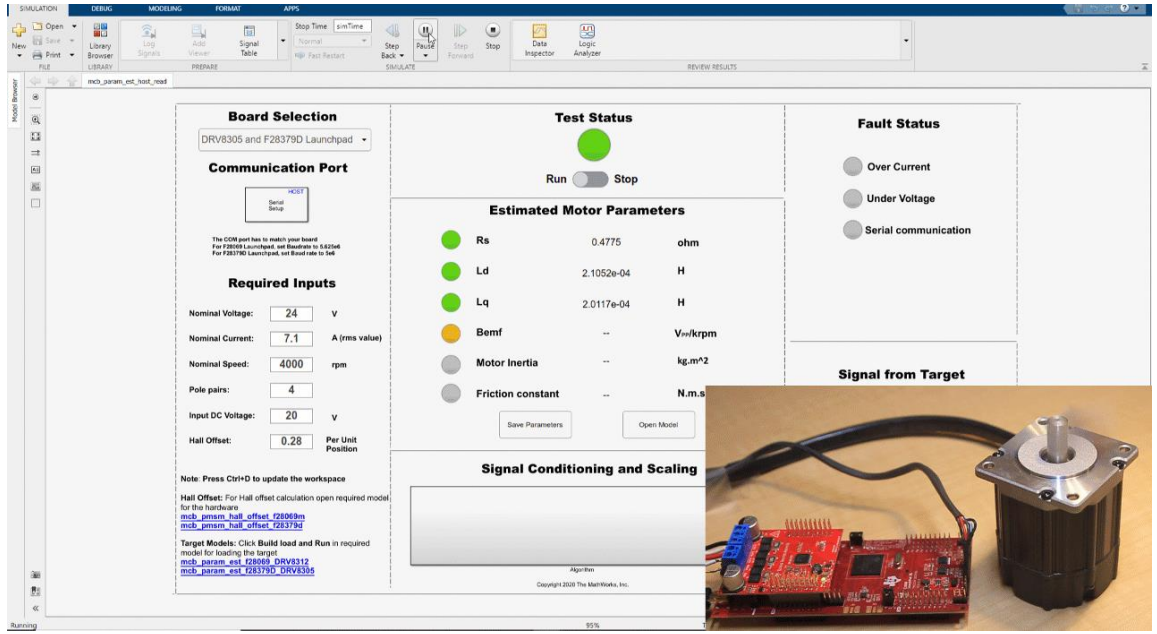




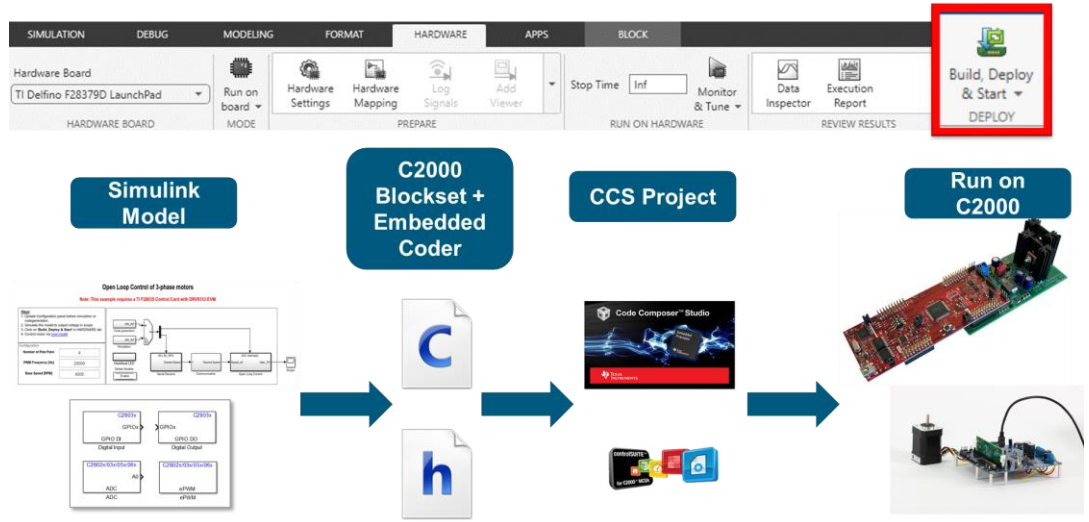
Simulink Control Design
Reinforcement Learning Toolbox

Návrh a implementácia algoritmov riadenia motorov

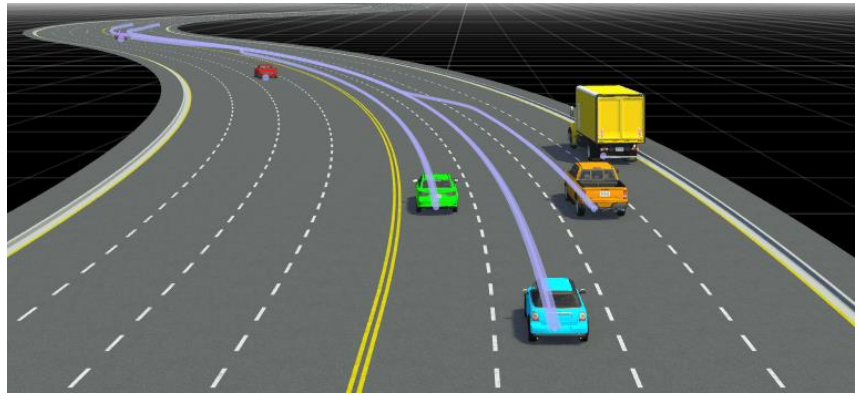
- Motor Control Blockset
  - odhad parametrov motorov
  - bloky pozorovateľov stavu
  - referenčné príklady
  - generovanie HDL kódu



