

# Introducing MATLAB Copilot

## Accelerate Robust Model Development, Testing & Validation

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# How to make sense of legacy code with little documentation?

```
%% portfolio
```

```
% Create a Portfolio object with specified asset names
```

```
p = Portfolio('AssetList',assetNames);
```

```
% Set default constraints for the portfolio
```

```
p = setDefaultConstraints(p);
```

```
% Calc
```

```
activ
```

```
% Est
```

```
pAct
```

```
% Est
```

```
pwgtA
```

```
% Estim
```

```
[portRiskAct, portRetnAct] = estimatePortMoments(pAct, pwgtAct);
```

```
% Get daily asset returns and covariance
```

```
[assetActRetnDaily, assetActCovarDaily] = getAssetMoments(pAct);
```

```
% Calculate daily asset risk as the square root of the diagonal  
% of covariance
```

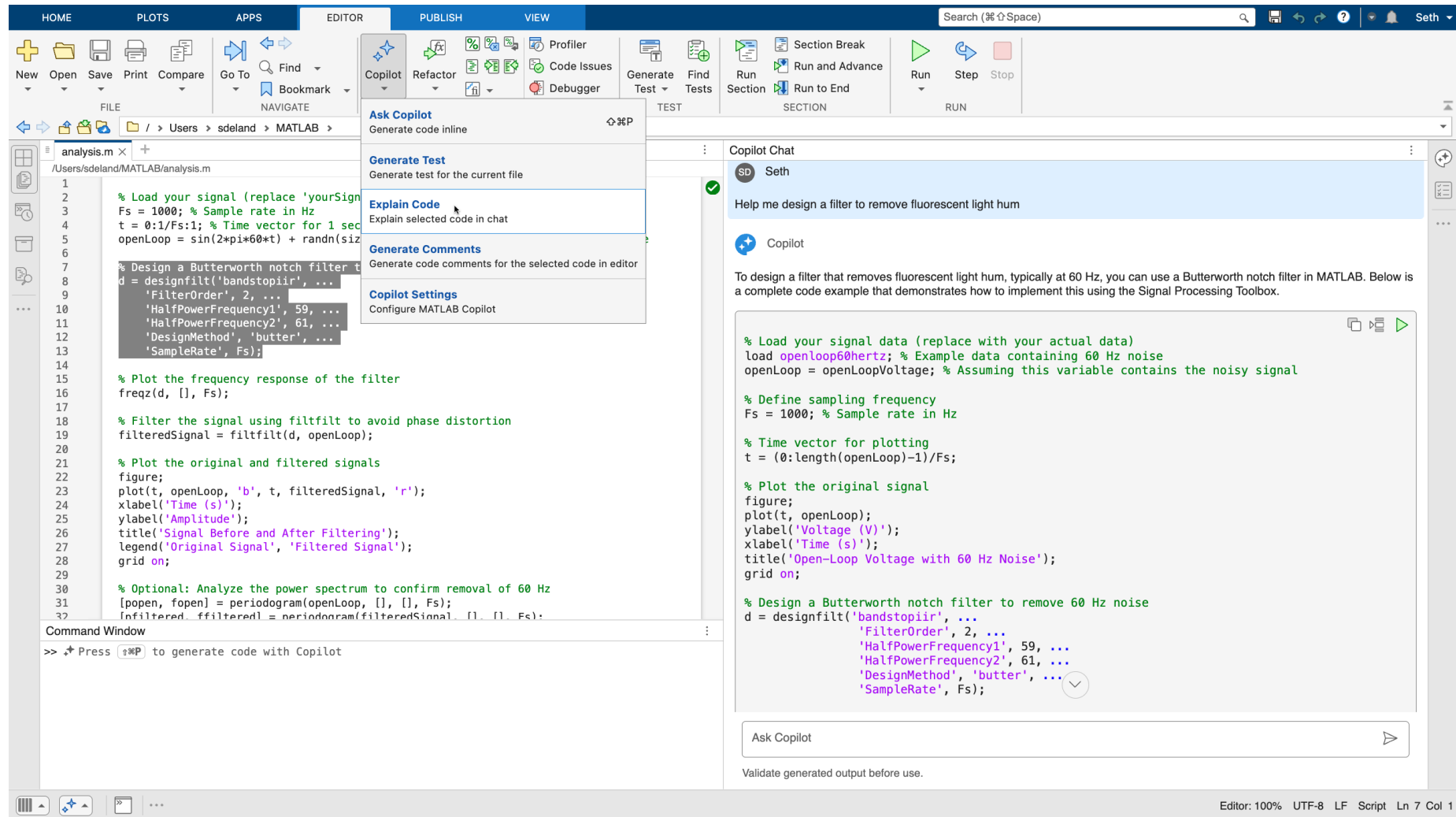
```
assetActRiskDaily = sqrt(diag(assetActCovarDaily));
```

```
asset return
```

**MATLAB Copilot**



# MATLAB Copilot integrates Generative AI into MATLAB



The screenshot displays the MATLAB Copilot interface within the MATLAB environment. The top toolbar includes tabs for HOME, PLOTS, APPS, EDITOR, PUBLISH, and VIEW. The EDITOR tab is active, showing a file named 'analysis.m' with MATLAB code. The code includes comments and functions for loading a signal, designing a Butterworth notch filter, plotting the frequency response, and filtering the signal. A context menu is open over the code, offering options like 'Ask Copilot', 'Generate Test', 'Explain Code', 'Generate Comments', and 'Copilot Settings'. The 'Ask Copilot' option is selected, opening a chat window on the right. The chat window shows a user prompt: 'Help me design a filter to remove fluorescent light hum'. The Copilot response provides a detailed explanation and a complete MATLAB code example for designing a Butterworth notch filter to remove 60 Hz noise. The Command Window at the bottom shows the prompt: '>> Press [F10] to generate code with Copilot'.

