

交大电院软件学院 无人系统设计课程

MATLAB 2021b 工具箱功能简要说明 2022.02

序号	工具箱产品	功能简介	链接
1	5G Toolbox	<p>仿真、分析和测试 5G 通信系统</p> <p>5G Toolbox™ 提供符合标准的函数和参考示例，用于对 5G NR 通信系统进行建模、仿真和验证。该工具箱支持链路级仿真、黄金参考验证、一致性测试以及测试波形生成。</p> <p>借助该工具箱，您可以配置、仿真、测量和分析端到端 5G NR 通信链路，还可以修改或自定义工具箱函数，将其用作实现 5G 系统和设备的参考模型。</p> <p>该工具箱提供一系列函数和参考示例，可帮助您描述上行链路和下行链路基带规范的特征，并仿真射频设计和干扰源对系统性能的影响。您可以通过编程方式或使用 Wireless Waveform Generator 应用程序交互式生成波形并自定义测试平台。利用这些波形，您可以验证您的设计、原型和实现是否符合 3GPP 5G NR 规范。</p>	https://ww2.mathworks.cn/products/5g.html?s_tid=srchtitle_5G%20toolbox_3
		<p>Simulate, analyze, and test 5G communications systems</p> <p>5G Toolbox™ provides standard-compliant functions and reference examples for the modeling, simulation, and verification of 5G New Radio (NR) communications systems. The toolbox supports link-level simulation, golden reference verification, conformance testing, and test waveform generation.</p> <p>With the toolbox you can configure, simulate, measure, and analyze end-to-end 5G NR communications links. You can modify or customize the toolbox functions and use them as reference models for implementing 5G systems and devices. The toolbox provides functions and reference examples to help you characterize uplink and downlink baseband specifications and simulate the effects of RF designs and interference sources on system performance. You can generate waveforms and customize test benches, either programmatically or interactively using the Wireless Waveform Generator app. With these waveforms, you can verify that your designs, prototypes, and implementations comply with the 3GPP 5G NR specifications.</p>	https://ww2.mathworks.cn/help/5g/index.html?s_tid=srchtitle_5G%20toolbox_1

2	Aerospace Blockset	<p>建模、仿真和分析航空航天飞行器动力学</p> <p>Aerospace Blockset™ 提供 Simulink® 参考示例和模块，用于建模、仿真以及分析高保真航空器和航天器平台。其中包括飞行器动力学、已验证的飞行环境模型，以及针对飞行员行为、作动器动力学和动力系统的模块。利用内置的航天航空数学运算、坐标系与空间变换，可以表示航空器和航天器的运动及方向。要检验仿真结果，可将二维和三维可视化模块与模型相连。</p> <p>Aerospace Blockset 提供标准模型架构，用于构建可重用的飞行器平台模型。这些平台模型支持飞行及任务分析、概念研究、详细任务设计、制导/导航和控制 (GNC) 算法开发、软件集成测试以及硬件在环 (HIL) 测试，可应用于自主飞行、雷达与通信等领域。</p>	https://www.mathworks.cn/products/aerospace-blockset.html?s_tid=srchtitle_aerospace%20blockset_2
		<p>Model, simulate, and analyze aerospace vehicle dynamics</p> <p>Aerospace Blockset™ provides Simulink® reference examples and blocks for modeling, simulating, and analyzing high-fidelity aircraft and spacecraft platforms. It includes vehicle dynamics, validated models of the flight environment, and blocks for pilot behavior, actuator dynamics, and propulsion. Built-in aerospace math operations and coordinate system and spatial transformations let you represent aircraft and spacecraft motion and orientation. To examine simulation results, you can connect 2D and 3D visualization blocks to your model.</p> <p>Aerospace Blockset provides standard model architectures for building reusable vehicle platform models. These platform models can support flight and mission analysis; conceptual studies; detailed mission design; guidance, navigation, and control (GNC) algorithm development; software integration testing; and hardware-in-the-loop (HIL) testing for applications in autonomous flight, radar, and communications.</p>	https://www.mathworks.cn/help/aeroblocks/index.html?s_tid=srchtitle_aerospace%20blockset_1

3	Aerospace Toolbox	<p>使用参考标准和模型对航天航空飞行器运动进行分析和可视化</p> <p>Aerospace Toolbox 为分析航空航天飞行器的运动、任务和环境提供了标准的工具和函数。其中包括航空航天数学运算、坐标系和空间转换，以及经过验证的环境模型，可用于解释飞行数据。该工具箱还包括二维和三维可视化工具，以及标准座舱仪表以用于观察飞行器运动。</p> <p>在对飞行器进行分析时，您可以直接将 Data Compendium (DATCOM) 文件导入 MATLAB® 中以反映飞行器的空气动力学。您可以将空气动力学与参考参数结合使用，来定义飞机配置和动力学以进行控制设计和飞行质量分析。</p> <p>借助 Aerospace Toolbox，您可以设计并分析卫星和地面站场景。您可以根据轨道根数或两行轨道数据集传播卫星轨迹，载入卫星和星座星历表，执行使命分析任务（如视距接入），并将场景可视化为地面轨迹或地球。</p>	https://www.mathworks.cn/products/aerospace-toolbox.html?s_tid=srchtitle_aerospace%20toolbox_2
		<p>Analyze and visualize aerospace vehicle motion using reference standards and models</p> <p>Aerospace Toolbox provides standards-based tools and functions for analyzing the motion, mission, and environment of aerospace vehicles. It includes aerospace math operations, coordinate system and spatial transformations, and validated environment models for interpreting flight data. The toolbox also includes 2D and 3D visualization tools and standard cockpit instruments for observing vehicle motion.</p> <p>For flight vehicles, you can import Data Compendium (Datcom) files directly into MATLAB® to represent vehicle aerodynamics. The aerodynamics can be combined with reference parameters to define your aircraft configuration and dynamics for control design and flying qualities analysis.</p> <p>Aerospace Toolbox lets you design and analyze scenarios consisting of satellites and ground stations. You can propagate satellite trajectories from orbital elements or two-line element sets, load in satellite and constellation ephemerides, perform mission analysis tasks such as line-of-sight access, and visualize the scenario as a ground track or globe.</p>	https://www.mathworks.cn/help/aerobx/index.html?s_tid=srchtitle_aerospace%20toolbox_1

4	Antenna Toolbox	<p>设计、分析和可视化天线单元和天线阵列</p> <p>Antenna Toolbox™ 提供用于设计、分析和可视化天线单元和阵列的函数和 App。您可以使用预定义单元设计独立天线和构建天线阵列，可以采用参数化的几何结构、任意平面结构，或者由 STL 文件描述的自定义三维结构。</p> <p>Antenna Toolbox 使用包括矩量法 (MoM) 在内的电磁场求解器，可计算阻抗、电流分布、效率以及近场和远场辐射方向图。要改进天线设计，您可以使用手动方法或工具箱中提供的优化方法。天线几何结构和分析结果能够以二维和三维形式可视化。该工具箱支持您将天线阵列方向图集成到无线系统中，以仿真波束成形和波束控制算法。阻抗分析结果可用于设计与射频前端集成的匹配网络。您可以将天线安装在大型平台上，如车辆或飞机上，并分析结构对天线性能的影响。您可以导入 STL 和 Gerber 文件来分析先前已有的结构，或导出它们来共享您的设计或投入制造。通过站点查看器，您可以使用各种传播模型（包括射线追踪）在三维地形图上可视化天线覆盖范围。</p>	https://www.mathworks.cn/products/antenna.html?s_tid=srchtitle_antenna%20toolbox_2
		<p>Design, analyze, and visualize antenna elements and antenna arrays</p> <p>Antenna Toolbox™ provides functions and apps for the design, analysis, and visualization of antenna elements and arrays. You can design standalone antennas and build arrays of antennas using predefined elements with parameterized geometry, arbitrary planar structures, or custom 3D structures described with STL files.</p> <p>Antenna Toolbox uses electromagnetic solvers, including the method of moments (MoM), to compute impedance, current distribution, efficiency, and near-field and far-field radiation patterns. To improve the antenna design, you can use manual methods or use the optimization methods provided in the toolbox. Antenna geometry and analysis results can be visualized in 2D and 3D. The toolbox lets you integrate antenna array patterns into wireless systems for simulating beamforming and beam steering algorithms. The impedance analysis results can be used to design matching networks for integration with the RF front-end. You can install the antennas on large platforms such as vehicles or aircraft and analyze the effects of the structure on antenna performance. You can import STL and Gerber files to analyze a pre-existing structure or export them to share or manufacture your design. A site viewer enables you to visualize antenna coverage on a 3D terrain map using a variety of propagation models, including ray tracing.</p>	https://www.mathworks.cn/help/antenna/index.html?s_tid=srchtitle_antenna%20toolbox_1