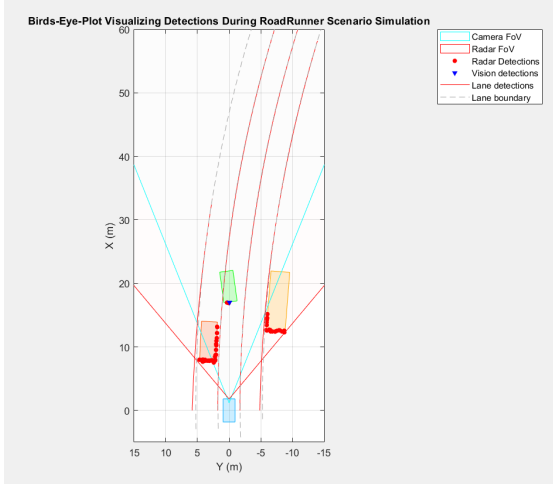
- C2000 Microcontroller Blockset
  - väčšina TI C2000 zariadení
  - bloky periférií, multiCore architektúry
  - connected I/O, ladenie a monitorovanie
  - referenčné príklady

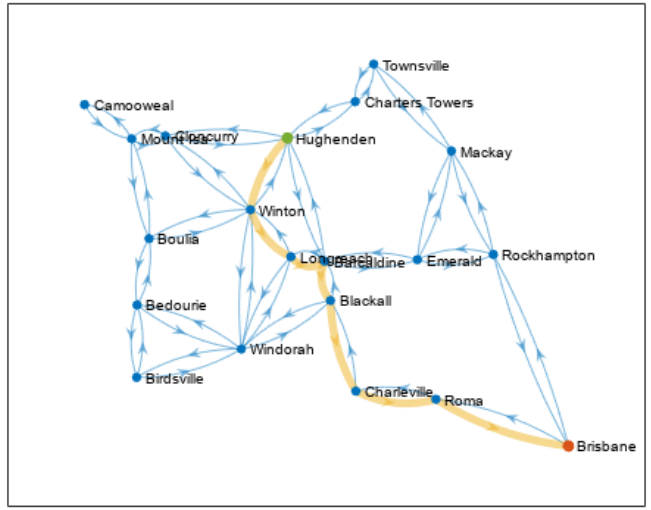


Autonómne systémy a navigácia



- Autonómne riadenie
  - RoadRunner Scenario simulácia so snímačmi
  - mono kamera – YOLO v3 detektor
- Navigácia
  - kontrola kolízií – objekt a mapa
  - Factor Graph pre SLAM
  - A* pre cestné siete
- Senzorická fúzia a sledovanie
  - JIPDA smoother – vyhladzovanie odhadov
  - trackingFilterTuner – automatické ladenie filtrov