**Code in analysis.m:**

```
1 % Load your signal (replace 'yourSignal' with actual data)
2 Fs = 1000; % Sample rate in Hz
3 t = 0:1/Fs:1; % Time vector for 1 sec
4 openLoop = sin(2*pi*60*t) + randn(size(t));
5
6 % Design a Butterworth notch filter to remove 60 Hz noise
7 d = designfilt('bandstopiir', 'FilterOrder', 2, 'HalfPowerFrequency1', 59, 'HalfPowerFrequency2', 61, 'DesignMethod', 'butter', 'SampleRate', Fs);
8
9 % Plot the frequency response of the filter
10 freqz(d, [], Fs);
11
12 % Filter the signal using filtfilt to avoid phase distortion
13 filteredSignal = filtfilt(d, openLoop);
14
15 % Plot the original and filtered signals
16 figure;
17 plot(t, openLoop, 'b', t, filteredSignal, 'r');
18 xlabel('Time (s)');
19 ylabel('Amplitude');
20 title('Signal Before and After Filtering');
21 legend('Original Signal', 'Filtered Signal');
22 grid on;
23
24 % Optional: Analyze the power spectrum to confirm removal of 60 Hz
25 [popen, fopen] = periodogram(openLoop, [], [], Fs);
26 [pfilt, ffilt] = periodogram(filteredSignal, [], [], Fs);
```

**Copilot Chat:**

**Seth**  
Help me design a filter to remove fluorescent light hum

**Copilot**  
To design a filter that removes fluorescent light hum, typically at 60 Hz, you can use a Butterworth notch filter in MATLAB. Below is a complete code example that demonstrates how to implement this using the Signal Processing Toolbox.

```
% Load your signal data (replace with your actual data)
load openLoop60hertz; % Example data containing 60 Hz noise
openLoop = openLoopVoltage; % Assuming this variable contains the noisy signal

% Define sampling frequency
Fs = 1000; % Sample rate in Hz

% Time vector for plotting
t = (0:length(openLoop)-1)/Fs;

% Plot the original signal
figure;
plot(t, openLoop);
ylabel('Voltage (V)');
xlabel('Time (s)');
title('Open-Loop Voltage with 60 Hz Noise');
grid on;

% Design a Butterworth notch filter to remove 60 Hz noise
d = designfilt('bandstopiir', 'FilterOrder', 2, 'HalfPowerFrequency1', 59, 'HalfPowerFrequency2', 61, 'DesignMethod', 'butter', 'SampleRate', Fs);
```

Ask Copilot

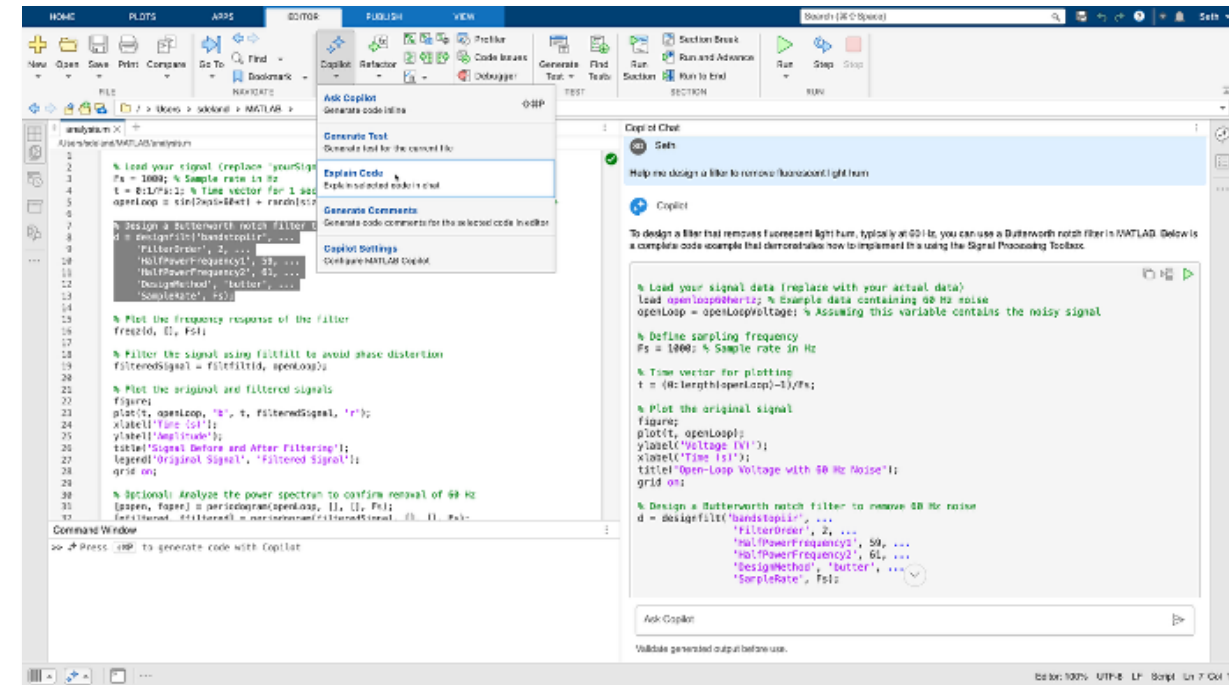
Validate generated output before use.

