MATLAB EXPO

From Embedded to Empowered: The Rise of Software-Defined Products

Tanya Morton and Ned Gulley MathWorks



















Software-Defined Products



Software-Defined Vehicle

Brand-Distinctive Features and Main Customer Value Will Come From Software

Customer expectations

- Sustainable and safe mobility
- Digital life continuity

Technology and innovation

- Electrification
- Autonomy
- Connectivity

Business opportunity

- App stores, software features on demand
- Subscription plans for software services



Recycled PET Bottles are not Software-Defined





Machines that produce the rPET bottles are software-defined

Goals and Challenges:

- Inconsistent feedstock
- Maximize yield
- Minimize reconfiguration time
- Achieve 100% rPET reuse





• New bottle types

Software-Defined Vehicles



Robotic Surgery Systems



Renewable Energy Systems



Advanced Air Mobility



White Goods



Industrial Packaging Systems



Software-Defined



Modern Software Practices

- Fast development
- Frequent eleases
- Highautorhation

Data-Driven Functionality



Leverages Cloud

Systems



Reliability



Functional Safety





Modern Software Practices



Data-Driven Functionality



Leverages Cloud



Reliability



Functional Safety





Modern Software Practices



Data-Driven Functionality



Leverages Cloud



Reliability



Functional Safety



Systems





Motor Control Blockset



Simscape Electrical



Simscape Battery



Embedded Coder HDL Coder





Systems

Systems





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Infineon AURIX[™] microcontroller Systems



Qualcomm[®] Hexagon[™] NPU for Snapdragon



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Infineon AURIX[™] microcontroller



NXP[®] GoldBox for in-vehicle HPC



Systems

Qualcomm[®] Hexagon[™] NPU for Snapdragon



Systems

RoadRunner Scenario



Satellite to aircraft comms









Systems





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Demo: Implementation of Vision, Radar and Wireless Communication Systems using Embedded Hardware David Northcote, MathWorks



Modern Software Practices



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Modern Software Practices

- Fast development
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- High automation



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Functional Safety















Modern Software Practices

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Demo: Using MATLAB and Simulink Products with Continuous Integration Platforms Charles Hawkins, MathWorks



Talk: Accelerating Product Development Through Simulation Lachlan Jardine, MathWorks



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Functional Safety









Design your system with AI

AI Reference Examples



Predictive

Maintenance





Signal

Processing

Hyperspectral Imaging



Robotic Control





Hip joir

(nee joi

Ankle jo



Wireless Communications

Audio



Driving





Reinforcement Learning





Medical Imaging





If your AI model is done with PyTorch, integrate it into MATLAB and Simulink





MATLAB works with TensorFlow and PyTorch:

- Co-execution
- Model converters
- MATLAB Deep Learning Model Hub



Enabling collaboration across engineering, data science and IT teams using Python, MATLAB and Simulink



Start

Load

mai_pya									
1	<pre>t = table(["a";"b";"c"],datetime("now")+days(0:2)')</pre>								
	t = 3×2 table								
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			1	"a"	03-Sep-2024 12:35:19				
			2	"b"	04-Sep-2024 12:35:19				
			3	"c"	05-Sep-2024 12:35:19				
	(
	Ŧ	Run Python Code					Deriver Autorun 🛛 😧		
		df = Run Python code using MATLAB variable t							
		✓ Select input type							
		⊸ Ente	r Pyth	on code					
		df							
	import pandas as pd def add_column(df):								
	df['new_col'] = (1,2,3) return df add_column(df)								
	▶ Output options								
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27		table	(df)						
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			1	"a"	03-Sep-2024 12:35:19		1		
			2	"D'	04-Sep-2024 12:35:19		2		
			3	C	05-Sep-2024 12:35:19		3		

Generative AI for MATLAB AI Chat Playground

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MathWorks® Products Solutions Academia Support Community Events	MATL	AB SD III
MATLAB Answers File Exchange Cody Al Chat Playground Discussions Contests Blogs More -		
<mark>⇔</mark> New -	Сору	Download
All Hello! Whether you're checking out MATLAB for the first time or have been using it for years, I'm here to answer your questions and provide coding tips. Please keep in mind that Al sometimes writes code and text that seems accurate, but isn't. All does not yet have knowledge of features delivered after June 2021 and only limited knowledge of Simulink and specialized toolboxes. This is a space for experimentation. Try it, verify any resulting code, and kindly give the or QP on the results to help improve the responses. * Roll two six-sided dice 1000 times and plot the sum of each roll * 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 kmeans clustering, and then plot the cluster regions Enter prompt here Enter prompt here Benerated code and text might be inaccurate. Validate before use. @About <u>Alphouss</u>		

