

MATLAB EXPO

**What's New for Managing, Testing,
and Building your MATLAB Code**



Workshop Agenda

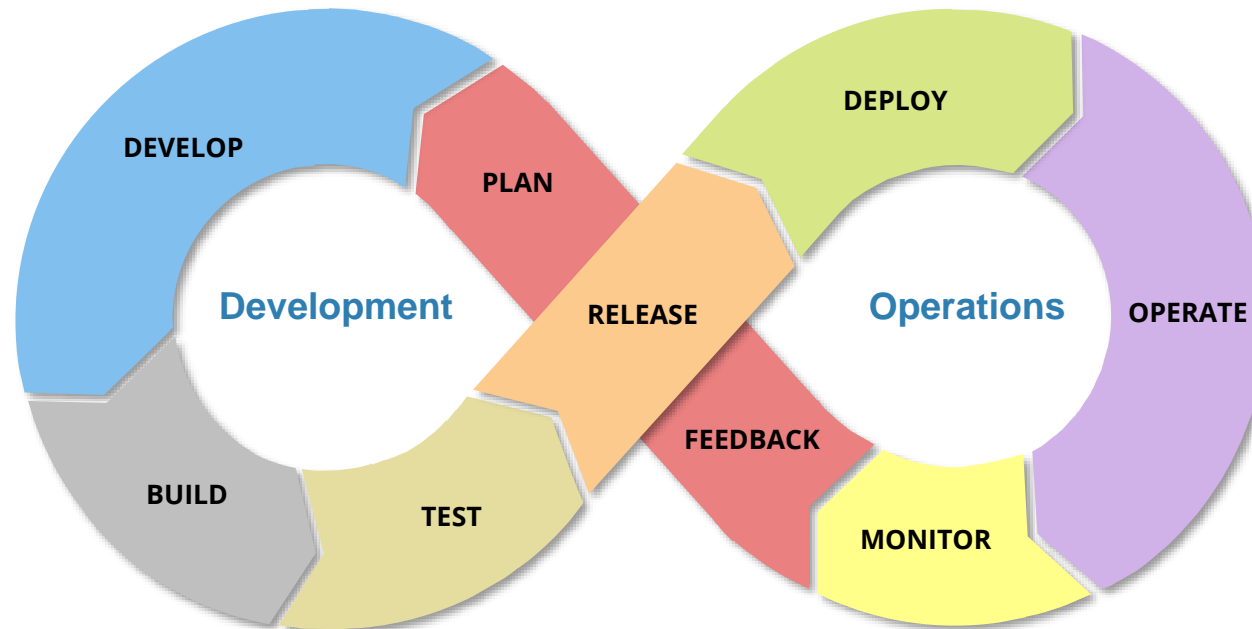
- High-level presentation of features (15-20 minutes)
 - Too many features for a hands-on workshop
 - Great introduction to some of the most important features to know about
- Hands-on workshop (60 minutes)
 - Walk through many of the features discussed in the presentation
- Q&A (10 minutes)
 - We'll set aside some time at the end to try and answer some questions
 - Please feel free to chat any questions, feedback, or feature requests you have
 - We'll also try to answer as many as we can in the chat as we go

"All companies are software companies" – Satya Nadella

- Software systems are becoming more complex, and involving more people
- The need for better software development practices is growing everywhere
- Automation systems are speeding up and standardizing the way we work