5	Audio Toolbox	<p>设计和分析语音、声学 and 音频处理系统</p> <p>Audio Toolbox™ 为音频处理、语音分析和声学测量提供工具。它包含各种算法，可用于处理音频信号（例如均衡和时间拉伸）、估计声信号指标（例如响度和清晰度）以及提取音频特征（例如 MFCC 和基音）。它还提供先进的机器学习模型（包括 i-vector）和预训练深度学习网络（包括 VGGish 和 CREPE）。工具箱 App 支持实时算法测试、脉冲响应测量和信号标注。该工具箱提供了面向 ASIO、CoreAudio 和其他声卡以及 MIDI 设备的流接口，以及用于生成和托管 VST 和 Audio Units 插件的工具。</p> <p>Audio Toolbox 支持您导入、标注和增强音频数据集，以及提取特征以便训练机器学习和深度学习模型。所提供的预训练模型可应用于录音，以进行高级语义分析。</p> <p>通过对声卡流式传输低延迟音频，您可以实时构建音频处理算法原型，或运行自定义声学测量。您可以将算法转变为音频插件，以在外部托管应用程序（如 Digital Audio Workstations）中运行，从而对其进行验证。通过插件托管，您可以将外部音频插件作为常规 MATLAB® 对象使用。</p>	https://ww2.mathworks.cn/products/audio.html?s_tid=srchtitle_audio%20toolbox_2
		<p>Design and analyze speech, acoustic, and audio processing systems</p> <p>Audio Toolbox™ provides tools for audio processing, speech analysis, and acoustic measurement. It includes algorithms for processing audio signals such as equalization and time stretching, estimating acoustic signal metrics such as loudness and sharpness, and extracting audio features such as MFCC and pitch. It also provides advanced machine learning models, including i-vectors, and pretrained deep learning networks, including VGGish and CREPE. Toolbox apps support live algorithm testing, impulse response measurement, and signal labeling. The toolbox provides streaming interfaces to ASIO™, CoreAudio, and other sound cards; MIDI devices; and tools for generating and hosting VST and Audio Units plugins.</p> <p>With Audio Toolbox you can import, label, and augment audio data sets, as well as extract features to train machine learning and deep learning models. The pre-trained models provided can be applied to audio recordings for high-level semantic analysis.</p> <p>You can prototype audio processing algorithms in real time or run custom acoustic measurements by streaming low-latency audio to and from sound cards. You can validate your algorithm by turning it into an audio plugin to run in external host applications such as Digital Audio Workstations. Plugin hosting lets you use external audio plugins as regular MATLAB® objects.</p>	https://ww2.mathworks.cn/help/audio/index.html?s_tid=srchtitle_audio%20toolbox_1

6	Automated Driving Toolbox	<p>设计、仿真和测试 ADAS 以及自动驾驶系统</p> <p>Automated Driving Toolbox™ 提供用于设计、仿真和测试 ADAS 以及自动驾驶系统的算法和工具。您可以设计和测试视觉和激光雷达感知系统以及传感器融合、路径规划和车辆控制。可视化工具包括显示传感器覆盖范围、检测和跟踪的鸟瞰图和示波器，以及视频、激光雷达和地图的显示。利用该工具箱可以导入和使用 HERE 高清实时地图数据以及 OpenDRIVE® 路网。</p> <p>使用 Ground Truth Labeler 应用，您可以自动标注真值，以训练和评估感知算法。您可以生成并仿真驾驶场景，用于感知、传感器融合、路径规划和控制逻辑的硬件在环 (HIL) 测试和桌面仿真。您可以在拟真的 3D 环境中仿真摄像机、雷达和激光雷达传感器输出，在 2.5-D 仿真环境中仿真目标和车道边界的传感器检测。</p> <p>Automated Driving Toolbox 提供常见 ADAS 和自动驾驶功能的参考应用示例，包括前向碰撞警告、自主紧急制动、自适应巡航控制、车道保持辅助和代客泊车。该工具箱支持 C/C++ 代码生成，实现快速原型和 HIL 测试，支持涵盖传感器融合、跟踪、路径规划和车辆控制器算法。</p>	<p>https://www.mathworks.cn/products/automated-driving.html?s_tid=srchtitle_automated%20driving%20toolbox_3</p>
		<p>Design, simulate, and test ADAS and autonomous driving systems</p> <p>Automated Driving Toolbox™ provides algorithms and tools for designing, simulating, and testing ADAS and autonomous driving systems. You can design and test vision and lidar perception systems, as well as sensor fusion, path planning, and vehicle controllers. Visualization tools include a bird's-eye-view plot and scope for sensor coverage, detections and tracks, and displays for video, lidar, and maps. The toolbox lets you import and work with HERE HD Live Map data and ASAM OpenDRIVE® road networks.</p> <p>Using the Ground Truth Labeler app, you can automate the labeling of ground truth to train and evaluate perception algorithms. For hardware-in-the-loop (HIL) testing and desktop simulation of perception, sensor fusion, path planning, and control logic, you can generate and simulate driving scenarios. You can simulate camera, radar, and lidar sensor output in a photorealistic 3D environment and sensor detections of objects and lane boundaries in a 2.5D simulation environment.</p> <p>Automated Driving Toolbox provides reference application examples for common ADAS and automated driving features, including forward collision warning, autonomous emergency braking, adaptive cruise control, lane keeping assist, and parking valet. The toolbox supports C/C++ code generation for rapid prototyping and HIL testing, with support for sensor fusion, tracking, path planning, and vehicle controller algorithms.</p>	<p>https://www.mathworks.cn/help/driving/index.html?s_tid=srchtitle_automated%20driving%20toolbox_1</p>

7	AUTOSAR Blockset	<p>设计和仿真 AUTOSAR 软件</p> <p>AUTOSAR Blockset 提供各种应用App和模块，以借助 Simulink® 模型开发 AUTOSAR Classic 和 Adaptive 软件。您可以使用 AUTOSAR Component Designer 应用App设计 Simulink 模型并将其映射到软件组件（SWC）。您也可以借助AUTOSAR Blockset，从 AUTOSAR 描述文件(ARXML) 导入软件组件（SWC）和软件组合（Composition），并产生符合 AUTOSAR 标准的 Simulink 模型。</p> <p>AUTOSAR Blockset 还提供了模块和结构用于模拟 AUTOSAR 例程和基础软件层 (BSW) 服务，包括 NVRAM 和诊断服务（Diagnostics）。通过将基础软件（BSW）层服务与应用层软件模型一起进行仿真，可以在Simulink 环境中验证 AUTOSAR ECU 软件。</p> <p>您可以使用 AUTOSAR Blockset 在 Simulink 中创建 AUTOSAR 架构模型（需要 System Composer™）。在 AUTOSAR 架构模型中您可以设计软件组合（Composition）、软件组件（SWC）和接口。您可以添加包括基础软件（BSW）层服务组件在内的仿真行为。另外，您还可以通过 ARXML 描述文件的导入和导出功能实现架构和单元设计的双向处理。</p> <p>AUTOSAR Blockset 支持 C 和 C++ 代码生成（使用 Embedded Coder®）。它已被审核可用于 ISO 26262 标准认证（使用 IEC Certification Kit）。</p>	https://ww2.mathworks.cn/products/autosar.html?s_tid=srchtitle_autosar%20blockset_2
		<p>Design and simulate AUTOSAR software</p> <p>AUTOSAR Blockset provides apps and blocks for developing AUTOSAR Classic and Adaptive software using Simulink® models. You can design and map Simulink models to software components using the AUTOSAR Component Designer app. Alternatively, the blockset lets you generate new Simulink models for AUTOSAR by importing software component and composition descriptions from AUTOSAR XML (ARXML) files.</p> <p>AUTOSAR Blockset provides blocks and constructs for AUTOSAR library routines and Basic Software (BSW) services, including NVRAM and Diagnostics. By simulating the BSW services together with your application software model, you can verify your AUTOSAR ECU software without leaving Simulink.</p> <p>AUTOSAR Blockset lets you create AUTOSAR architecture models in Simulink (requires System Composer™). In the AUTOSAR architecture model, you can author software compositions, components, and interfaces. You can add simulation behavior including Basic Software service components. Alternatively, you can round-trip (import and export) software descriptions via ARXML files.</p> <p>AUTOSAR Blockset supports C and C++ production code generation (with Embedded Coder®). It is qualified for use with the ISO 26262 standard (with IEC Certification Kit).</p>	https://ww2.mathworks.cn/help/autosar/index.html?s_tid=srchtitle_autosar%20blockset_1

8	Bioinformatics Toolbox	<p>读取、分析和可视化基因组和蛋白质组数据</p> <p>Bioinformatics Toolbox™ 提供一系列算法和 App，可用于下一代测序技术 (NGS)、微阵列分析、质谱分析法和基因本体论。您可以使用工具箱函数，从标准文件格式（如 SAM、FASTA、CEL 和 CDF）以及在线数据库（如 NCBI Gene Expression Omnibus 和 GenBank®）读取基因组和蛋白质组数据。您可利用序列浏览器、空间热图和聚类图探查和可视化此类数据。该工具箱还提供了用于检测峰值、针对缺失数据输入值和选择特征的统计方法。</p> <p>您可以综合利用工具箱函数来支持常见的生物信息学工作流。您可以使用 ChIP-Seq 数据来识别转录因子；分析 RNA-Seq 数据来识别差异表达基因；识别微阵列数据中的拷贝数变异和 SNP；使用质谱数据进行蛋白图谱分类。</p>	https://ww2.mathworks.cn/products/bioinfo.html?s_tid=srchtitle_bioinformatics%20toolbox_2
		<p>Read, analyze, and visualize genomic and proteomic data</p> <p>Bioinformatics Toolbox™ provides algorithms and apps for Next Generation Sequencing (NGS), microarray analysis, mass spectrometry, and gene ontology. Using toolbox functions, you can read genomic and proteomic data from standard file formats such as SAM, FASTA, CEL, and CDF, as well as from online databases such as the NCBI Gene Expression Omnibus and GenBank®. You can explore and visualize this data with sequence browsers, spatial heatmaps, and clustergrams. The toolbox also provides statistical techniques for detecting peaks, imputing values for missing data, and selecting features.</p> <p>You can combine toolbox functions to support common bioinformatics workflows. You can use ChIP-Seq data to identify transcription factors; analyze RNA-Seq data to identify differentially expressed genes; identify copy number variants and SNPs in microarray data; and classify protein profiles using mass spectrometry data.</p>	https://ww2.mathworks.cn/help/bioinfo/?s_tid=srchbrcm