Editor: 100% UTF-8 LF Script Ln 7 Col 1

# MATLAB Copilot: Optimized for MATLAB

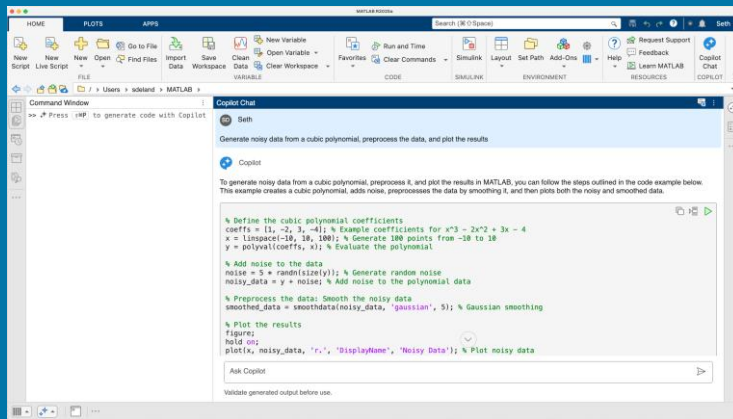
# R2025a

- Tightly integrated with MATLAB
- Responses are based on the latest MathWorks documentation
- Tuned for modeling workflows



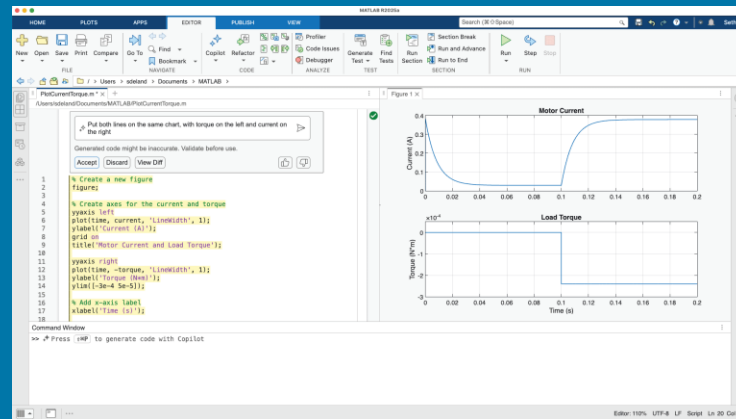
# Three ways to use MATLAB Copilot

1.



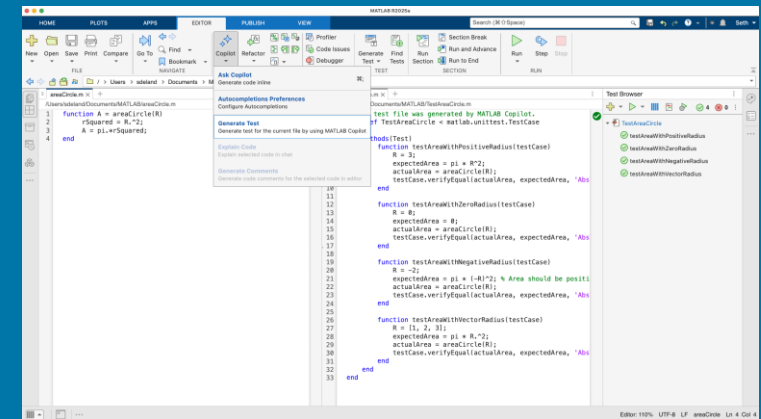
## Copilot Chat

2.



## Copilot in the Editor and Command Window

3.



## Copilot Actions

# 1. Copilot Chat



MATLAB R2025a


HOME PLOTS APPS PROJECT

Search (⌘ Space)

Seth

FILE VARIABLE CODE SIMULINK ENVIRONMENT RESOURCES COPILOT

Command Window


>> Press  to generate code with Copilot

Copilot Chat

Copilot

Hello! Copilot is here to answer your questions, help write and explain code, and even identify code issues. Learn more about [Copilot](#).

Remember that Copilot sometimes writes code and text that seems accurate, but is not. Make sure to verify any received code and give feedback on the results to help improve the responses.

 Shuffle Example Prompts

- ✦ Solve the linear equations with coefficients  $A = [2, 4; 1, 3]$  and constants  $B = [8; 5]$  and display the results
- ✦ Load Fisher's iris data set, use the petal lengths and widths as predictors, cluster data using k-means clustering, and then plot the cluster regions
- ✦ Create a 3D bar graph of data from magic function

Ask Copilot

Validate generated output before use.

MATLAB R2025a

HOME PLOTS APPS PROJECT

Search (% ↵ Space)


New Script New Live Script New Open Go to File Find Files Import Data Save Workspace Clean Data New Variable Open Variable Clear Workspace

FILE VARIABLE

Favorites Run and Time Clear Commands Simulink Layout Set Path Add-Ons Settings Parallel Help Feedback Learn MATLAB Request Support Copilot Chat

CODE SIMULINK ENVIRONMENT RESOURCES COPILOT

Command Window

>> Press  to generate code with Copilot

Copilot Chat




```
% Example of using Hampel filter
filteredData = hampel(Anoise, 5); % 5-point window
plot(t, Anoise, t, filteredData);
legend("Noisy Data", "Hampel Filtered Data");
```

5. **Outlier Removal:** You can also programmatically remove outliers using the `isoutlier` function or by defining exclusion rules in the Curve Fitter app.




```
% Example of removing outliers programmatically
outliers = isoutlier(data);
cleanedData = data(~outliers);
```

These methods can help you effectively smooth outliers and improve the quality of your data analysis.