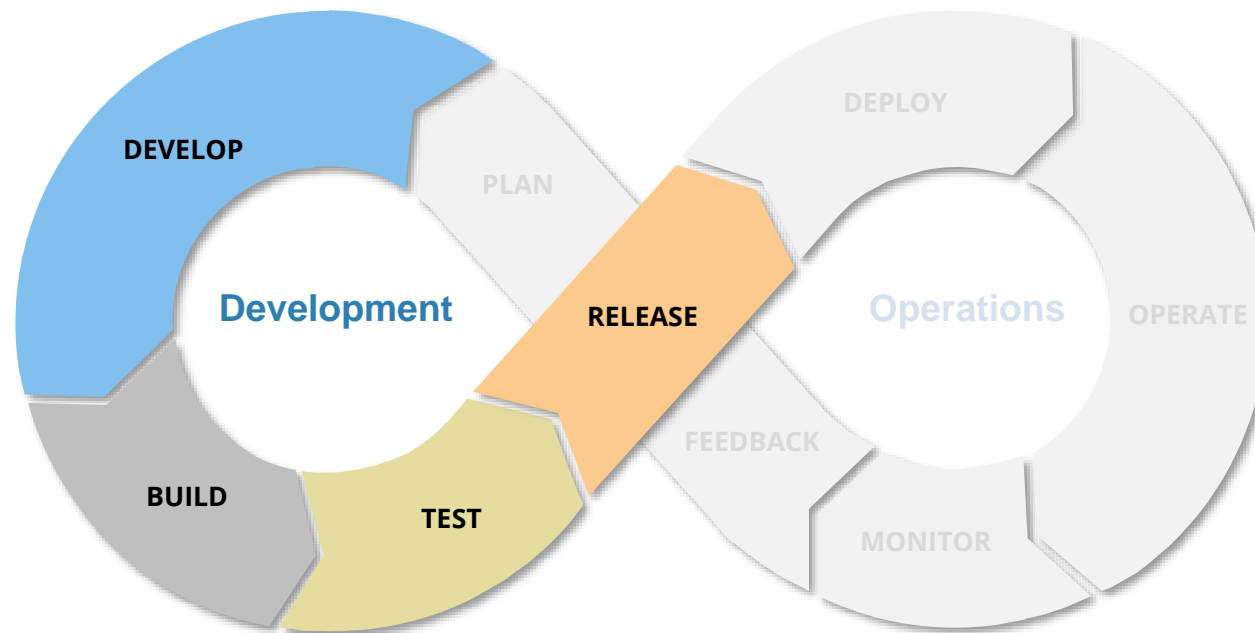
MATLAB is providing more tools to better support your software needs

- We want to help streamline your entire development workflow



MATLAB is providing more tools to better support your software needs

- We want to help streamline your entire development workflow
- Today, we're going to focus on the first half of the DevOps cycle



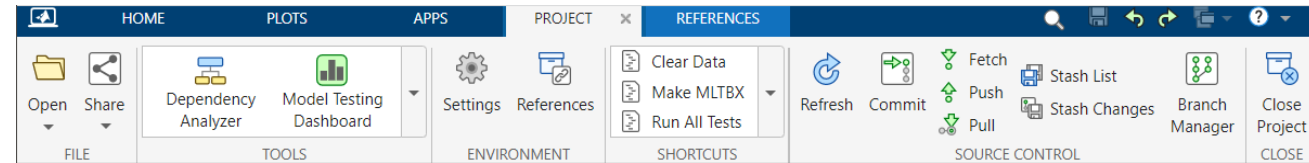
What's new for...

Understanding and managing your code

Reproducible development environment – MATLAB projects

R2019a

- Automatic path setup (add/remove)
- Deeper refactoring/renaming tools
- Customizable startup/shutdown actions
- Group and filter files using labels
- Project-specific tools and shortcuts
- Project-to-project dependencies