9	Communications Toolbox	<p>对通信系统的物理层进行设计和仿真</p> <p>Communications Toolbox™ 提供多种算法和应用程序，可对通信系统进行分析、设计、端到端仿真和验证。工具箱算法包括信道编码、调制、MIMO 和 OFDM，您可以组建和仿真基于标准或自定义设计的无线通信系统的物理层模型。</p> <p>该工具箱提供波形生成应用程序、星座图和眼图、误码率以及其他分析工具和示波器以验证设计。这些工具可用来生成和分析信号、可视化信道特征、获取误差向量幅度 (EVM) 等性能指标。工具箱包含 SISO 及 MIMO 统计和空间信道模型。信道分布选项包括瑞利 (Rayleigh)、莱斯 (Rician) 和 WINNER II 模型。它还包括 RF 损伤，例如 RF 非线性和载波偏移，并提供补偿算法，例如载波和符号定时同步器。这些算法支持您对链路级设计规范进行真实建模并补偿信道衰落效应。</p> <p>使用 Communications Toolbox 配合 RF 仪器或硬件支持包，您可以将发射机和接收机模型连接到无线电设备，并通过无线传输测试来验证设计。</p>	https://www.mathworks.cn/products/communications.html?s_tid=srchtitle_communications%20toolbox_2
		<p>Design and simulate the physical layer of communications systems</p> <p>Communications Toolbox™ provides algorithms and apps for the analysis, design, end-to-end simulation, and verification of communications systems. Toolbox algorithms including channel coding, modulation, MIMO, and OFDM enable you to compose and simulate a physical layer model of your standard-based or custom-designed wireless communications system.</p> <p>The toolbox provides a waveform generator app, constellation and eye diagrams, bit-error-rate, and other analysis tools and scopes for validating your designs. These tools enable you to generate and analyze signals, visualize channel characteristics, and obtain performance metrics such as error vector magnitude (EVM). The toolbox includes SISO and MIMO statistical and spatial channel models. Channel profile options include Rayleigh, Rician, and WINNER II models. It also includes RF impairments, including RF nonlinearity and carrier offset and compensation algorithms, including carrier and symbol timing synchronizers. These algorithms enable you to realistically model link-level specifications and compensate for the effects of channel degradations.</p> <p>Using Communications Toolbox with RF instruments or hardware support packages, you can connect your transmitter and receiver models to radio devices and verify your designs with over-the-air testing.</p>	https://www.mathworks.cn/help/comm/?s_tid=srchbrcm

10	Computer Vision Toolbox	<p>设计和测试计算机视觉、三维视觉和视频处理系统</p> <p>Computer Vision Toolbox™ 提供多种算法、函数和 App，可用于设计和测试计算机视觉、三维视觉和视频处理系统。您可以执行目标检测和跟踪，以及特征检测、提取和匹配。您可以自动化单目相机、立体相机和鱼眼相机的标定工作流。对于三维视觉，该工具箱支持视觉和点云 SLAM、立体视觉、基于运动进行构建和点云处理。各种计算机视觉 App 可自动执行真值标注和相机标定工作流程。</p> <p>您可以使用 YOLO v2、SSD 和 ACF 等深度学习和机器学习算法训练自定义目标检测器。对于语义和实例分割，您可以使用深度学习算法，例如 U-Net 和 Mask R-CNN。该工具箱提供目标检测和分割算法，用于分析太大而无法放入内存的图像。使用预训练模型，您可以检测面部、行人及其他常见目标。</p> <p>您可以在多核处理器和 GPU 上运行算法以实现加速。工具箱算法支持 C/C++ 代码生成，以便集成到现有代码、桌面原型以及嵌入式视觉系统部署。</p>	https://ww2.mathworks.cn/products/computer-vision.html?s_tid=srchtitle_computer%20vision%20toolbox_2
		<p>Design and test computer vision, 3D vision, and video processing systems</p> <p>Computer Vision Toolbox™ provides algorithms, functions, and apps for designing and testing computer vision, 3D vision, and video processing systems. You can perform object detection and tracking, as well as feature detection, extraction, and matching. You can automate calibration workflows for single, stereo, and fisheye cameras. For 3D vision, the toolbox supports visual and point cloud SLAM, stereo vision, structure from motion, and point cloud processing. Computer vision apps automate ground truth labeling and camera calibration workflows.</p> <p>You can train custom object detectors using deep learning and machine learning algorithms such as YOLO v2, SSD, and ACF. For semantic and instance segmentation, you can use deep learning algorithms such as U-Net and Mask R-CNN. The toolbox provides object detection and segmentation algorithms for analyzing images that are too large to fit into memory. Pretrained models let you detect faces, pedestrians, and other common objects.</p> <p>You can accelerate your algorithms by running them on multicore processors and GPUs. Toolbox algorithms support C/C++ code generation for integrating with existing code, desktop prototyping, and embedded vision system deployment.</p>	https://ww2.mathworks.cn/help/vision/?s_tid=srchbrcm

11	Control System Toolbox	<p>设计和分析控制系统</p> <p>Control System Toolbox™ 为系统化地分析、设计和调节线性控制系统提供算法和应用程序。您可以将系统指定为传递函数、状态空间、零极点增益或频率响应模型。通过应用程序和函数（如阶跃响应图和波特图），您可以分析和可视化时域和频域中的系统行为。</p> <p>您可以使用交互式方法（如波特回路整形和根轨迹方法）来调节补偿器参数。该工具箱可以自动调节 SISO 和 MIMO 补偿器，包括 PID 控制器。补偿器可以包括多个跨越若干反馈回路的可调节模块。您可以调节增益调度控制器并指定多个调节目标，如参考跟踪、干扰抑制和稳定裕度。您可以通过校验上升时间、超调量、稳定时间、增益和相位裕度及其他要求来验证您的设计。</p>	https://ww2.mathworks.cn/products/control.html?s_tid=srchtitle_control%20system%20toolbox_2
		<p>Design and analyze control systems</p> <p>Control System Toolbox™ provides algorithms and apps for systematically analyzing, designing, and tuning linear control systems. You can specify your system as a transfer function, state-space, zero-pole-gain, or frequency-response model. Apps and functions, such as step response plot and Bode plot, let you analyze and visualize system behavior in the time and frequency domains.</p> <p>You can tune compensator parameters using interactive techniques such as Bode loop shaping and the root locus method. The toolbox automatically tunes both SISO and MIMO compensators, including PID controllers. Compensators can include multiple tunable blocks spanning several feedback loops. You can tune gain-scheduled controllers and specify multiple tuning objectives, such as reference tracking, disturbance rejection, and stability margins. You can validate your design by verifying rise time, overshoot, settling time, gain and phase margins, and other requirements.</p>	https://ww2.mathworks.cn/help/control/?s_tid=srchbrcm

12	Curve Fitting Toolbox	<p>使用回归、插值和平滑对数据进行曲线和曲面拟合</p> <p>Curve Fitting Toolbox™ 提供一个 App 和多个函数，可对数据进行曲线和曲面拟合。使用该工具箱可以执行探索性数据分析，预处理和后处理数据，比较候选模型，以及删除离群值。您可以使用工具箱提供的线性和非线性模型库进行回归分析，也可以指定自定义方程。该库提供优化的求解器参数和起始条件，以提高拟合质量。该工具箱还提供非参数化建模方法，如样条、插值和平滑。</p> <p>在创建一个拟合之后，您可以运用多种后处理方法进行绘图、插值和外插，估计置信区间，并可计算积分和导数。</p>	https://ww2.mathworks.cn/products/curvefitting.html?s_tid=srchtitle_curve%20fitting%20toolbox_2
		<p>Curve Fitting Toolbox™ provides an app and functions for fitting curves and surfaces to data. The toolbox lets you perform exploratory data analysis, preprocess and post-process data, compare candidate models, and remove outliers. You can conduct regression analysis using the library of linear and nonlinear models provided or specify your own custom equations. The library provides optimized solver parameters and starting conditions to improve the quality of your fits. The toolbox also supports nonparametric modeling techniques, such as splines, interpolation, and smoothing.</p> <p>After creating a fit, you can apply a variety of post-processing methods for plotting, interpolation, and extrapolation; estimating confidence intervals; and calculating integrals and derivatives.</p>	https://ww2.mathworks.cn/help/curvefit/?s_tid=srchbrcm