MATLAB Shorts Video Contest



Generative AI for MATLAB MATLAB GPT for ChatGPT



Generative AI for MATLAB MATLAB Extension for Visual Studio Code





Generative AI for MATLAB

Available at mathworks.com

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ATLAB Answers File Exchange Cody AI Chat Playground Discussions Contests	Blogs Mo	More •	
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san crisis a an searges soas marriere an ance and rook since are presente an INE	- Land	N N N 0 19 > 00	
<pre>% Roll two six-sided dice 1000 times rolls = randi([1, 6], 1000, 2); % Calculate the sum of each roll sum= sum(rolls, 2);</pre>	€ Þ	<pre>come sum(=bn();; sums sum(=bn();; v)=lot the sum of each roll sums(=lifton while(); v)=lot(('frequency'); v)=lot(('frequency'); title('sum of the black soll(); v)=lot('frequency');</pre>	
<pre>% Plot the sum of each roll histogram(sums, 'BisHethad', 'integers'); xlabel('Frequency'); title('sum of No Dice Rolls');</pre>		100 Sum of Two Dice Rolls	
This code uses the rand I function to generate random integers between 1 and 8 for each the two disc. The sum function is then used to calculate the sum of each roll. Finally, the histogram function is used to plot the frequency of each sum. \$2 how can I choose the number of a file or the workhest of file?	roll of	100 /00100 999 80	
4 th Can I customize the appearance of the histogram?		40	
\mathcal{P} is there a way to calculate the probabilities of each sum occurring?		20-	
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AI Chat Playground

Available at OpenAI GPT Store

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Available at Visual Studio Marketplace



Generative AI for MATLAB, Simulink, and Polyspace

In development: MATLAB Copilot

Planned 2025

In development: Simulink Copilot

Planned 2025

In development: Polyspace Copilot

Planned 2025

Available at mathworks.com



AI Chat Playground

Available at OpenAI GPT Store



MATLAB GPT for ChatGPT

Available at Visual Studio Marketplace



MATLAB Extension for VS Code



Data-Driven Functionality and Generative AI

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Demo: Building and Deploying Robust Al Models Lewis Lea, MathWorks



Demo: Integrating LLMs and Generative AI into MATLAB and Simulink Workflows Wenwen Li, MathWorks



Modern Software Practices



Data-Driven Functionality



Leverages Cloud



Reliability



Functional Safety



In my Software-Defined System, can we release a major feature with no hardware changes, leveraging the cloud?





Leveraging the Cloud





Elektrobit

SYNOPSYS[®]













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Integrations to Leverage Data and Cloud



DevOps and CI Platforms



Systems

Integrations to Leverage Data and Cloud



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DevOps and CI Platforms

Model-based Software Developers System Engineers

MathWorks Products Solutions Learn - Company Sign In Enterprise and IT Systems Overview Architecture Patterns CI/CD Data Integrations Application Integration Data Integration Resources Read, write, and analyze data from various data sources **Big Data** FIND BY CATEGORY Big Data Run Apache Spark/Hadoop jobs, or work with third-party data platforms such as Databricks, Cloudera Cloud Data Store and Azure HDInsight. Databases Messaging / Stre roduct Required Pr Data MATLAB Compiler In-product (MATLAB Compiler) - see Documentation File Formats MATLAB Parallel Server In-product (MATLAB Parallel Server) - see Documentation MATLAB Get on GitHub Hadoop MATLAB Compiler In-product (MATLAB Compiler) - see Documentation Parallel Computing Toolbox In-product (MATLAB Parallel Computing Toolbox) - See or MATLAB Parallel Server Databricks MATLAB Compiler Learn more and download Cloudera Data Platform MATLAB Compiler In-product (MATLAB Compiler) - see Docum In-product (MATLAB Parallel Server) - see Documenta MATLAB Parallel Serve MATLAB Compiler Apache Ambari In-product - see Documentatio Azure HDInsight MATLAB Compile In-product - see Documentati

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Google BigQuery



Empowering Platform Engineers: Accelerating MATLAB Startup with Custom Cloud Images



Model-based **Software Developers** **System Engineers**

DevOps and CI Platforms

MATLAB Cold-Start in Cloud: 12

1 minute \rightarrow 25 seconds

Point platform engineers to MathWorks Reference Architectures on GitHub

Search "matlab github packer"





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Talk: Engineering in the Cloud, Unlocking New Possibilities Amélie Lamarquette, MathWorks



Demo: Deploying MATLAB and Simulink in the Cloud Matt Elliot, MathWorks



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Software-Defined Products

Software-Defined Systems

Software-Defined Vehicles

Robotic Surgery Systems

Renewable Energy Systems

Advanced Air Mobility

White Goods

Industrial Packaging Systems

Software-Design Systems

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Panel: Software-Centric Design: Transforming Industry to Be Software First

Anita Teo,Nathan King,BAE SystemsCeres Power

Simon Message, Jaguar and Land Rover

Tim Engstrom, Elysia Battery Intelligence by Fortescue

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Thank you

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