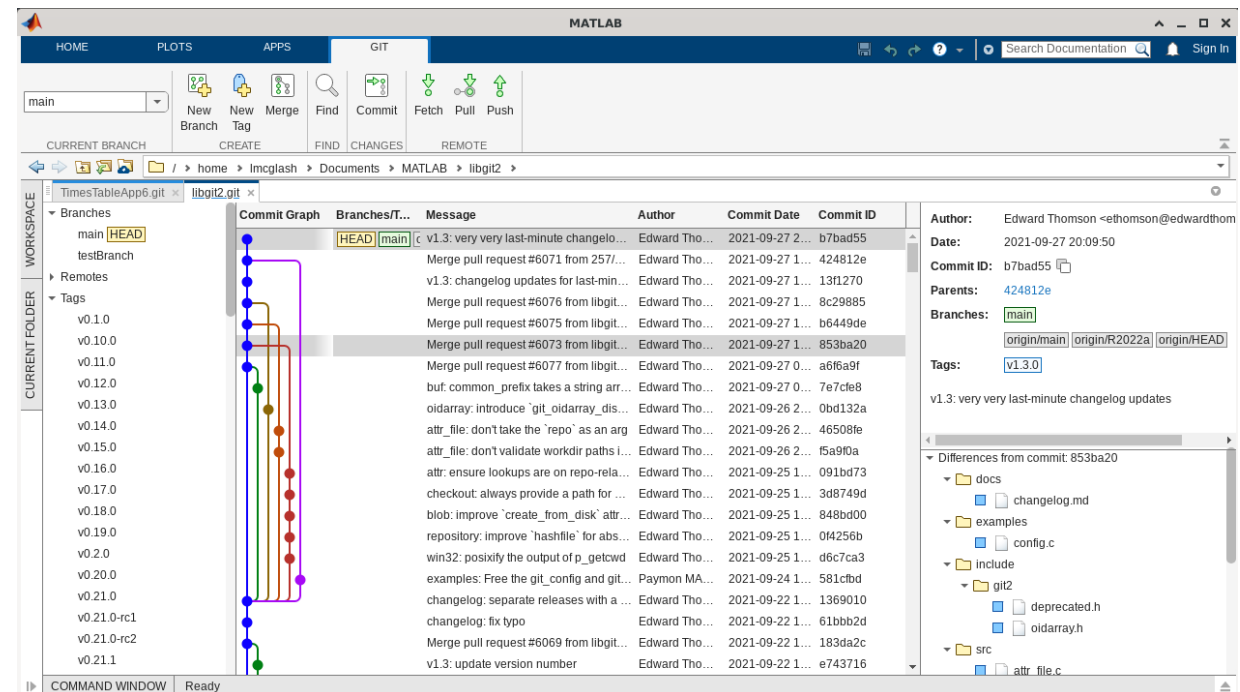


Project			
Name	Git	Status	Labels
▶ .github	○	✓	
▶ Example_CodeAnalyzerConfiguration	○	✓	
CodeAnalyzerConfiguration.json	○	✓	
▶ Example_ToolboxOptionsObject	○	✓	
packageMyToolbox.m	○	✓	Design
pokerHandToolboxDefinition.m	○	✓	Design
▶ PokerHandsToolbox	○	✓	
GettingStarted.mlx	○	✓	Design
PokerDeck.m	○	✓	Design
PokerHand.m	○	✓	Design
▶ resources	○	○	
▶ tests	○	✓	
testPokerHandComparisons.m	○	✓	Test
testPokerHandCreation.m	○	✓	Test
testToolboxPackaging.m	○	✓	Test
.gitattributes	○	✓	
.gitignore	○	✓	
buildfile.m	○	✓	Design
License.txt	○	✓	
README.md	○	✓	
SECURITY.md	○	✓	
WorkshopGuide.mlx	○	✓	Design
WorkshopProject.prj	○		

Improved source control interfaces - Branch Manager

MATLAB Online only
(for now)