13	Data Acquisition Toolbox	<p>连接到数据采集卡、设备和模块</p> <p>Data Acquisition Toolbox™ 提供一些应用程序和函数，用于配置数据采集硬件、将数据读入 MATLAB® 和 Simulink®, 以及将数据写入 DAQ 模拟和数字输出通道。该工具箱支持多种 DAQ 硬件，包括来自 National Instruments® 和其他供应商的 USB、PCI、PCI Express®、PXI® 和 PXI Express® 设备。</p> <p>利用该工具箱中的应用程序，您可以交互式地配置和运行数据采集会话。然后生成等效的 MATLAB 代码，以便在将来的会话中自动进行采集。工具箱函数可让您灵活地控制模拟输入、模拟输出、计数器定时器以及 DAQ 设备的数字 I/O 子系统。您可以访问设备特定的功能，同步从多个设备采集的数据。</p> <p>您可以在采集数据时分析数据，或保存数据供后处理。您还可以将测试自动化，并根据分析结果不断迭代更新测试设置。</p>	https://www.mathworks.cn/products/data-acquisition.html?s_tid=srchtitle_data%20acquisition%20%20toolbox_2
		<p>Connect to data acquisition cards, devices, and modules</p> <p>Data Acquisition Toolbox™ provides apps and functions for configuring data acquisition hardware, reading data into MATLAB® and Simulink®, and writing data to DAQ analog and digital output channels. The toolbox supports a variety of DAQ hardware, including USB, PCI, PCI Express®, PXI®, and PXI-Express devices, from National Instruments® and other vendors.</p> <p>The toolbox apps let you interactively set up a data acquisition interface and configure it to your hardware. You can then generate equivalent MATLAB code to automate your data acquisition. Toolbox functions give you the flexibility to control the analog input, analog output, counter/timer, and digital I/O subsystems of a DAQ device. You can access device-specific features and synchronize data acquired from multiple devices.</p> <p>You can analyze data as you acquire it or save it for post-processing. You can also automate tests and make iterative updates to your test setup based on analysis results.</p>	https://www.mathworks.cn/help/daq/?s_tid=srchbrcm

14	Database Toolbox	<p>与关系型和非关系型数据库交换数据</p> <p>Database Toolbox™ 提供 App 和一系列函数，支持与关系型和非关系型数据库交换数据。该工具箱可自动执行数据库与 MATLAB® 数据类型之间的转换，从而实现数据交换。</p> <p>Database Toolbox 支持所有兼容 ODBC 或 JDBC 的关系型数据库。它还提供针对 Apache™ Cassandra®、MongoDB® 和 Neo4j® 的 NoSQL 支持。此外，该工具箱提供 MySQL® 和 PostgreSQL 本地接口。</p> <p>借助数据库资源管理器，您无需编写代码便能探查关系型数据，然后生成 MATLAB 代码，以实现数据库工作流程自动化或可操作化。对于大型数据工作流程，您可以拆分 SQL 查询，然后并行访问数据（需要 Parallel Computing Toolbox™ 和 MATLAB Parallel Server™）。</p>	https://ww2.mathworks.cn/products/database.html?s_tid=srchtitle_database%20%20toolbox_2
		<p>Exchange data with relational and nonrelational databases</p> <p>Database Toolbox™ provides functions and an app for exchanging data with relational and nonrelational databases. It enables this exchange by automatically converting between database and MATLAB® data types.</p> <p>Database Toolbox supports any ODBC-compliant or JDBC-compliant relational database. It also provides NoSQL support for Apache™ Cassandra®, MongoDB®, and Neo4j®. Native interfaces are provided for MySQL® and PostgreSQL.</p> <p>With the Database Explorer app, you can explore relational data without writing code and then generate MATLAB code to automate or operationalize database workflows. For large data workflows, you can split SQL queries and parallelize access to data (with Parallel Computing Toolbox™ and MATLAB Parallel Server™).</p>	https://ww2.mathworks.cn/help/database/?s_tid=srchbrm

15	Datafeed Toolbox	<p>访问来自数据服务提供商的金融数据</p> <p>Datafeed Toolbox™ 支持访问金融数据、新闻、社交媒体数据和交易系统。您可以在 MATLAB® 中建立连接，以检索历史数据流、当日数据流或实时数据流，然后执行分析、开发模型、制定金融交易策略，并通过创建可视化来反映金融行为和市场行为。</p> <p>您可以在 MATLAB 中处理流式数据和基于事件的数据，据此制定自动交易策略，通过行业标准的或专有的交易执行平台对市场事件作出响应。此工具箱提供了多种函数，可用于分析交易成本、访问交易数据和报价数据、定义委托单类型以及执行委托单。</p> <p>支持的数据提供商包括 Bloomberg®、FRED®、Haver Analytics®、Quandl®、Twitter® 和 Refinitiv™。支持的交易执行平台包括 Bloomberg EMSX、Trading Technologies® X_TRADER®、Wind 数据服务 (WDS) 和 CQG®。</p>	https://www.mathworks.cn/products/datafeed.html?s_tid=srchtitle_datafeed%20%20toolbox_2
		<p>Access financial data from data service providers</p> <p>Datafeed Toolbox™ provides access to financial data, news and social media data, and trading systems. You can establish connections from MATLAB® to retrieve historical, intraday, or real-time data streams and then perform analyses, develop models and financial trading strategies, and create visualizations that reflect financial and market behavior.</p> <p>You can use the streaming and event-based data in MATLAB to build automated trading strategies that react to market events via industry-standard or proprietary trade execution platforms. The toolbox includes functions for analyzing transaction costs, accessing trade and quote pricing data, defining order types, and executing orders.</p> <p>Supported data providers include Bloomberg®, FRED®, Haver Analytics®, Quandl®, Twitter®, and Refinitiv™. Supported trade execution platforms include Bloomberg EMSX, Trading Technologies® X_TRADER®, Wind Data Feed Services (WDS), and CQG®.</p>	https://www.mathworks.cn/help/datafeed/?s_tid=srchbrm

16	DDS Blockset	<p>设计和仿真 DDS 应用</p> <p>DDS Blockset 提供一系列 App 和模块，可对通过数据分发服务 (DDS) 中间件发布或订阅数据的软件应用进行建模和仿真。该模块集包括 DDS 字典，用于在 Simulink® 中管理、创建和编辑 DDS 定义。您可以导入 XML 文件形式的 DDS 设定，以创建一个 Simulink 模型骨架，作为开发 DDS 应用算法的起点。</p> <p>DDS Blockset 提供多种模块，支持通过 DDS 发布和订阅数据采样及其相应的服务质量 (QoS)。它完全集成了 RTI Connext DDS 和 eProsima Fast DDS 堆栈。</p> <p>DDS Blockset 可以从 Simulink 模型生成 C++ 代码和 XML 文件（需要 Embedded Coder®）。</p>	https://www.mathworks.cn/products/dds.html?s_tid=srchtitle_DDS%20Blockset_2
		<p>Design and simulate DDS applications</p> <p>DDS Blockset provides apps and blocks for modeling and simulating software applications that publish or subscribe to Data Distribution Service (DDS) middleware. The blockset includes a DDS dictionary that lets you manage, create, and edit your DDS definitions in Simulink®. You can import DDS specifications as XML files to create a skeleton Simulink model as a starting point for developing algorithms for DDS applications.</p> <p>DDS Blockset provides blocks for publishing and subscribing samples to DDS, including their corresponding Quality of Service (QoS). It fully integrates with the RTI Connext DDS and eProsima Fast DDS stacks.</p> <p>DDS Blockset generates C++ code and XML files from Simulink models (with Embedded Coder®).</p>	https://www.mathworks.cn/help/dds/?s_tid=srchtitle_DDS%20Blockset_2

17	Deep Learning HDL Toolbox	<p>面向 FPGA 和 SoC 进行深度学习网络原型开发和部署</p> <p>Deep Learning HDL Toolbox™ 提供一系列函数和工具，用于面向 FPGA 和 SoC 进行深度学习网络原型开发和实现。它提供预置的比特流，用于在支持的 Xilinx® 和 Intel® FPGA 与 SoC 设备上运行各种深度学习网络。借助性能分析和估计工具，您可以探索各种设计、性能和资源使用量权衡方案，以便自定义深度学习网络。</p> <p>通过 Deep Learning HDL Toolbox，您可以自定义深度学习网络的硬件实现，并生成可移植、可合成的 Verilog® 和 VHDL® 代码，在各种 FPGA 上进行部署（需要 HDL Coder™ 和 Simulink®）。</p>	https://ww2.mathworks.cn/products/deep-learning-hdl.html?s_tid=srchtitle_deep%20learning%20HDL%20toolbox_2
		<p>Prototype and deploy deep learning networks on FPGAs and SoCs</p> <p>Deep Learning HDL Toolbox™ provides functions and tools to prototype and implement deep learning networks on FPGAs and SoCs. It provides pre-built bitstreams for running a variety of deep learning networks on supported Xilinx® and Intel® FPGA and SoC devices. Profiling and estimation tools let you customize a deep learning network by exploring design, performance, and resource utilization tradeoffs.</p> <p>Deep Learning HDL Toolbox enables you to customize the hardware implementation of your deep learning network and generate portable, synthesizable Verilog® and VHDL® code for deployment on any FPGA (with HDL Coder™ and Simulink®).</p>	https://ww2.mathworks.cn/help/deep-learning-hdl/?s_tid=srchbrcm