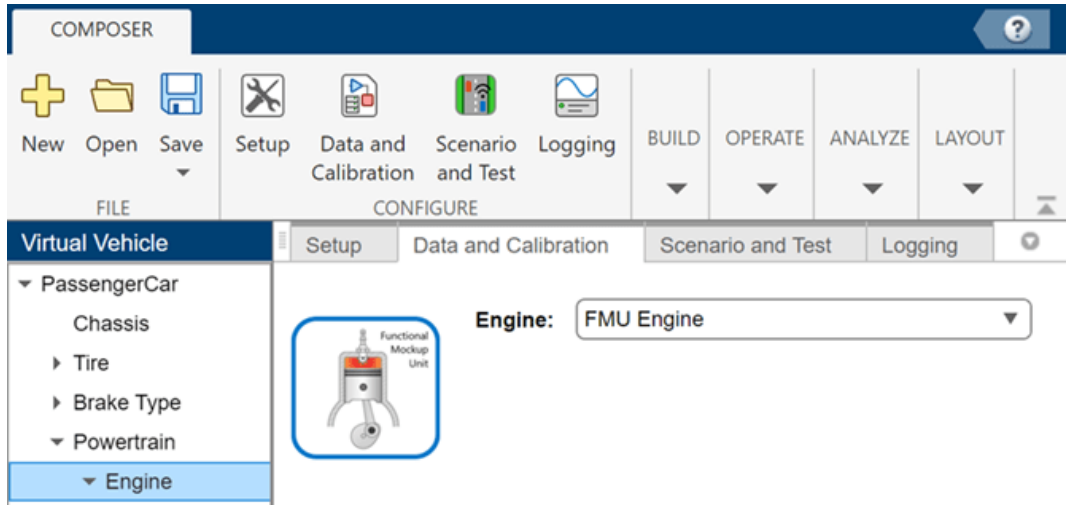


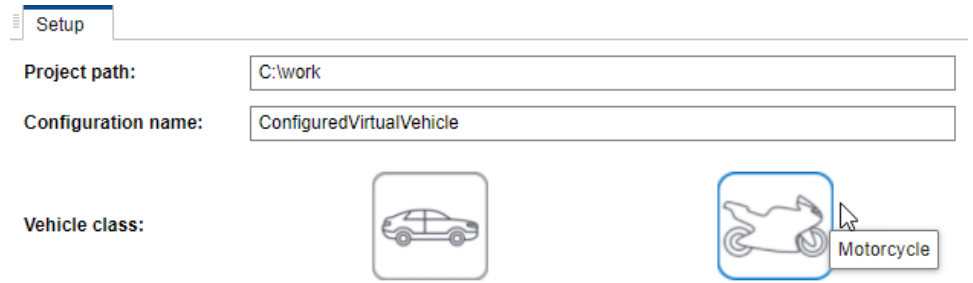


Automated Driving Toolbox, Navigation Toolbox
Sensor Fusion and Tracking Toolbox

Modelovanie automobilových systémov

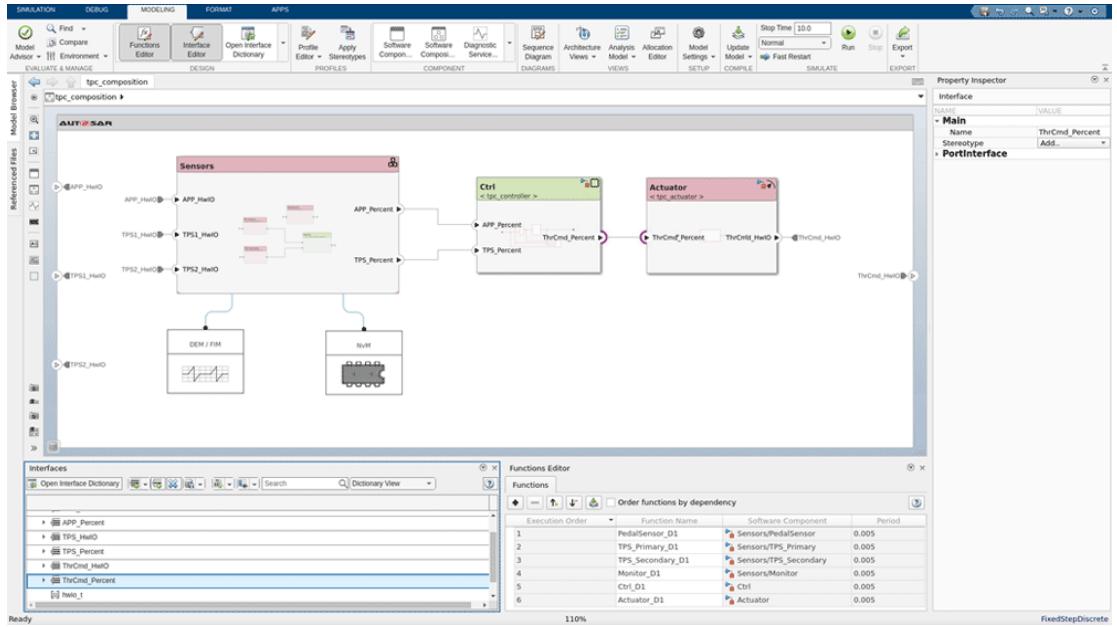
- Pohony
  - architektúra EV 2, 3, a 4
  - integrácia FMU pohonov
  - kalibrácia blokov z datasetov (CI, SI, Electric)
  - model pohonu pomocou deep learningu
- Dynamika vozidla
  - konfigurácia a analýza motocyklov
  - modelovanie pneumatík – Dugoff, Magic Formula
- 3D modelovanie
  - Formula student vehicle, One-axle trailer