References:

-  [Data Smoothing and Outlier Detection](#)
-  [Signal Smoothing](#)
-  [Remove Outliers](#)

Follow-up Prompts:

-  How do I choose the best smoothing technique for my specific dataset?
-  Can you explain the differences in performance between the moving average and median filter?
-  How can I visualize the effect of outlier removal on my data?

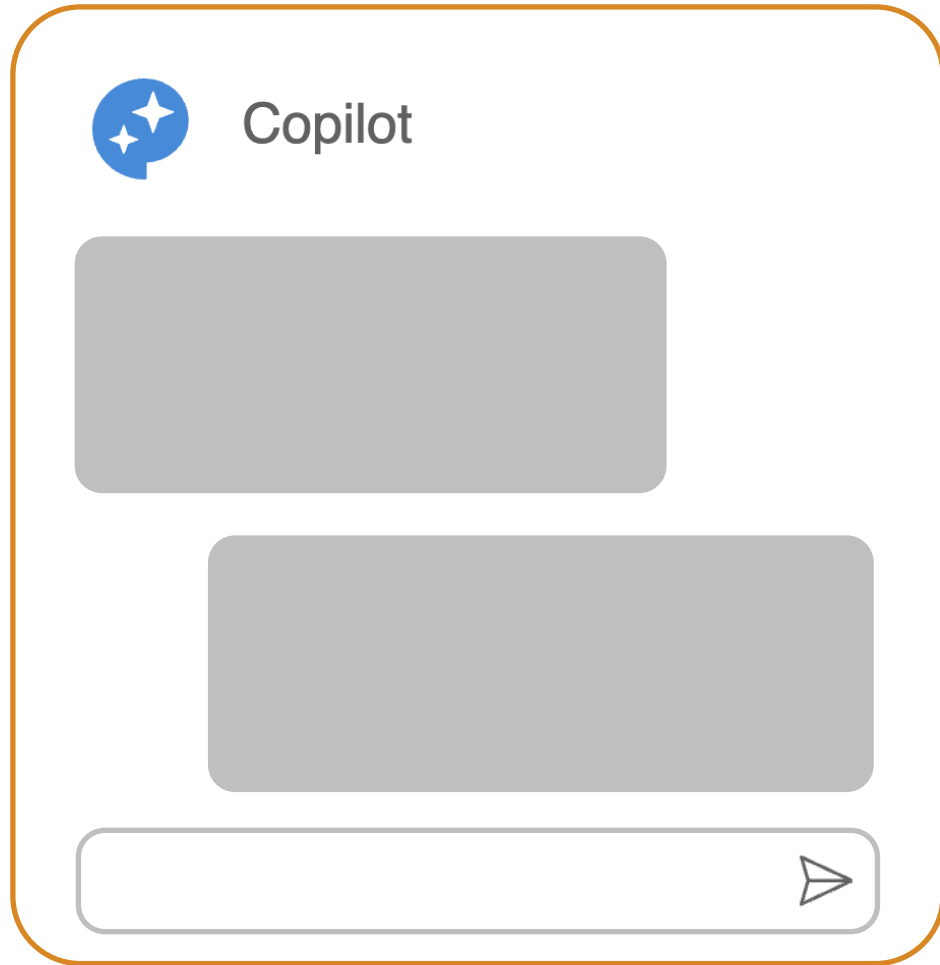
👍 🗨 📄

Ask Copilot

Validate generated output before use.



# Copilot Chat



**Based on MathWorks Documentation**



**Get suggestions for prompting**



**Quickly run and assess code**

## 2. Copilot in the Editor and Command Window

MATLAB R2025a

HOME PLOTS APPS PROJECT LIVE EDITOR INSERT VIEW Search (⌘ Space)

New Open Save Print Export Compare Go To Find Bookmark Text Code Control Task Copilot Refactor Code Issues Debugger Generate Test Find Tests Run Section Run and Advance Run Step Stop

FILE NAVIGATE TEXT CODE ANALYZE TEST SECTION RUN

/Users/sdeland/Documents/MATLAB/projects/AlforAutomotive/VirtualSensorExample/script.mlx

script.mlx x

/Users/sdeland/Documents/MATLAB/projects/AlforAutomotive/VirtualSensorExample/script.mlx

Load the data into a table.

```
1 datafile = fullfile("data","LGHG2@n10C_to_25degC",...
2   "Train","TRAIN_LGHG2@n10degC_to_25degC_Norm_5Inputs.mat");
3 load(datafile,"X","Y");
4
5 t = array2table([X',Y'], ...
6   VariableNames=["Voltage","Current","Temperature","V_avg","I_avg","SOC"])
```

t = 669956x6 table

	Voltage	Current	Temperature	V_avg	I_avg	SOC
100	0.3855	0.7510	0.4545	0.3853	0.7510	0.2064
101	0.3855	0.7510	0.4561	0.3853	0.7510	0.2064
102	0.3855	0.7510	0.4577	0.3853	0.7510	0.2064
103	0.3855	0.7510	0.4592	0.3853	0.7510	0.2064
104	0.3855	0.7510	0.4608	0.3853	0.7510	0.2064
105	0.3855	0.7510	0.4624	0.3853	0.7510	0.2064
106	0.3855	0.7510	0.4640	0.3853	0.7510	0.2064
107	0.3855	0.7510	0.4656	0.3853	0.7510	0.2064

## References

[1] Kollmeyer, Phillip, Carlos Vidal, Mina Naguib, and Michael Skells. "LG 18650HG2 Li-Ion Battery Data and Example Deep Neural Network XEV SOC Estimator Script." Mendeley, March 5, 2020. <https://doi.org/10.17632/CP3473X7XV.3>.