18	Deep Learning Toolbox	<p>设计、训练和分析深度学习网络</p> <p>Deep Learning Toolbox™ 提供了一个用于通过算法、预训练模型和 App 来设计和实现深度神经网络的框架。您可以使用卷积神经网络 (ConvNet、CNN) 和长短期记忆 (LSTM) 网络对图像、时序和文本数据执行分类和回归。您可以使用自动微分、自定义训练循环和共享权重来构建网络架构，如生成对抗网络 (GAN) 和孪生网络。使用深度网络设计器，您能够以图形方式设计、分析和训练网络。试验管理器可帮助您管理多个深度学习试验，跟踪训练参数，分析结果，并比较不同试验的代码。您可以可视化层激活，并以图形方式监控训练进度。</p> <p>您可以通过 ONNX™ 格式与 TensorFlow™ 和 PyTorch 交换模型，并从 TensorFlow-Keras 和 Caffe 导入模型。该工具箱支持使用 DarkNet-53、ResNet-50、NASNet、SqueezeNet 和许多其他预训练模型进行迁移学习。</p> <p>您可以在单 GPU 或多 GPU 工作站（安装了 Parallel Computing Toolbox™）上加快训练速度，或扩展到集群和云，包括 NVIDIA® GPU Cloud 和 Amazon EC2® GPU 实例（安装了 MATLAB® Parallel Server™）。</p>	https://www.mathworks.cn/help/deeplearning/?s_tid=srchbrcm
		<p>Design, train, and analyze deep learning networks</p> <p>Deep Learning Toolbox™ provides a framework for designing and implementing deep neural networks with algorithms, pretrained models, and apps. You can use convolutional neural networks (ConvNets, CNNs) and long short-term memory (LSTM) networks to perform classification and regression on image, time-series, and text data. You can build network architectures such as generative adversarial networks (GANs) and Siamese networks using automatic differentiation, custom training loops, and shared weights. With the Deep Network Designer app, you can design, analyze, and train networks graphically. The Experiment Manager app helps you manage multiple deep learning experiments, keep track of training parameters, analyze results, and compare code from different experiments. You can visualize layer activations and graphically monitor training progress.</p> <p>You can exchange models with TensorFlow™ and PyTorch through the ONNX™ format and import models from TensorFlow-Keras and Caffe. The toolbox supports transfer learning with DarkNet-53, ResNet-50, NASNet, SqueezeNet and many other pretrained models.</p> <p>You can speed up training on a single- or multiple-GPU workstation (with Parallel Computing Toolbox™), or scale up to clusters and clouds, including NVIDIA® GPU Cloud and Amazon EC2® GPU instances (with MATLAB® Parallel Server™).</p>	https://www.mathworks.cn/help/deeplearning/index.html?lang=en

19	DSP System Toolbox	<p>对流信号处理系统进行设计和仿真</p> <p>DSP System Toolbox™ 提供多种算法、App 和示波器，用于在 MATLAB® 和 Simulink® 中设计、仿真和分析信号处理系统。您可以为通信、雷达、音频、医疗设备、IoT 和其它应用进行实时 DSP 系统建模。</p> <p>DSP System Toolbox 支持您设计和分析 FIR、IIR、多速率、多级和自适应滤波器。您可以从变量、数据文件和网络设备流式传输信号以进行系统开发和验证。时域示波器、频谱分析器和逻辑分析器支持您对流信号进行动态可视化和测量。在桌面原型构建和嵌入式处理器（包括 ARM® Cortex® 架构）部署方面，该系统工具箱支持 C/C++ 代码生成。它还支持从滤波器、FFT、IFFT 和其他算法进行位真定点建模和 HDL 代码生成。</p> <p>算法采用多种形式，包括 MATLAB 函数、System object™ 和 Simulink 模块。</p>	https://ww2.mathworks.cn/products/dsp-system.html?s_tid=srchtitle_DSP%20system%20toolbox_2
		<p>Design and simulate streaming signal processing systems</p> <p>DSP System Toolbox™ provides algorithms, apps, and scopes for designing, simulating, and analyzing signal processing systems in MATLAB® and Simulink®. You can model real-time DSP systems for communications, radar, audio, medical devices, IoT, and other applications.</p> <p>With DSP System Toolbox you can design and analyze FIR, IIR, multirate, multistage, and adaptive filters. You can stream signals from variables, data files, and network devices for system development and verification. The Time Scope, Spectrum Analyzer, and Logic Analyzer let you dynamically visualize and measure streaming signals. For desktop prototyping and deployment to embedded processors, including ARM® Cortex® architectures, the toolbox supports C/C++ code generation. It also supports bit-accurate fixed-point modeling and HDL code generation from filters, FFT, IFFT, and other algorithms.</p> <p>Algorithms are available as MATLAB functions, System objects, and Simulink blocks.</p>	https://ww2.mathworks.cn/help/dsp/?s_tid=srchbrcm

20	Econometrics Toolbox	<p>使用统计方法对金融和经济系统进行建模和分析</p> <p>Econometrics Toolbox™ 提供用于对时序数据进行建模和分析的函数。该工具箱包含多种用于选择模型的诊断检验，包括脉冲分析检验、单位根和平稳性检验、协整检验和结构变化检验。您可以使用多种模型来估算、模拟及预测经济系统，这些模型包括回归、ARIMA、状态空间、GARCH、多元 VAR 和 VEC 以及表示数据动态变化的转换模型。此外，工具箱还提供基于贝叶斯和马尔可夫框架的工具，用于开发可基于新数据进行学习的时变模型。</p>	https://ww2.mathworks.cn/products/econometrics.html?s_tid=srchtitle_econometrics%20toolbox_2
		<p>Model and analyze financial and economic systems using statistical methods</p> <p>Econometrics Toolbox™ provides functions for analyzing and modeling time series data. It offers a wide range of visualizations and diagnostics for model selection, including tests for autocorrelation and heteroscedasticity, unit roots and stationarity, cointegration, causality, and structural change. You can estimate, simulate, and forecast economic systems using a variety of modeling frameworks. These frameworks include regression, ARIMA, state-space, GARCH, multivariate VAR and VEC, and switching models. The toolbox also provides Bayesian tools for developing time-varying models that learn from new data.</p>	https://ww2.mathworks.cn/help/econ/?s_tid=srchbrcm

21	Embedded Coder	<p>生成针对嵌入式系统优化的 C 和 C++ 代码</p> <p>Embedded Coder® 可生成可读、紧凑且快速的 C 和 C++ 代码，以便用于大规模生产中使用的嵌入式处理器。它扩展了 MATLAB Coder™ 和 Simulink Coder™ 的功能，支持通过高级优化对生成的函数、文件和数据进行精确控制。这些优化可提高代码效率，并有助于与已有代码、数据类型和标定参数集成。您可以集成第三方开发工具，以便为嵌入式系统或快速原型板上的全套部署构建可执行文件。</p> <p>Embedded Coder 为 AUTOSAR、MISRA C® 和 ASAP2 软件标准提供内置支持。它还提供可追溯性报告、代码文档记录和自动化软件验证功能，以支持 DO-178、IEC 61508 和 ISO 26262 软件开发。Embedded Coder 代码可移植，并且可在任何处理器上编译和执行。此外，Embedded Coder 为特定硬件提供了包含高级优化和设备驱动程序的支持软件包。</p> <p>了解各家公司如何使用 Embedded Coder 生成产品级代码，用于控制、信号处理、图像处理 and 计算机视觉以及机器学习应用。</p>	https://www.mathworks.cn/products/embedded-coder.html?s_tid=srchtitle_embedded%20coder_2
		<p>Generate C and C++ code optimized for embedded systems</p> <p>Embedded Coder® generates readable, compact, and fast C and C++ code for embedded processors used in mass production. It extends MATLAB® Coder™ and Simulink® Coder with advanced optimizations for precise control of the generated functions, files, and data. These optimizations improve code efficiency and facilitate integration with legacy code, data types, and calibration parameters. You can incorporate a third-party development tool to build an executable for turnkey deployment on your embedded system or rapid prototyping board.</p> <p>Embedded Coder offers built-in support for AUTOSAR, MISRA C®, and ASAP2 software standards. It also provides traceability reports, code documentation, and automated software verification to support DO178, IEC 61508, and ISO 26262 software development. Embedded Coder code is portable, and can be compiled and executed on any processor. In addition, it offers support packages with advanced optimizations and device drivers for specific hardware.</p>	https://www.mathworks.cn/help/ecoder/index.html?lang=en

22	Filter Design HDL Coder	<p>为定点滤波器生成 HDL 代码</p> <p>Filter Design HDL Coder™ 用于生成可合成、可移植的 VHDL® 和 Verilog® 代码，以实现在 FPGA 或 ASIC 上使用 MATLAB® 设计的定点滤波器。它还可以自动创建 VHDL 和 Verilog 测试平台，以仿真、测试和验证生成的代码。</p>	https://ww2.mathworks.cn/products/filterhdl.html?s_tid=srchtitle_filter%20design%20HDL%20coder_3
		<p>Generate HDL code for fixed-point filters</p> <p>Filter Design HDL Coder™ generates synthesizable, portable VHDL® and Verilog® code for implementing fixed-point filters designed with MATLAB® on FPGAs or ASICs. It automatically creates VHDL and Verilog test benches for simulating, testing, and verifying the generated code.</p>	https://ww2.mathworks.cn/help/hdlfilter/?s_tid=srchbrcm