Powertrain Blockset
Vehicle Dynamics Blockset

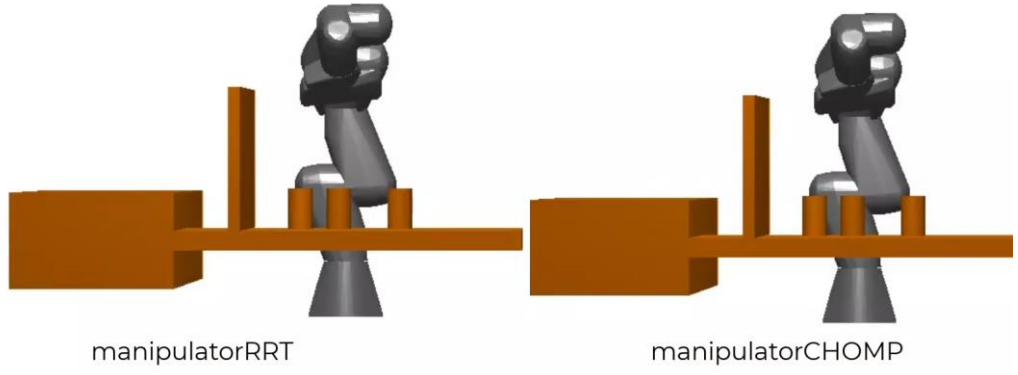
Návrh a simulácia AUTOSAR softvéru

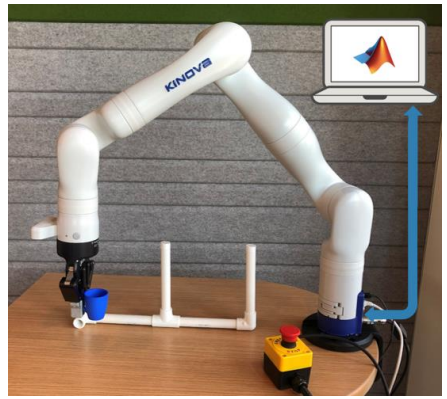


- Modelovanie architektúry
  - System Composer
  - Adaptive AUTOSAR, šablóna
  - Interface dictionary, Interface Editor
  - profily a stereotypy
- Asynchrónne neblokované správanie
  - Adaptive AUTOSAR, client-server komunikácia
  - Modelovanie a generovanie kódu pre ara::com::method
- Tvorba spustiteľného kódu
  - Embedded Coder Support Package for Linux Applications
  - Testovanie pomocou Linux Runtime Manager

Robotické aplikácie

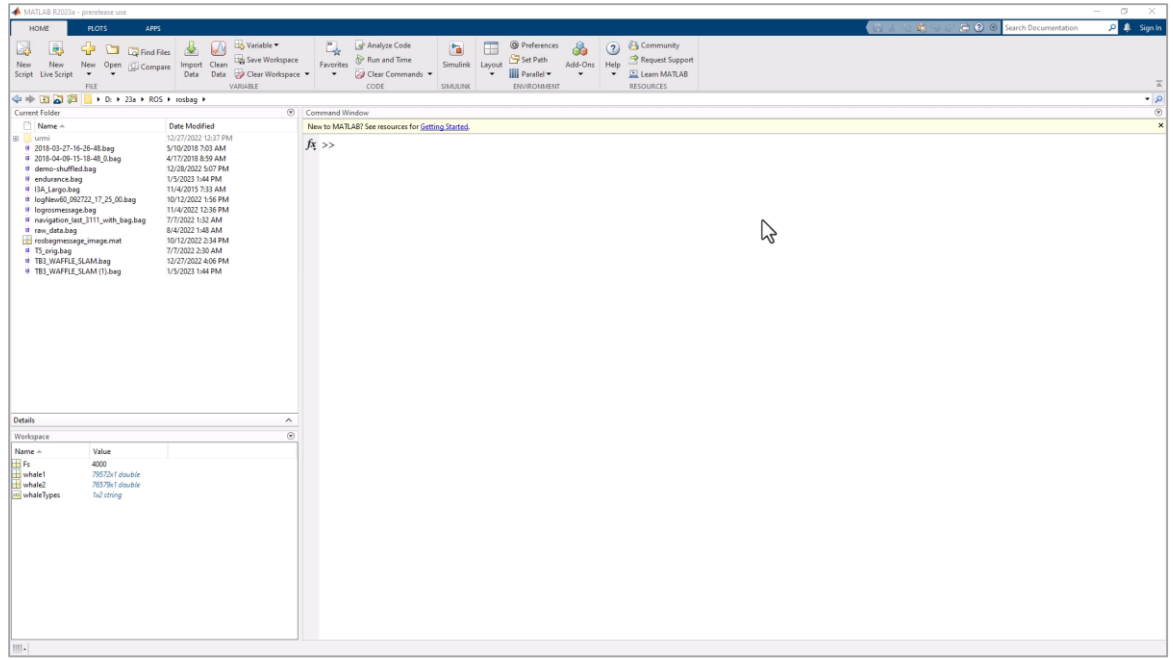
- Modely
  - manipulátor a gripper, xacro súborov
- Plánovanie trajektórií
  - manipulatorRRT s occupancyMap3D
  - manipulatorCHOMP, Time Optimal Trajectory
  - Piecewise-Polynomial Trajectory
- Referenčné príklady
  - ROS, Gazebo, spracovanie obrazu, riadenie
- Spolupráca s hardvérom
  - Robotics System Toolbox Support Package for KINOVA Gen3 Manipulators
  - Robotics System Toolbox Support Package for Universal Robots UR Series Manipulators