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MATLAB R2025a

HOME PLOTS APPS PROJECT LIVE EDITOR INSERT VIEW Search (⌘ Space)

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FILE NAVIGATE TEXT CODE ANALYZE TEST SECTION RUN

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script.mlx \* x

/Users/sdeland/Documents/MATLAB/projects/AlforAutomotive/VirtualSensorExample/script.mlx

6

```
VariableNames=["Voltage","Current","Temperature","V_avg","I_avg","SOC"]
```

t = 669956x6 table

	Voltage	Current	Temperature	V_avg	I_avg	SOC
1	0.3851	0.7510	0.3031	0.3851	0.7510	0.2064
2	0.3852	0.7510	0.3046	0.3851	0.7510	0.2064
3	0.3852	0.7510	0.3061	0.3852	0.7510	0.2064
4	0.3852	0.7510	0.3076	0.3852	0.7510	0.2064
5	0.3852	0.7510	0.3091	0.3852	0.7510	0.2064
6	0.3852	0.7510	0.3106	0.3852	0.7510	0.2064
7	0.3852	0.7510	0.3120	0.3852	0.7510	0.2064
8	0.3852	0.7510	0.3135	0.3852	0.7510	0.2064
9	0.3852	0.7510	0.3150	0.3852	0.7510	0.2064

## References

[1] Kollmeyer, Phillip, Carlos Vidal, Mina Naguib, and Michael Skells. "LG 18650HG2 Li-Ion Battery Data and Example Deep Neural Network XEV SOC Estimator Script." Mendeley, March 5, 2020. <https://doi.org/10.17632/CP3473X7XV.3>.

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MATLAB R2025a


HOME PLOTS APPS EDITOR PUBLISH VIEW Search (⌘ Space) Seth

FILE NAVIGATE CODE ANALYZE TEST SECTION RUN

plotAccelerometerData.m

```
1 function plotAccelerometerData(t)
2     plot(t.Time, t.X, t.Time, t.Y, t.Time, t.Z);
3     xlabel('Time (s)');
4     ylabel('Acceleration (m/s^2)');
5     title('Accelerometer Measurements');
6     grid on;
7 end
```

Command Window

>> Press  to generate code with Copilot

Copilot Chat

Copilot

Hello! Copilot is here to answer your questions, help write and explain code, and even identify code issues. Learn more about [Copilot](#).

Copilot sometimes produces output that seems accurate but is not. Validate generated output before use. Share feedback on the output to help improve the responses.

[Shuffle Example Prompts](#)

- ✦ Plot a sine wave and add a vertical line using xline
- ✦ Plot the sine function over a linearly spaced vector of values from 0 to  $2\pi$
- ✦ Determine whether a matrix is sparse

Ask Copilot

Validate generated output before use.

Editor: 100% UTF-8 LF plotAccelerometerData Ln 7 Col 4

# Copilot in the Editor and Command Window



The diagram illustrates the Copilot interface within the MATLAB Editor and Command Window. It features a rounded rectangular container with an orange border. Inside, there are four horizontal orange lines at the top, representing code or a prompt. Below these is a light gray rounded rectangle containing a star icon, the text "Ask Copilot", and a right-pointing arrow icon. Underneath this button are three horizontal gray lines, followed by two horizontal orange lines at the bottom, representing the output or suggestions provided by Copilot.