23	Financial Instruments Toolbox	<p>设计、定价和对冲复杂的金融工具</p> <p>金融工具箱™提供用于定价、建模、对冲和管理工具组合的功能。您可以分析固定收益证券和衍生工具的现金流，包括利率、通货膨胀、股票、商品、信贷和能源工具。该工具箱提供了一个模块化框架，支持各种工作流程，使您能够使用各种模型和定价方法对工具进行定价。</p>	https://ww2.mathworks.cn/products/financial-instruments.html?s_tid=srchtitle_financial%20instruments%20toolbox_1
		<p>Design, price, and hedge complex financial instruments</p> <p>Financial Instruments Toolbox™ provides functions for pricing, modeling, hedging, and analyzing cash flows, fixed-income securities, and derivative instruments (including equity, interest-rate, credit, and energy instruments). For interest-rate instruments, you can calculate price, yield, spread, and sensitivity values for various instrument types, including convertible bonds, mortgage-backed securities, treasury bills, bonds, swaps, caps, floors, and floating-rate notes. For derivative instruments, you can compute price, implied volatility, and Greeks using binomial trees, trinomial trees, Shifted SABR, Heston, Monte Carlo simulation, and other models. You can also connect to Numerix® CrossAsset Integration Layer for the valuation and risk management of fixed-income securities, OTC derivatives, structured products, and variable annuity products.</p>	https://ww2.mathworks.cn/help/fininst/?s_tid=srchbrcm

24	Financial Toolbox	<p>分析金融数据，开发金融模型</p> <p>Financial Toolbox™ 提供了众多函数，用于对金融数据进行数学建模和统计分析。您可以对投资组合进行分析、回测和优化，同时将周转率、交易成本、半连续约束以及最小或最大资产数量考虑在内。该工具箱可用于评估风险、对信用评分卡建模、分析收益率曲线、对固定收益工具和欧式期权定价，以及衡量投资业绩。</p> <p>随机微分方程 (SDE) 工具支持您对各种随机过程进行建模和模拟。时序分析函数可帮助您在缺失数据的情况下执行转换或回归，并在不同交易日历和天数计算规则之间进行转换。</p>	https://www.mathworks.cn/products/finance.html?s_tid=srchtitle_financial%20toolbox_2
		<p>Analyze financial data and develop financial models</p> <p>Financial Toolbox™ provides functions for the mathematical modeling and statistical analysis of financial data. You can analyze, backtest, and optimize investment portfolios taking into account turnover, transaction costs, semi-continuous constraints, and minimum or maximum number of assets. The toolbox enables you to estimate risk, model credit scorecards, analyze yield curves, price fixed-income instruments and European options, and measure investment performance.</p> <p>Stochastic differential equation (SDE) tools let you model and simulate a variety of stochastic processes. Time series analysis functions let you perform transformations or regressions with missing data and convert between different trading calendars and day-count conventions.</p>	https://www.mathworks.cn/help/finance/index.html?lang=en

25	Fixed-Point Designer	<p>对定点和浮点算法进行建模和优化</p> <p>Fixed-Point Designer™ 提供了丰富的数据类型和工具，用于在嵌入式硬件上优化和实现定点和浮点算法。它包括定点和浮点数据类型以及特定于目标的数值设置。使用 Fixed-Point Designer，您可以执行特定于目标的定点位真仿真。然后，您可以事先测试和调试溢出及精度损失等量化效应，之后再在硬件上实现设计。</p> <p>Fixed-Point Designer 提供的应用程序和工具可用于分析双精度算法，并将其转换为降精度浮点或定点。使用优化工具，您可以选择满足数值精度要求和目标硬件约束的数据类型。为了高效实现，您可以将运算量庞大的设计构造替换为硬件最优的模式，如压缩的查找表。</p> <p>您可以直接从定点和浮点优化模型生成产品级 C 和 HDL 代码。</p>	https://ww2.mathworks.cn/products/fixed-point-designer.html?s_tid=srchtitle_fixed=point%20designer_2
		<p>Model and optimize fixed-point and floating-point algorithms</p> <p>Fixed-Point Designer™ provides data types and tools for optimizing and implementing fixed-point and floating-point algorithms on embedded hardware. It includes fixed-point and floating-point data types and target-specific numeric settings. With Fixed-Point Designer you can perform target-aware simulation that is bit-true for fixed point. You can then test and debug quantization effects such as overflows and precision loss before implementing the design on hardware.</p> <p>Fixed-Point Designer provides apps and tools for analyzing double-precision algorithms and converting them to reduced-precision floating point or fixed point. Optimization tools enable you to select data types that meet your numerical accuracy requirements and target hardware constraints. For efficient implementation you can replace computationally expensive design constructs with hardware-optimal patterns such as compressed lookup tables.</p> <p>Production C and HDL code can be generated directly from your fixed- and floating-point optimized models.</p>	https://ww2.mathworks.cn/help/fixedpoint/index.html?lang=en

26	Fuzzy Logic Toolbox	<p>对模糊逻辑系统进行设计和仿真</p> <p>Fuzzy Logic Toolbox™ 提供了 MATLAB® 函数、应用程序和 Simulink® 模块，用于对基于模糊逻辑的系统进行分析、设计和仿真。该产品将指导您按步骤完成模糊推理系统的设计。它为很多常用的方法，包括模糊聚类 and 自适应神经模糊学习，提供了函数。</p> <p>借助此工具箱，您可以使用简单的逻辑规则为复杂的系统行为建模，然后在模糊推理系统中实现这些规则。您可以将其用作独立的模糊推理引擎。或者可以在 Simulink 中使用模糊推理模块，在整个动态系统的综合模型中对模糊系统进行仿真。</p>	https://ww2.mathworks.cn/products/fuzzy-logic.html?s_tid=srchtitle_fuzzy%20logic%20toolbox_2
		<p>Design and simulate fuzzy logic systems</p> <p>Fuzzy Logic Toolbox™ provides MATLAB® functions, apps, and a Simulink® block for analyzing, designing, and simulating systems based on fuzzy logic. The product guides you through the steps of designing fuzzy inference systems. Functions are provided for many common methods, including fuzzy clustering and adaptive neuro-fuzzy learning.</p> <p>The toolbox lets you model complex system behaviors using simple logic rules, and then implement these rules in a fuzzy inference system. You can use it as a stand-alone fuzzy inference engine. Alternatively, you can use fuzzy inference blocks in Simulink and simulate the fuzzy systems within a comprehensive model of the entire dynamic system.</p>	https://ww2.mathworks.cn/help/fuzzy/?s_tid=srchrcm

27	Global Optimization Toolbox	<p>求解多个极大值、多个极小值和非光滑优化问题</p> <p>Global Optimization Toolbox 所提供的函数可为包含多个极大值或极小值的问题搜索全局解。工具箱求解器包括替代、模式搜索、遗传算法、粒子群、模拟退火、多初始点和全局搜索。对于目标函数或约束函数连续、不连续、随机、导数不存在或包含模拟或黑箱函数的优化问题，都可以使用这些求解器。对于有多个目标的问题，您可以使用遗传算法或模式搜索求解器确定帕累托前沿。</p> <p>您可以通过调整选项，或者对于适用的求解器，通过自定义创建、更新和搜索函数，从而提高求解器效率。可以使用自定义数据类型，配合遗传算法和模拟退火求解器，来描绘采用标准数据类型不容易表达的问题。利用混合函数选项，可在第一个求解器之后应用第二个求解器来改进解。</p>	https://ww2.mathworks.cn/products/global-optimization.html?s_tid=srchtitle_global%20optimization%20toolbox_2
		<p>Solve multiple maxima, multiple minima, and nonsmooth optimization problems</p> <p>Global Optimization Toolbox provides functions that search for global solutions to problems that contain multiple maxima or minima. Toolbox solvers include surrogate, pattern search, genetic algorithm, particle swarm, simulated annealing, multistart, and global search. You can use these solvers for optimization problems where the objective or constraint function is continuous, discontinuous, stochastic, does not possess derivatives, or includes simulations or black-box functions. For problems with multiple objectives, you can identify a Pareto front using genetic algorithm or pattern search solvers.</p> <p>You can improve solver effectiveness by adjusting options and, for applicable solvers, customizing creation, update, and search functions. You can use custom data types with the genetic algorithm and simulated annealing solvers to represent problems not easily expressed with standard data types. The hybrid function option lets you improve a solution by applying a second solver after the first.</p>	https://ww2.mathworks.cn/help/gads/?s_tid=srchrcm