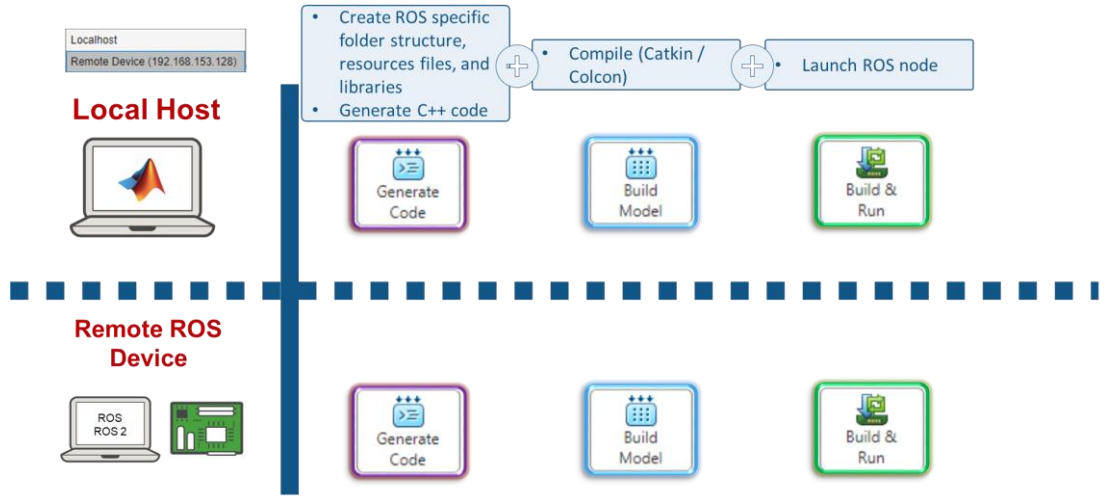




Prepojenie MATLABu a Simulinku s ROS

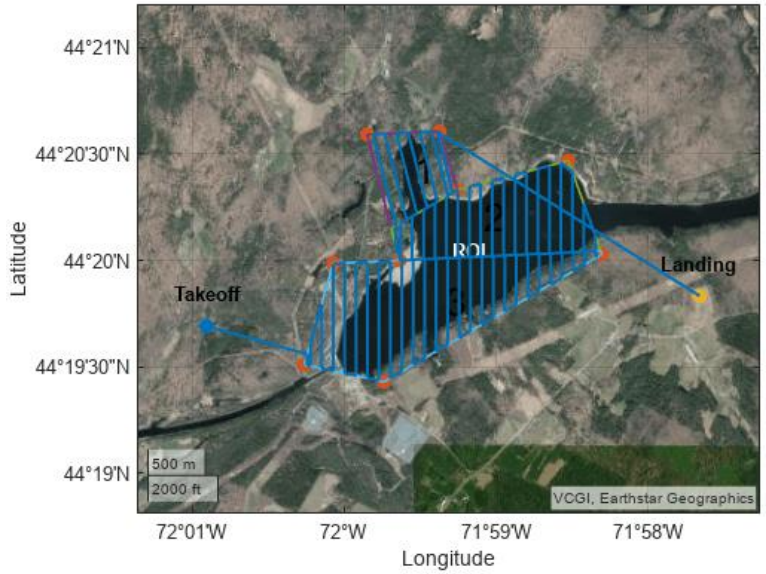
- Verzie (LTS)
  - ROS Noetic, ROS2 Foxy
- Prehrávanie a logovanie dát
  - Rosbag Viewer App, ROS Logger app
- Generovanie kódu vrátane prekladu
  - CUDA optimalizované ROS nody
  - ros_control s ladením parametrov
  - oddelené nody – model reference
- Vylepšené prepojenie
  - rosdevice objekt pre spojenie a ladenie
  - podpora 64bit integerov