**Describe the code you want**



**Edit code using natural language**

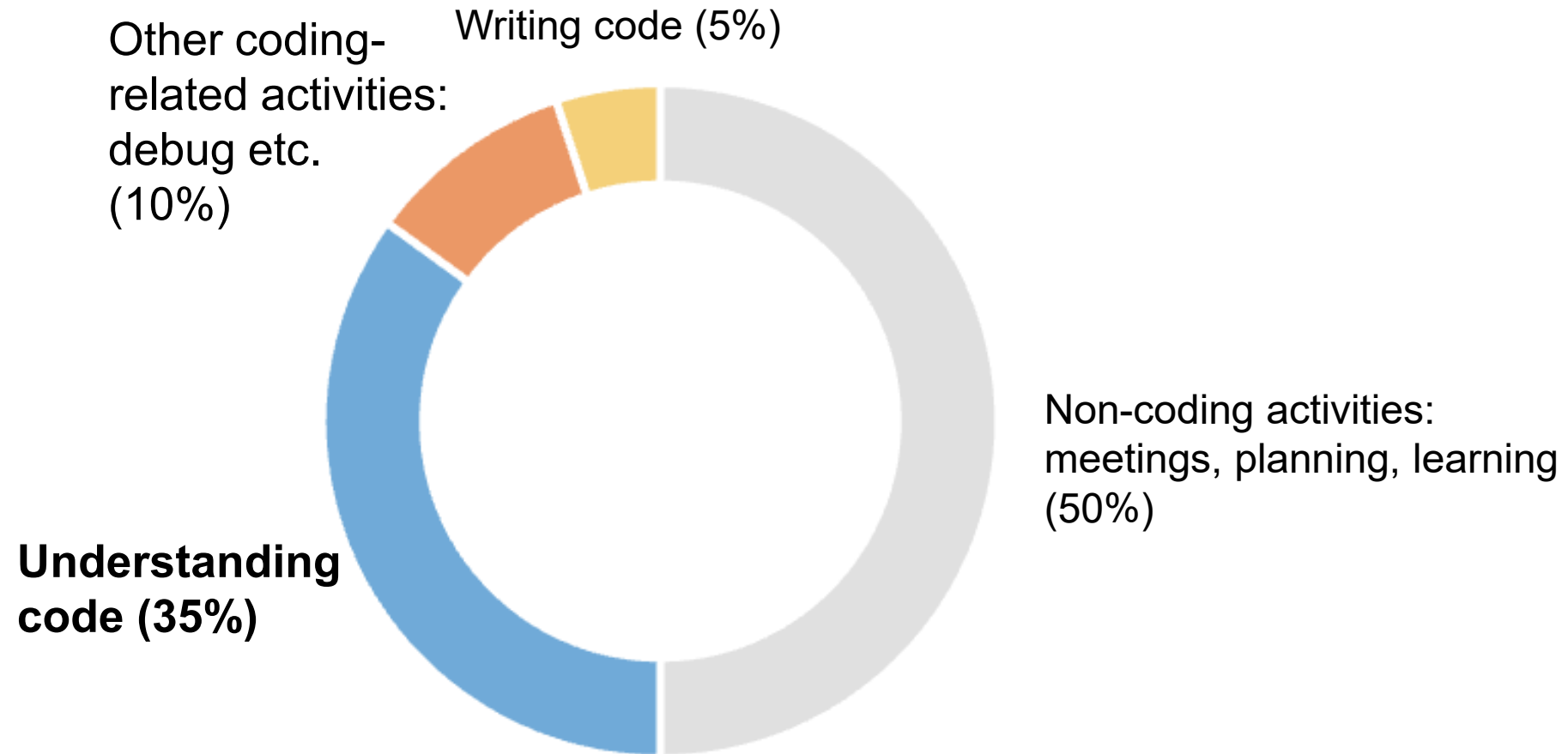


**Get suggestions while typing**



## 3. Copilot Actions

Authoring code is only one part of the story. Much time is spent understanding and evaluating code.



Povarov, Nikita (2022, May 20) *AI for Software Developers: a Future or a New Reality?*. InfoQ. <https://www.infoq.com/articles/ai-for-software-developers/>

## Actions provide timely assistance in common workflows

```
1  function str = formatNumbersAsStrings(num)
2      num = round(num);
3      str = string(num);
4      str = regexprep(str, "[0-9](?=(?:[0-9]{3})+(?![0-9]))", "$&," );
5  end
```

MATLAB R2025a

HOME PLOTS APPS EDITOR PUBLISH VIEW

New Open Save Print Compare Go To Find Bookmark Copilot Refactor Profiler Code Issues Generate Test Find Tests Run Section Run Step Stop

FILE NAVIGATE CODE ANALYZE TEST SECTION RUN

/ > Users > sdeland > Documents > MATLAB > Work

formatNumbersAsStrings.m × +

```
1 function str = formatNumbersAsStrings(num)
2     num = round(num);
3     str = string(num);
4     str = regexprep(str, '[0-9](?=(?:[0-9]{3})+(?![0-9]))', '$&,' );
5 end
```

Copilot Chat

Copilot

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Remember that Copilot sometimes writes code and text that seems accurate, but is not. Make sure to verify any received code and give feedback on the results to help improve the responses.

Shuffle Example Prompts

Read "peppers.png" and display as grayscale

Plot a sine wave and add a vertical line using vline

Ask Copilot

Validate generated output before use.

Editor: 110% UTF-8 LF formatNumbersAsStrings Ln 4 Col 66



Copilot

## What

**Brief Overview:** This code adds commas to a string representation of a number to format it with thousands separators.

**Summary:** The code uses a regular expression to find positions in a string where a digit is followed by groups of three digits, and it inserts a comma at those positions. This is particularly useful for formatting large numbers for better readability, such as converting "1000000" into "1,000,000".

### Walkthrough:

#### 1. Regular Expression Replacement:

```
str = regexprep(str, '[0-9](?=(?:[0-9]{3})+(?![0-9]))', '$&,' );
```



## How

- `regexprep` is a MATLAB function that replaces parts of a string based on a regular expression pattern.
- The pattern `'[0-9](?=(?:[0-9]{3})+(?![0-9]))'` is used to identify digits that should be followed by a comma.
  - `[0-9]` matches any single digit.
  - `(?=(?:[0-9]{3})+(?![0-9]))` is a lookahead assertion that checks if the matched digit is followed by groups of three digits (i.e., thousands) without any additional digits after those groups.
- `'$&,'` specifies that the matched digit (denoted by `$&`) should be followed by a comma.
- The result is that every appropriate digit in the string `str` is followed by a comma, effectively formatting the number with thousands separators.

This code is a concise way to enhance the readability of numerical strings by formatting them appropriately.