28	GPU Coder	<p>为 NVIDIA GPU 生成 CUDA 代码</p> <p>GPU Coder™ 可从 MATLAB® 代码和 Simulink® 模型生成优化的 CUDA® 代码。所生成的代码包含 CUDA 内核，针对深度学习、嵌入式视觉和信号处理算法的可并行化部分。为了提高性能，生成的代码会调用优化的 NVIDIA® CUDA 库，包括 TensorRT™、cuDNN、cuFFT、cuSolver 和 cuBLAS。您可以将这些代码作为源代码、静态库或动态库集成到您的项目，也可以针对桌面、服务器和嵌入到 NVIDIA Jetson™、NVIDIA DRIVE™ 及其他平台的 GPU 进行编译。您可以使用在 MATLAB 中生成的 CUDA 代码，对深度学习网络以及算法中的其他计算密集型部分进行加速。使用 GPU Coder，您可以将手写 CUDA 代码整合到您的 MATLAB 算法和生成的代码中。</p> <p>您可以将 GPU Coder 与 Embedded Coder® 结合使用，以通过软件在环 (SIL) 测试和处理器在环 (PIL) 测试验证生成代码的数值行为。</p>	https://www.mathworks.cn/products/gpu-coder.html?s_tid=srchtitle_GPU%20coder_2
		<p>Generate CUDA code for NVIDIA GPUs</p> <p>GPU Coder™ generates optimized CUDA® code from MATLAB® code and Simulink® models. The generated code includes CUDA kernels for parallelizable parts of your deep learning, embedded vision, and signal processing algorithms. For high performance, the generated code calls optimized NVIDIA® CUDA libraries, including TensorRT, cuDNN, cuFFT, cuSolver, and cuBLAS. The code can be integrated into your project as source code, static libraries, or dynamic libraries, and it can be compiled for desktops, servers, and GPUs embedded on NVIDIA Jetson®, NVIDIA DRIVE®, and other platforms. You can use the generated CUDA within MATLAB to accelerate deep learning networks and other computationally intensive portions of your algorithm. GPU Coder lets you incorporate handwritten CUDA code into your algorithms and into the generated code.</p> <p>When used with Embedded Coder®, GPU Coder lets you verify the numerical behavior of the generated code via software-in-the-loop (SIL) and processor-in-the-loop (PIL) testing.</p>	https://www.mathworks.cn/help/gpu/coder/?s_tid=srchbrcm

29	HDL Coder	<p>生成用于 FPGA 和 ASIC 设计的 VHDL 和 Verilog 代码</p> <p>HDL Coder 从 MATLAB® 函数、Simulink® 模型和 Stateflow® 图表生成可移植、可合成的 Verilog® 和 VHDL® 代码。生成的 HDL 代码可用于 FPGA 编程或 ASIC 原型建立和设计。</p> <p>HDL Coder 提供用于 Xilinx®、Microsemi® 和 Intel® FPGA 自动化编程的 Workflow Advisor。您可以控制 HDL 架构 (49:42) 和实现、突出显示关键路径，以及生成硬件资源利用率估算信息。HDL Coder 可在 Simulink 模型与生成的 Verilog 和 VHDL 代码之间建立可追溯性，从而能够遵循 DO-254 及其他标准对高完整性应用进行代码验证。</p>	https://www.mathworks.cn/products/hdl-coder.html?s_tid=srchtitle_HDL%20coder_2
		<p>Generate VHDL and Verilog code for FPGA and ASIC designs</p> <p>HDL Coder™ generates portable, synthesizable VHDL® and Verilog® code from MATLAB® functions, Simulink® models, and Stateflow® charts. The generated HDL code can be used for FPGA programming or ASIC prototyping and design.</p> <p>HDL Coder provides a workflow advisor that automates the programming of Xilinx®, Microsemi®, and Intel® FPGAs. You can control HDL architecture and implementation, highlight critical paths, and generate hardware resource utilization estimates. HDL Coder provides traceability between your Simulink model and the generated Verilog and VHDL code, enabling code verification for high-integrity applications adhering to DO-254 and other standards.</p> <p>Support for industry standards is available through IEC Certification Kit (for ISO 26262 and IEC 61508).</p>	https://www.mathworks.cn/help/hdlcoder/?s_tid=srchbreadcrumb

30	HDL Verifier	<p>使用 HDL 仿真器和 FPGA 板测试并验证 Verilog 和 VHDL</p> <p>利用 HDL Verifier™ 可以测试并验证 FPGA、ASIC 和 SoC 的 Verilog® 和 VHDL® 设计。您可以借助 HDL 仿真器，通过协同仿真，对照在 MATLAB® 或 Simulink® 中运行的测试平台来验证 RTL。同样的测试平台还可用于 FPGA 和 SoC 开发板，以验证硬件中的 HDL 实现。</p> <p>HDL Verifier 提供了一些工具，用于在 Xilinx® 和 Intel® 板上调试和测试 FPGA 实现。您可以使用 MATLAB 写入和读取内存映射的寄存器，以便在硬件上测试设计。您可以将探测器插入到设计中，并设置触发条件，从而将内部信号上传到 MATLAB 进行可视化和分析。</p> <p>HDL Verifier 会生成验证模型，以供在 RTL 测试平台中使用，包括 Universal Verification Methodology (UVM) 测试平台。这些模型在支持 SystemVerilog Direct Programming Interface (DPI) 的仿真器中本地运行。</p>	https://www.mathworks.cn/products/hdl-verifier.html?s_tid=srchtitle_HDL%20verifier_2
		<p>Test and verify Verilog and VHDL using HDL simulators and FPGA boards</p> <p>HDL Verifier™ lets you test and verify Verilog® and VHDL® designs for FPGAs, ASICs, and SoCs. You can verify RTL against test benches running in MATLAB® or Simulink® using cosimulation with an HDL simulator. These same test benches can be used with FPGA and SoC development boards to verify HDL implementations in hardware.</p> <p>HDL Verifier provides tools for debugging and testing FPGA implementations on Xilinx® and Intel® boards. You can use MATLAB to write to and read from memory-mapped registers for testing designs on hardware. You can insert probes into designs and set trigger conditions to upload internal signals into MATLAB for visualization and analysis.</p> <p>HDL Verifier generates verification models for use in RTL test benches, including Universal Verification Methodology (UVM) test benches. These models run natively in simulators that support the SystemVerilog Direct Programming Interface (DPI).</p>	https://www.mathworks.cn/help/hdl-verifier/?s_tid=srchbrcm

31	Image Acquisition Toolbox	<p>通过行业标准硬件采集图像和视频</p> <p>Image Acquisition Toolbox™ 包含一系列函数和模块，可将相机连接到 MATLAB® 和 Simulink®。它包含一个可让您交互式检测和配置硬件属性的 MATLAB 属性。您然后可以生成等效的 MATLAB 代码，以便在将来的会话中自动进行采集。该工具箱支持各种采集模式，如在环处理、硬件触发、后台采集以及跨多台设备同步采集。</p> <p>Image Acquisition Toolbox 支持所有主要标准和硬件供应商，包括 USB3 Vision、GigE Vision® 和 GenICam™ GenTL。您可以连接到机器视觉相机和抓帧器，以及高端科学和工业设备。</p>	https://ww2.mathworks.cn/products/image-acquisition.html?s_tid=srchtitle_image%20acquisition%20toolbox_2
		<p>Acquire images and video from industry-standard hardware</p> <p>Image Acquisition Toolbox™ provides functions and blocks for connecting cameras to MATLAB® and Simulink®. It includes a MATLAB app that lets you interactively detect and configure hardware properties. You can then generate equivalent MATLAB code to automate your acquisition in future sessions. The toolbox enables acquisition modes such as processing in-the-loop, hardware triggering, background acquisition, and synchronizing acquisition across multiple devices.</p> <p>Image Acquisition Toolbox supports all major standards and hardware vendors, including USB3 Vision, GigE Vision®, and GenICam™ GenTL. You can connect to machine vision cameras and frame grabbers, as well as high-end scientific and industrial devices.</p>	https://ww2.mathworks.cn/help/imag/?s_tid=srchbrcm

32	Image Processing Toolbox	<p>执行图像处理、可视化和分析</p> <p>Image Processing Toolbox™ 提供了一套全方位的参照标准算法和 workflow 应用程序，用于进行图像处理、分析、可视化和算法开发。可进行图像分割、图像增强、降噪、几何变换、图像配准和三维图像处理。</p> <p>利用 Image Processing Toolbox 应用程序，可自动完成常用图像处理流程。可采用交互方式分割图像数据，比较图像配准方法，对大型数据集进行批处理。利用可视化函数和应用程序，可以探查图像、三维物体以及视频，调节对比度，创建灰度图以及操作感兴趣区域 (ROI)。</p> <p>可通过在多核处理器和 GPU 上运行算法来进行加速。许多工具箱函数支持实现桌面原型建立和嵌入式视觉系统部署的 C/C++ 代码生成。</p>	https://www.mathworks.cn/products/image.html?s_tid=srchtitle_image%20%20processing%20toolbox_2
		<p>Perform image processing, visualization, and analysis</p> <p>Image Processing Toolbox™ provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development. You can perform image segmentation, image enhancement, noise reduction, geometric transformations, and image registration using deep learning and traditional image processing techniques. The toolbox supports processing of 2D, 3D, and arbitrarily large images.</p> <p>Image Processing Toolbox apps let you automate common image processing workflows. You can interactively segment image data, compare image registration techniques, and batch-process large datasets. Visualization functions and apps let you explore images, 3D volumes, and videos; adjust contrast; create histograms; and manipulate regions of interest (ROIs).</p> <p>You can accelerate your algorithms by running them on multicore processors and GPUs. Many toolbox functions support C/C++ code generation for desktop prototyping and embedded vision system deployment.</p> <p>图像处理工具箱™为图像处理、分析、可视化和算法开发提供了一套全面的参考标准算法和 workflow 应用程序。您可以使用深度学习和传统图像处理技术执行图像分割、图像增强、降噪、几何变换和图像配准。该工具箱支持处理 2D、3D 和任意大的图像。</p> <p>图像处理工具箱应用程序可让您自动执行常见的图像处理工作流。您可以以交互方式分割图像数据、比较图像配准技术以及批处理大型数据集。可视化函数和应用程序可让您探索图像、3D 体积和视频、调整对比度、创建直方图并操纵感兴趣的区</p>	https://www.mathworks.cn/help/images/index.html?lang=en