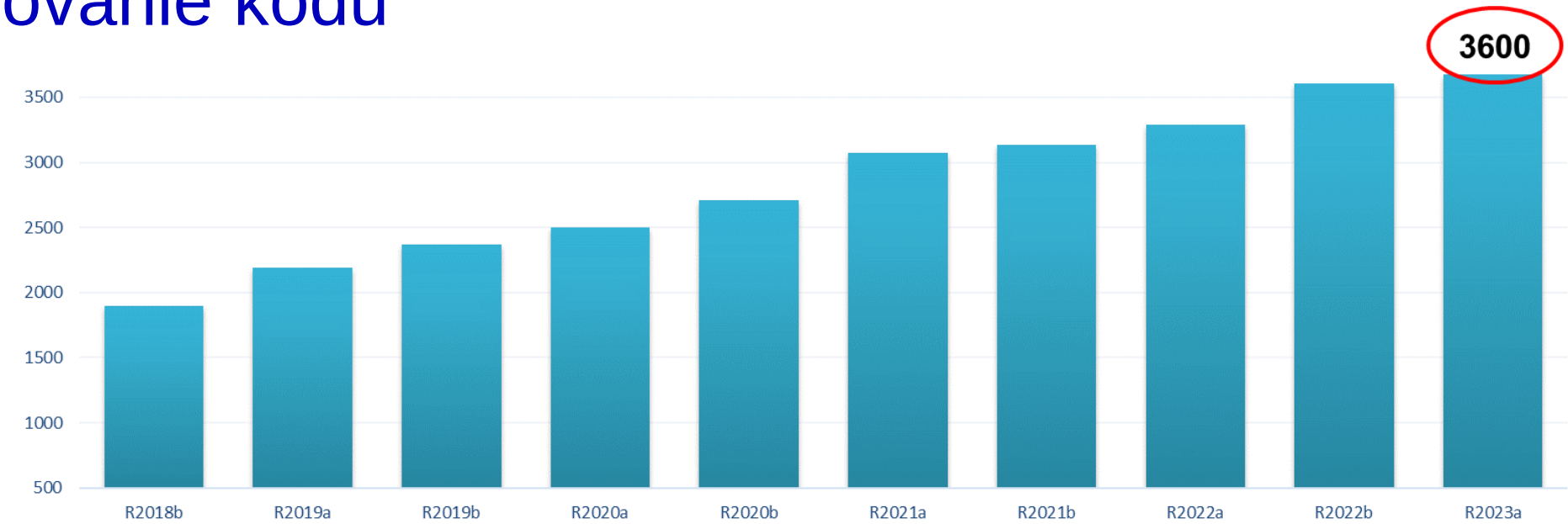


Modelovanie leteckých aplikácií

- Simulácia rotorových aplikácií
  - bloky Rotor a Multirotor
- Simulácia v 3D prostredí
  - helikoptéry, quadcoptéry
  - streamovanie máp pomocou Cesiumion
- UAV aplikácie
  - uavMision objekt
  - plánovanie pokrytia
  - 3D Vector Field Histogram
- Podpora hardvéru
  - PX4 Cube Orange



Generovanie kódu



- 5G Toolbox
- Aerospace Toolbox
- Antenna Toolbox
- Audio System Toolbox
- Automated Driving Toolbox
- Bluetooth Toolbox
- Communications Toolbox
- Computer Vision Toolbox
- Control System Toolbox
- Deep Learning Toolbox
- DSP System Toolbox
- Fixed-Point Designer
- Fuzzy Logic Toolbox
- Image Acquisition Toolbox
- Image Processing Toolbox
- Industrial Communication Toolbox
- Instrumental Control Toolbox
- Lidar Toolbox
- Mapping Toolbox
- Mixed-Signal Blockset
- Model Predictive Control Toolbox
- Navigation Toolbox
- Optimization Toolbox
- Phased Array System Toolbox
- Predictive Maintenance Toolbox
- Radar Toolbox
- Reinforcement Learning Toolbox
- Robotics System Toolbox
- ROS Toolbox
- Satellite Communications Toolbox
- Sensor Fusion and Tracking Toolbox
- SerDes Toolbox
- Signal Processing Toolbox
- Stats & Machine Learning Toolbox
- System Identification Toolbox
- UAV Toolbox
- Vision HDL Toolbox
- Wavelet Toolbox
- WLAN System Toolbox

Generovanie kódu

- C/C++
  - podpora jazyka (strcat, cellstr, sort, unique)
  - validácia argumentov (bloky funkcií)
  - coder.read, coder.write (.coderdata)
  - zlepšené logické indexovanie
  - požiadavky ako komentáre v kóde
- Deep Learning a GPU
  - analyzeNetworkForCodegen
  - GPU Performance Analyzer
  - bfloat16 format
  - ďalšie vrstvy a zrýchlenie DL pri C/C++

```
function out = useDefaults_2(a,b,c)
arguments
    a (1,1) double
    b (1,1) double = 5
    c (1,1) double = 7
end
out = a + b + c;
end
```

codegen command:

```
codegen -config:lib -c useDefaults_2 -args 0 -report
```

Generated code:

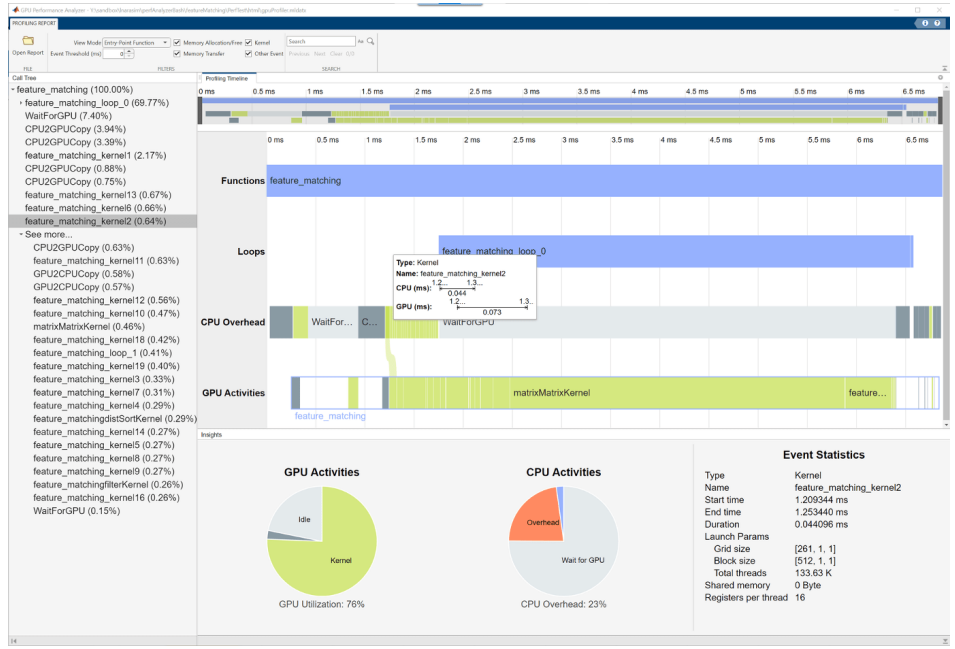
```
double useDefaults_2(double a)
{
  return (a + 5.0) + 7.0;
}
```

codegen command:

```
codegen -config:lib -c useDefaults_2 -args {0,0} -report
```