MATLAB R2025a

HOME PLOTS APPS PROJECT EDITOR PUBLISH VIEW

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FILE NAVIGATE CODE ANALYZE TEST SECTION RUN

/ > Users > sdeland > Documents > MATLAB > Work

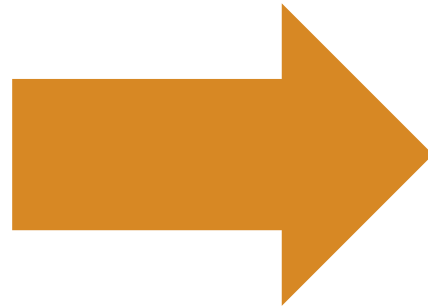
formatNumbersAsStrings.m ×

```
1 function str = formatNumbersAsStrings(num)
2     num = round(num);
3     str = string(num);
4     str = regexprep(str, '[0-9](?=(?:[0-9]{3})+(?![0-9]))', '$&');
5 end
```

Editor: 110% UTF-8 LF formatNumbersAsStrings Ln 5 Col 4



**How it works**



**Validating it works**

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FILE NAVIGATE CODE ANALYZE TEST SECTION RUN


/ > Users > sdeland > Documents > MATLAB > Work

formatNumbersAsStrings.m ×

/Users/sdeland/Documents/MATLAB/Work/formatNumbersAsStrings.m

```
1 function str = formatNumbersAsStrings(num)
2     % FORMATNUMBERSASSTRINGS Function to format numbers as strings with commas
3     %
4     % Input Arguments:
5     %     num - numeric value to be formatted
6     %
7     % Output Arguments:
8     %     str - formatted string representation of the number
9
10    % Round the number to the nearest integer
11    num = round(num);
12    % Convert the rounded number to a string
13    str = string(num);
14    % Insert commas as thousand separators in the string
```

Command Window

>> Press  to generate code with Copilot

Editor: 110% UTF-8 LF formatNumbersAsStrings Ln 5 Col 26

# Copilot Actions



**Understand what the code does**



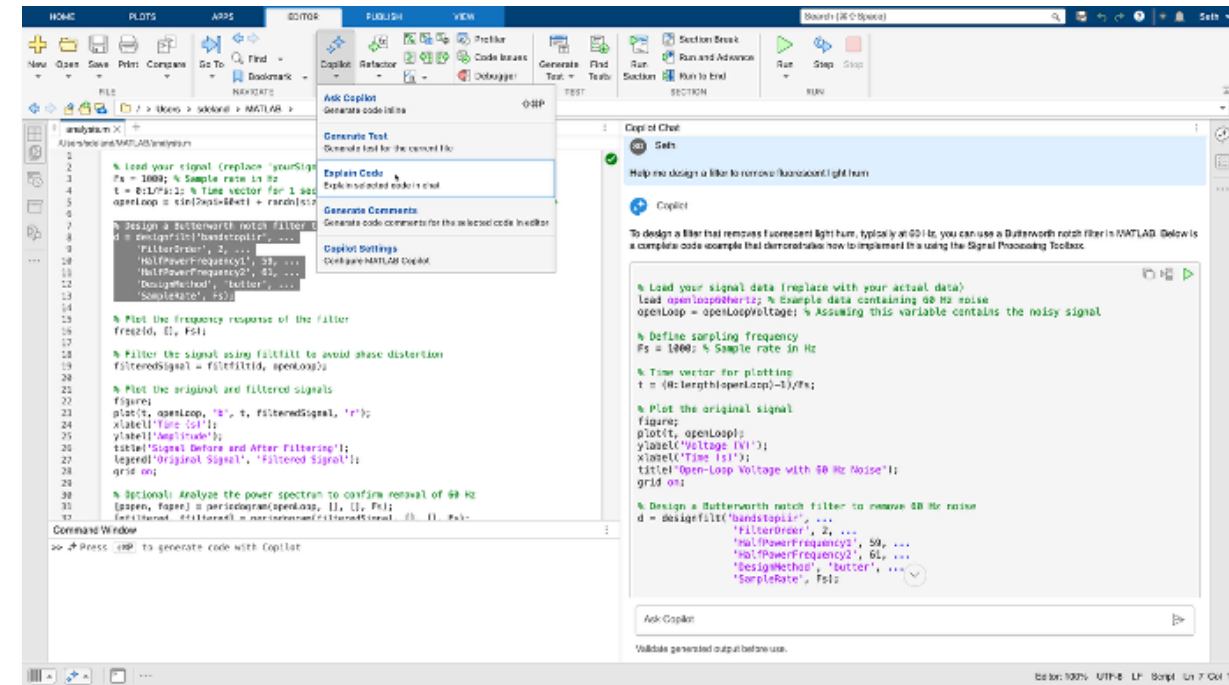
**Add comments to the code**



**Write example test cases** (with MATLAB Test)

# MATLAB Copilot: Optimized for MATLAB

- Tightly integrated with MATLAB
- Responses are based on the latest MathWorks documentation
- Tuned for modelling workflows



Learn more at [mathworks.com/products/matlab-copilot](https://mathworks.com/products/matlab-copilot)

# Adopting to a world with Generative AI with MATLAB Copilot

## Requires learning new skills

How to prompt and iterate on a response?

- Documentation on writing good prompts
- Suggested follow-up prompts



How to process the generated results?