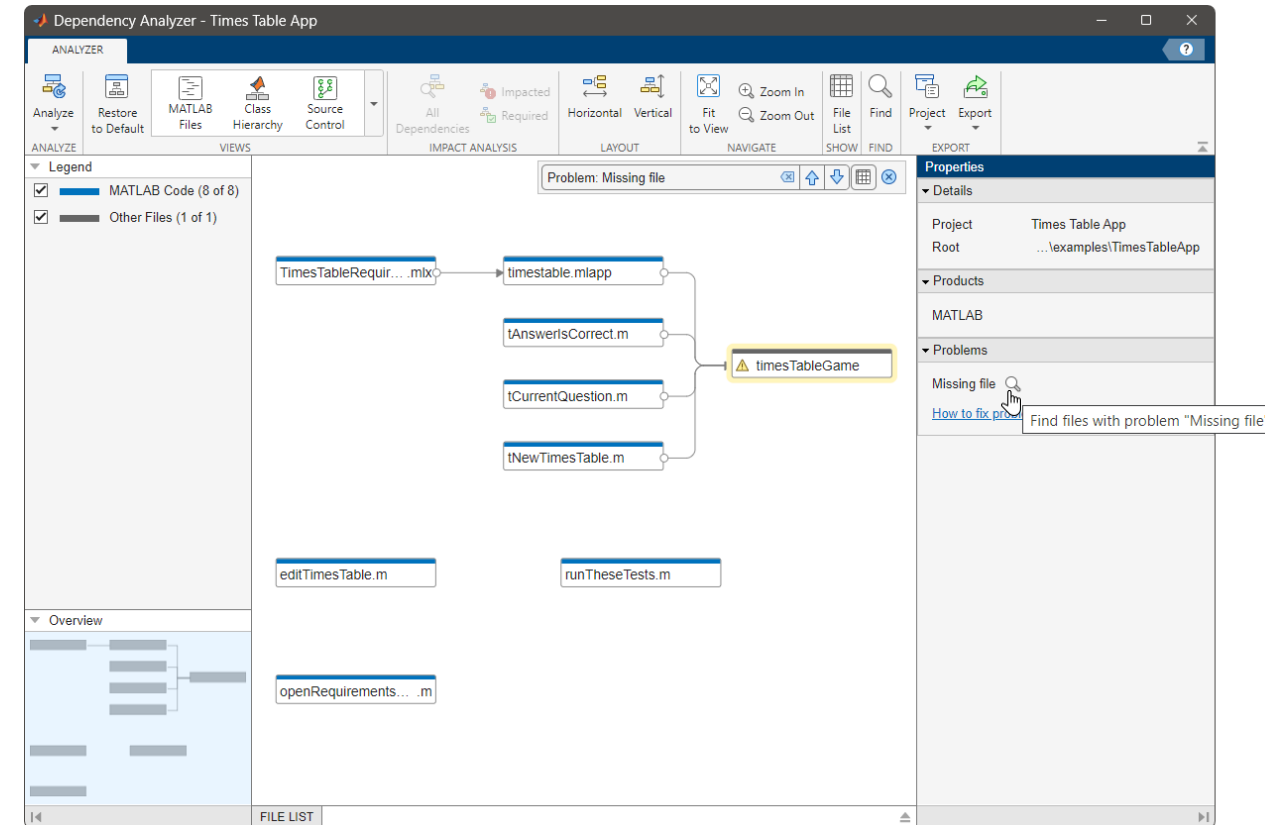
- Create, switch, merge, and delete branches
- Find and compare commits
- View the history of a repository
- Fetch, prune, and delete remotes
- Manage multiple repositories at once
- And more...



Understanding code dependencies – Dependency Analyzer

R2020a

- Find required products and add-ons
- Investigate and resolve problems
- Perform impact analysis to determine the impact of changing files
- Perform block-level analysis on Simulink models
- Export dependency analysis results
- Available outside of a MATLAB project R2023a



Identifying issues in your code – Code Analyzer

- Summary of code issues
- Easy to identify and focus on most important issues
- Interactive and programmatic workflows
 - Code Analyzer app
 - `codeIssues` object
- Auto-fix select issues R2023a

Code Analyzer

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

Overall Summary

Category	Count
893 total files	
Error	8
Warning	382
Info	1267

Select Folder: \\mathworks\devell\sandbox\mzhaol\workspace\example

Rerun Analysis Group By Filter by Severity Filter by Issue Type

Code Health Details
Analysis Date: 5/16/2022, 9:37:06 AM

Error (8)

- ▶ This case cannot be matched due to a call to UPPER or LOWER on the SWITCH value. (5)
- ▼ This condition has no effect because all blocks in this if statement are identical. Remove the condition or change the code blocks. (2)
- Line 232 \mathwc
- Line 238 \mathwc
- ▶ To pass MExcep...