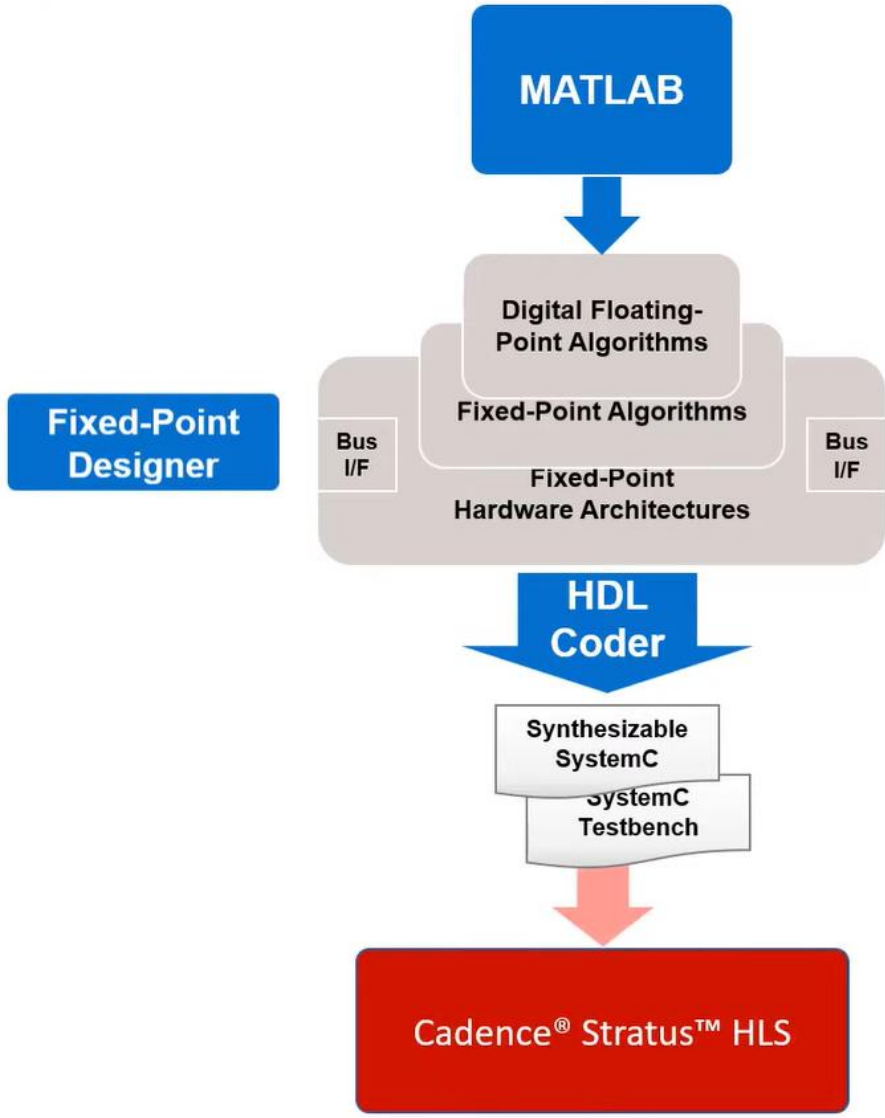
Generated code:

```
double useDefaults_2(double a, double b)
{
  return (a + b) + 7.0;
}
```



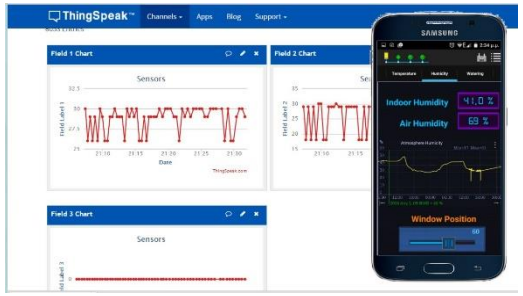
Generovanie a verifikácia HDL kódu

- Vylepšenie optimalizácií
  - rýchlosti, plochy, I/O, multirate
- Generovanie kódu
  - 2D, 3D matice, frame-based modely
- Spolupráca s Cadence Stratus HLS
  - generovanie SystemC z MATLABu
- Podpora prostredí
  - Xilinx Vivado, Intel Quartus, a ďalšie
- FPGA-in-the-loop
  - Ethernet pre Zynq, optimalizácie prenosu