- Try the code before using it
- Ask for explanations of code



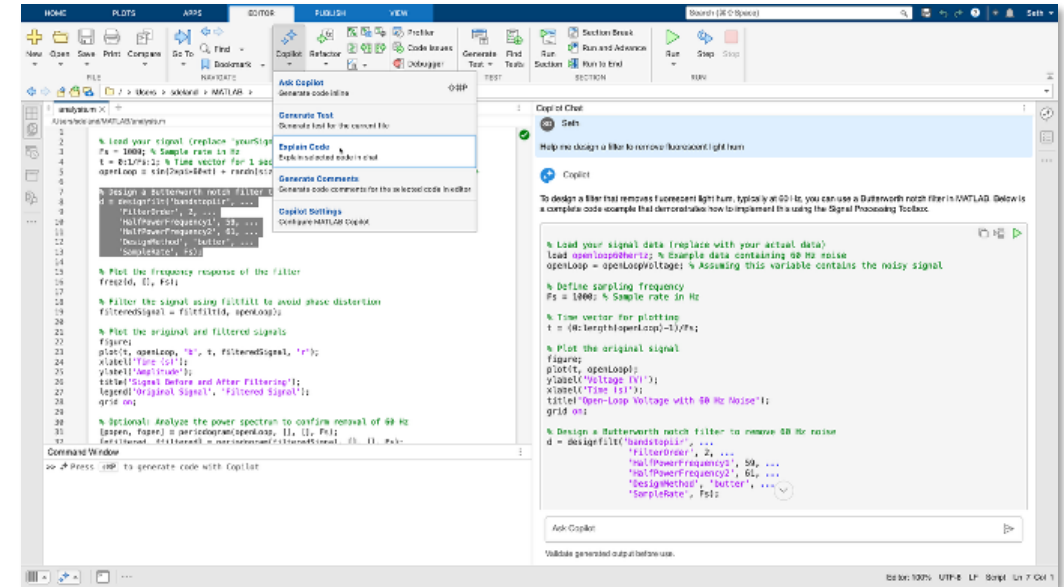
How do I know what the AI's strengths and weaknesses are?

- Use Actions as a starting point
- Work your way up from simpler problems
- My favorite: start with plotting



# MATLAB Copilot is a new product that connects LLMs in the cloud to MATLAB

- Available as an annual subscription
- An internet connection is required
- MathWorks does not use end-user data submitted to MATLAB Copilot to train AI models. Your data is used only to fulfill your requests
  - More information is available upon request





# Learn More

- Product Information:

<https://www.mathworks.com/products/matlab-copilot.html>

- Documentation:

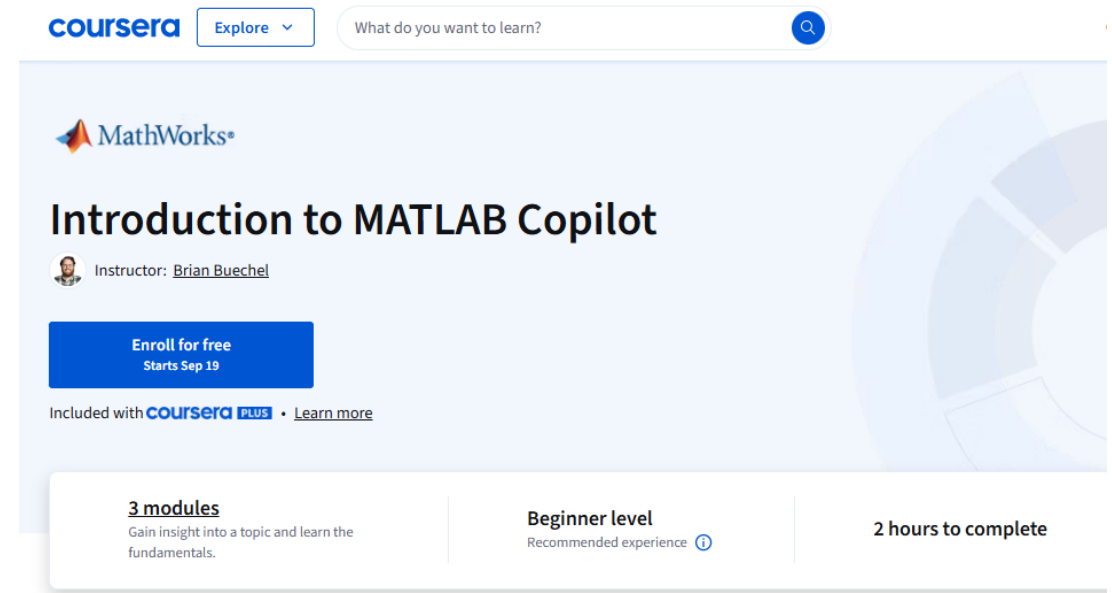
<https://www.mathworks.com/help/matlab-copilot/>

- Coursera Short Course:

<https://www.coursera.org/learn/matlab-copilot>

- FAQ:

<https://www.mathworks.com/products/matlab-copilot/faq.html>




The screenshot shows the Coursera interface for the course 'Introduction to MATLAB Copilot'. At the top, the Coursera logo and a search bar are visible. Below the search bar, the MathWorks logo is displayed. The course title 'Introduction to MATLAB Copilot' is prominently featured, followed by the instructor's name, Brian Buechel. A blue button labeled 'Enroll for free' with 'Starts Sep 19' is present. Below this, it states 'Included with coursera PLUS' and provides a link to 'Learn more'. At the bottom, three key details are listed: '3 modules' with a description of gaining insight into the topic, 'Beginner level' with a recommended experience icon, and '2 hours to complete'.

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## Introduction to MATLAB Copilot

 Instructor: [Brian Buechel](#)

**Enroll for free**  
Starts Sep 19

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<b>3 modules</b> Gain insight into a topic and learn the fundamentals.	<b>Beginner level</b> Recommended experience ⓘ	<b>2 hours to complete</b>
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# Questions?