Warning (382)

- ▶ Value assigned to

Web Browser - Code Analyzer

Rerun Analysis Group By Filter by Severity Filter by Issue Type

Analysis Date: 10/5/2022, 11:04:00 AM

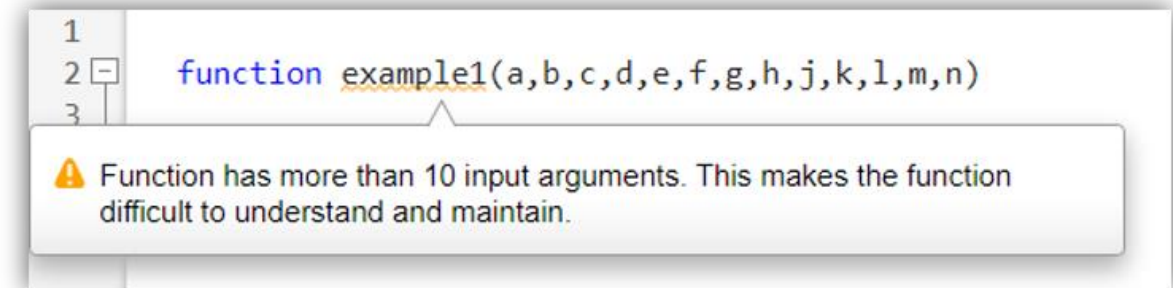
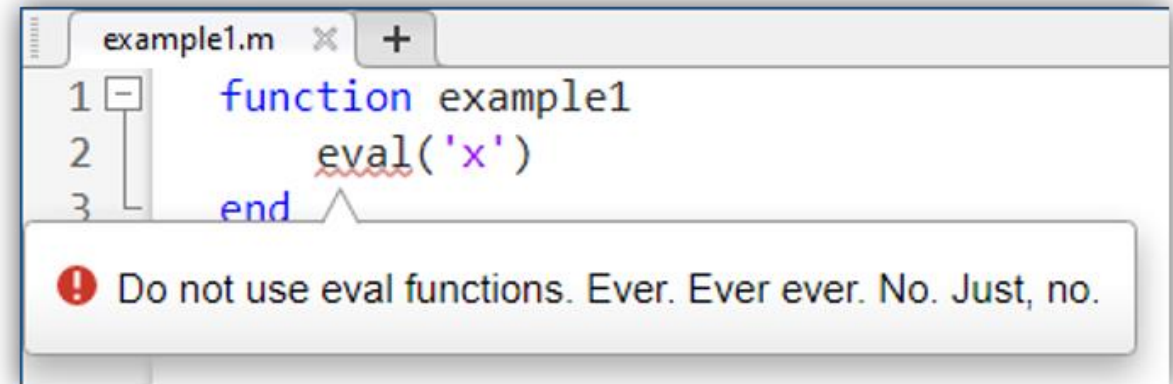
Info (7)

- ▶ 'datenum' is not recommended. With appropriate code changes, use 'datetime' instead. (4)
- ▼ Best practice is to separate output variables with commas. (3)

Line	File	Issue	Action
Line 30	convtemp.m	[slope bias] = unitconversion('temperature conversion',uin,uout,0);	Fix
Line 49	geocradius.m	[f R] = worldparams(nargin, varargin);	Fix
Line 1	wgs84model.m	function [f R] = wgs84model	Fix

Customize the issues that Code Analyzer finds and reports

- Configuration stays with code
 - Source control friendly file (JSON)
 - Applies to folder and all child folders
- Configure existing MATLAB checks
 - Enable/disable checks
 - Configure message text and severity
- Enable new custom checks
 - Disallow specific functions (e.g., `eval`)
 - Configurable line length, control statement nesting depth, number of inputs/outputs, ...