https://www.mathworks.com/products/new_products/latest_features.html

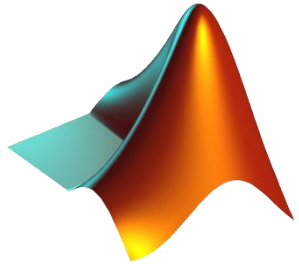
Online služby

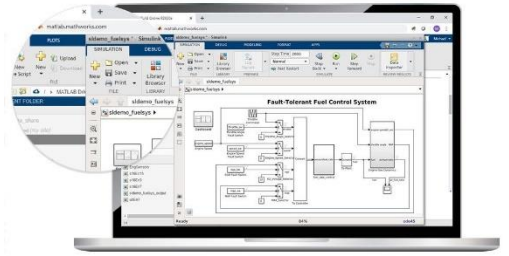


ThingSpeak

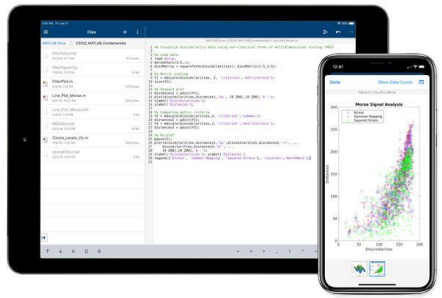
MATLAB Online

MATLAB Grader

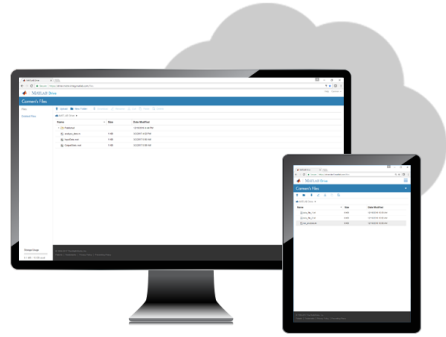




Simulink Online

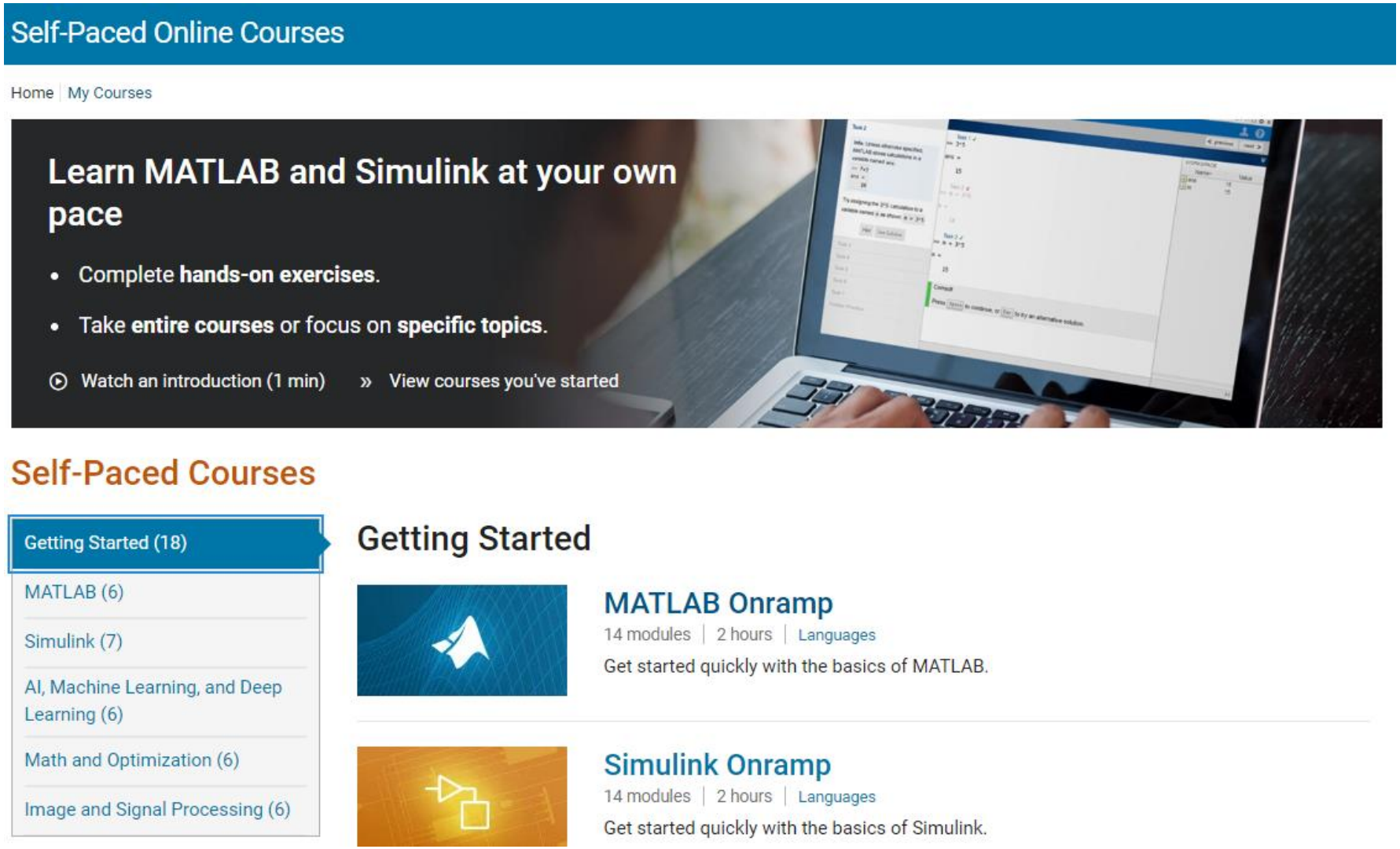


MATLAB Mobile



MATLAB Drive

MATLAB a Simulink vlastným tempom



https://matlabacademy.mathworks.com