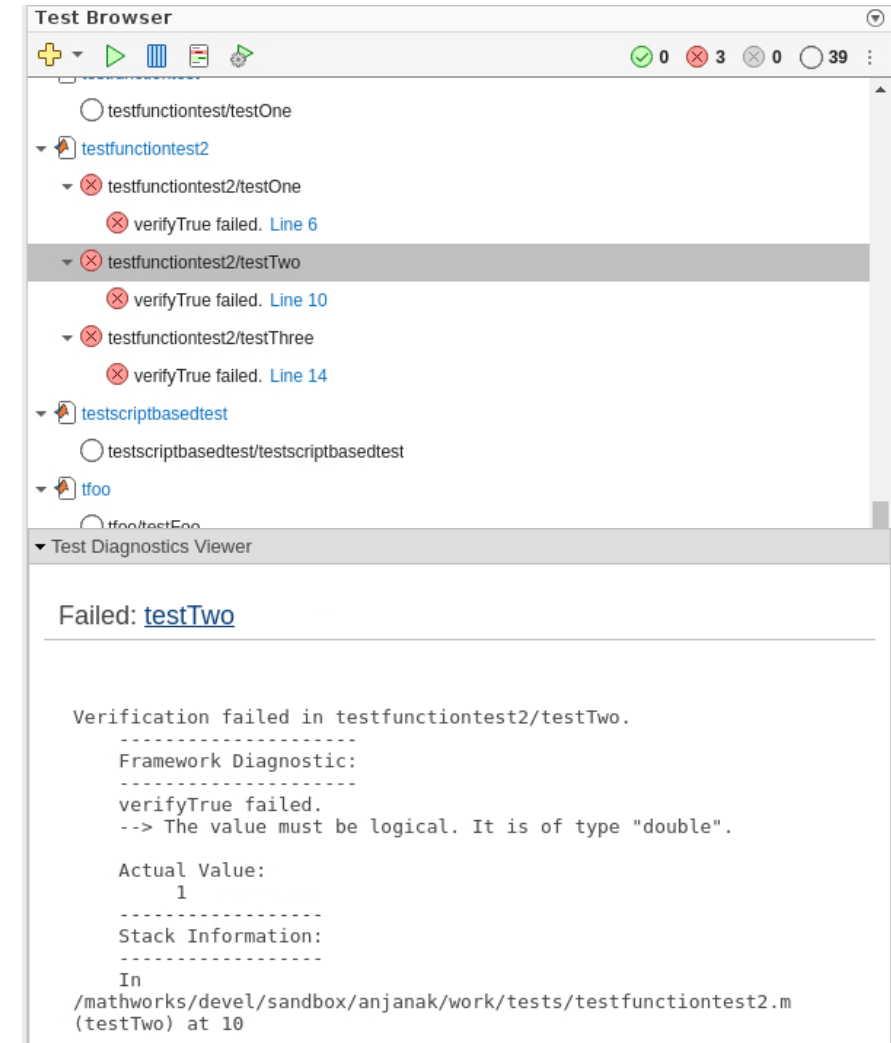


What's new for...

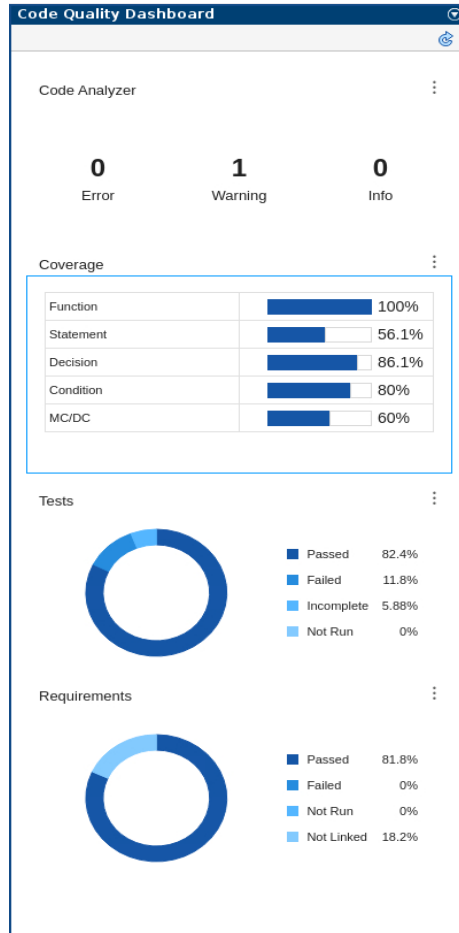
Testing

Test your code as you develop it – Test Browser

- New panel for iterative testing workflows
 - Running your tests is always a click away
 - Quickly dive into failed tests
- Open the Test Browser via:
 - "Run Tests" Editor toolstrip buttons
 - "Test Browser" in Apps Gallery
 - "Right-click > Run" a test file in Current Folder Browser
- Easily adjust test run configurations
 - Enable testing in parallel, code coverage metrics, ...



Increase verification rigor with MATLAB Test



- Reduce risk of software failures with comprehensive and systematic testing
- Increase verification rigor
 - Advanced code coverage to identify coverage gaps
 - Requirements-based MATLAB code verification
 - Equivalence testing between MATLAB code and generated artifacts
- Streamline verification workflows
 - Dashboards provide clear measurement of code quality
 - Interactive tools to manage large numbers of tests
 - Persistent test results to improve productivity

“Adoption and implementation of testing rigor provides a 10x return on investment”

What's new for...

Toolbox packaging and build automation

Fully scriptable toolbox creation – `ToolboxOptions` object

- A toolbox is collection of useful code, apps, data, ...
 - Often packaged as an .MLTBX file
 - Often published to GitHub / File Exchange
- UI to guide you through toolbox packaging
- Fully scriptable toolbox creation **R2023a**
 - Configure your toolbox directly in code
 - Enables CI/CD packaging workflows

```
% Create ToolboxOptions object
toolboxFolder = "code";
identifier = "c5520e2f-fedd-4f9a-bc7b-753a7bab5412";
opts = matlab.addons.toolbox.ToolboxOptions(toolboxFolder,identifier);

% Customize toolbox
opts.ToolboxName = "Poker Hand Toolbox";
opts.Summary = "Create poker hands using MATLAB!";
opts.Description = "Provides tools to create and compare poker hands.";
opts.ToolboxVersion = "1.0.1";
opts.MinimumMatlabRelease = "R2019a";
opts.MaximumMatlabRelease = "";

% Set output file name
tbxFileName = "PokerHandToolbox_" + opts.ToolboxVersion + ".mltbx";
opts.OutputFile = fullfile("derived",tbxFileName);

% Package toolbox
matlab.addons.toolbox.packageToolbox(opts);
```


Standardizing your build process – Build Tool

- Create automated build pipelines
- Declare dependencies between tasks
- Run, list, and visualize tasks and their dependencies
- Automatically skip tasks where inputs/outputs haven't changed

R2023a

Command Window

```
>> buildtool -tasks
check    - Identify code issues
test     - Run all tests
toolbox  - Package toolbox

>> buildtool toolbox
** Skipped check: up-to-date

** Starting test
.
** Finished test

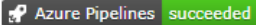
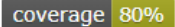

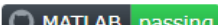
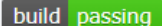
** Starting toolbox
** Finished toolbox
```

Free continuous integration (CI) for public GitHub repositories **R2020a**

- Free access to MATLAB and Simulink in cloud-based CI services for public GitHub repositories
- Currently supported CI platforms:
 - Azure DevOps
 - GitHub Actions
 - CircleCI
 - Travis CI
- Getting started:
 - Example CI configuration files
 - <https://github.com/mathworks/ci-configuration-examples>
 - Step-by-step guide to using MATLAB with GitHub Actions
 - <https://github.com/mathworks/ci-with-matlab-and-github-actions-workshop>

MATLAB CI Configuration Examples

This repository shows how to run MATLAB tests with a variety of continuous integration systems.

CI Platform	Badges	Badge Help
Azure DevOps	 	Blog with helpful information for setting up Azure DevOps badges
CircleCI		CircleCI documentation for setting up badges
GitHub Actions		GitHub Actions documentation for setting up badges
Travis CI		Travis CI documentation for setting up badges

Time for some hands-on experience!

Time for some hands-on experience!

- Our workshop will cover:
 - Working with Git using the Branch Manager
 - Understanding your code better with the Dependency Analyzer
 - Identifying issues in your code with **codeIssues**
 - Scriptable toolbox packaging with **ToolboxOptions**
 - Automating build operations with the build tool

- To get started:
 1. Go to the following URL:
 - <https://github.com/mathworks/Expo-2023-Whats-New-for-Managing-Testing-and-Building-your-MATLAB-Code>
 2. Click on the "Open in MATLAB Online" button
 3. Walk through the **WorkshopGuide.mlx** file

MATLAB EXPO

Thank you



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