33	Instrument Control Toolbox	<p>控制测试和测量仪器并与计算机外设和工业自动化设备通信</p> <p>利用 Instrument Control Toolbox™，可将 MATLAB® 直接连接到各种仪器，如示波器、函数发生器、信号分析仪、电源设备和分析仪器。该工具箱通过仪器驱动程序（如 IVI 和 VXIplug&play），或在常用的通信协议（如 GPIB、VISA、TCP/IP 和 UDP）上通过基于文本的 SCPI 命令，连接到您的仪器。您还可以控制测试设备并从中采集数据，而无需编写代码。</p> <p>使用 Instrument Control Toolbox，您可以在 MATLAB 中生成数据以将其发送至仪器，或将数据读入 MATLAB 进行分析和可视化处理。您可以根据 LXI、PXI 和 AXIe 标准自动执行测试、验证硬件设计和构建测试系统。</p> <p>该工具箱提供对 TCP/IP、UDP、I2C、SPI 和 Bluetooth® 串行协议的内置支持，从 MATLAB 中实现与其他计算机和印刷电路板 (PCB) 的远程通信。它还包含 MODBUS 协议专用的函数和应用，从而实现与可编程逻辑控制器 (PLC) 和可编程自动化控制器 (PAC) 等工业自动化设备的通信。</p>	https://www.mathworks.cn/products/instrument.html?s_tid=srchtitle_instrument%20control%20toolbox_1
		<p>Control test and measurement instruments and communicate with computer peripherals and industrial automation equipment</p> <p>Instrument Control Toolbox™ lets you connect MATLAB® directly to instruments such as oscilloscopes, function generators, signal analyzers, power supplies, and analytical instruments. The toolbox connects to your instruments via instrument drivers such as IVI and VXIplug&play, or via text-based SCPI commands over commonly used communication protocols such as GPIB, VISA, TCP/IP, and UDP. You can also control and acquire data from test equipment without writing code.</p> <p>With Instrument Control Toolbox, you can generate data in MATLAB to send out to an instrument or read data into MATLAB for analysis and visualization. You can automate tests, verify hardware designs, and build test systems based on LXI, PXI, and AXIe standards.</p> <p>The toolbox provides built-in support for TCP/IP, UDP, I2C, SPI, and Bluetooth® serial protocols for remote communication with other computers and printed circuit boards (PCBs) from MATLAB. It also includes functions and apps for the MODBUS® protocol, enabling communication with industrial automation equipment such as programmable logic controllers (PLCs) and programmable automation controllers (PACs).</p>	https://www.mathworks.cn/help/instrument/?s_tid=srchbrcm

34	Lidar Toolbox	<p>设计、分析和测试激光雷达处理系统</p> <p>Lidar Toolbox™ 提供多种算法、函数和 App，可用于设计、分析和测试激光雷达处理系统。您可以执行目标检测和跟踪、语义分割、形状拟合、激光雷达配准和障碍物检测。该工具箱提供激光雷达相机交叉标定的工作流和 App。</p> <p>该工具箱支持您流式传输来自 Velodyne® 激光雷达的数据，并读取 Velodyne 和 IBEO 激光雷达传感器记录的数据。激光雷达查看器支持激光雷达点云的交互式可视化和分析。您可以使用机器学习和深度学习算法（例如 PointPillars、SqueezeSegV2 和 PointNet++）来训练检测、语义分割和分类模型。激光雷达标注器支持手动和半自动标注激光雷达点云，用于训练深度学习和机器学习模型。</p> <p>Lidar Toolbox 为感知和导航工作流提供激光雷达处理参考示例。大多数工具箱算法都支持 C/C++ 代码生成，以便集成到现有代码、开发桌面原型和进行部署。</p>	https://www.mathworks.cn/products/lidar.html?s_tid=srchtitle_lidar%20toolbox_2
		<p>Design, analyze, and test lidar processing systems</p> <p>Lidar Toolbox™ provides algorithms, functions, and apps for designing, analyzing, and testing lidar processing systems. You can perform object detection and tracking, semantic segmentation, shape fitting, lidar registration, and obstacle detection. The toolbox provides workflows and an app for lidar-camera cross-calibration.</p> <p>The toolbox lets you stream data from Velodyne® lidars and read data recorded by Velodyne and IBEO lidar sensors. The Lidar Viewer App enables interactive visualization and analysis of lidar point clouds. You can train detection, semantic segmentation, and classification models using machine learning and deep learning algorithms such as PointPillars, SqueezeSegV2, and PointNet++. The Lidar Labeler App supports manual and semi-automated labeling of lidar point clouds for training deep learning and machine learning models.</p> <p>Lidar Toolbox provides lidar processing reference examples for perception and navigation workflows. Most toolbox algorithms support C/C++ code generation for integrating with existing code, desktop prototyping, and deployment.</p>	https://www.mathworks.cn/help/lidar/?s_tid=srchtitle_lidar%20toolbox_2

35	LTE Toolbox	<p>仿真、分析和测试 LTE 及 LTE-Advanced 无线通信系统的物理层</p> <p>LTE Toolbox™ 提供用于设计、仿真和验证 LTE、LTE-Advanced 和 LTE-Advanced Pro 通信系统且符合标准的函数和应用程序。该系统工具箱加速了 LTE 算法和物理层 (PHY) 开发，支持黄金参考验证和一致性测试，并能够生成测试波形。</p> <p>借助该工具箱，您可以配置、仿真、测量和分析端到端通信链路，还可以创建并重复使用符合性测试平台来验证设计、原型和实现是否符合 LTE 标准。</p> <p>通过使用带有 RF 仪器或硬件支持数据包的 LTE Toolbox，您可以将发射机和接收机模型连接到无线设备并通过无线传输和接收来验证您的设计。</p>	https://ww2.mathworks.cn/products/lte.html?s_tid=srchtitle_LTE%20toolbox_2
		<p>Simulate, analyze, and test the physical layer of LTE and LTE-Advanced wireless communications systems</p> <p>LTE Toolbox™ provides standard-compliant functions and apps for the design, simulation, and verification of LTE, LTE-Advanced, and LTE-Advanced Pro communications systems. The toolbox accelerates LTE algorithm and physical layer (PHY) development, supports golden reference verification and conformance testing, and enables test waveform generation.</p> <p>With the toolbox you can configure, simulate, measure, and analyze end-to-end communications links. You can also create and reuse a conformance test bench to verify that your designs, prototypes, and implementations comply with the LTE standard.</p> <p>Using LTE Toolbox with RF instruments or hardware support packages, you can connect transmitter and receiver models to radio devices and verify your designs via over-the-air transmission and reception.</p>	https://ww2.mathworks.cn/help/lte/?s_tid=srchbrcm

36	Mapping Toolbox	<p>分析和可视化地理信息</p> <p>Mapping Toolbox™ 提供多种算法和函数，可用于地理数据变换和地图显示创建。您可以在地理环境中可视化数据，基于 60 多种地图投影构建地图显示，并将来自各种数据源的数据变换为一致的地理坐标系。</p> <p>Mapping Toolbox 支持地理数据管理的整套工作流。您可以从各种 Web 地图服务器导入多种文件格式的矢量和光栅数据。该工具箱支持您使用删减、插值、重采样、坐标变换和其他方法来处理和自定义数据。您可以在单个地图显示中组合数据与多种来源的底图图层。您可以将数据导出为 shapefile、GeoTIFF 或 KML 等文件格式。</p>	https://ww2.mathworks.cn/products/mapping.html?s_tid=srchtitle_mapping%20toolbox_2
		<p>Analyze and visualize geographic information</p> <p>Mapping Toolbox™ provides algorithms and functions for transforming geographic data and creating map displays. You can visualize your data in a geographic context, build map displays from more than 60 map projections, and transform data from a variety of sources into a consistent geographic coordinate system.</p> <p>Mapping Toolbox supports a complete workflow for managing geographic data. You can import vector and raster data from a wide range of file formats and web map servers. The toolbox lets you process and customize data using trimming, interpolation, resampling, coordinate transformations, and other techniques. Data can be combined with base map layers from multiple sources in a single map display. You can export data in file formats such as shapefile, GeoTIFF, and KML.</p>	https://ww2.mathworks.cn/help/map/?s_tid=srchtitle_mapping%20toolbox_2

37	MATLAB Coder	<p>从 MATLAB 代码生成 C 和 C++ 代码</p> <p>MATLAB Coder™ 从 MATLAB® 代码生成 C 和 C++ 代码，以便您部署到包括桌面系统和嵌入式硬件在内的多种硬件平台。该产品支持多数 MATLAB 代码和各种工具箱。您可以将生成的代码作为源代码、静态库或动态库集成到您的项目。生成的代码可读且可移植。您可以将该代码与现有 C 和 C++ 代码以及库的关键部分相结合。您还可以将生成的代码打包为 MEX 函数，以在 MATLAB 中使用。</p> <p>结合 Embedded Coder®, MATLAB Coder 还支持代码自定义、特定于目标的优化、代码可追溯性以及软件在环 (SIL) 和处理器在环 (PIL) 验证。</p> <p>要将 MATLAB 程序部署为独立应用程序，请使用 MATLAB Compiler™。要生成软件组件，以便与其他编程语言集成，请使用 MATLAB Compiler SDK™。</p>	https://ww2.mathworks.cn/products/coder.html?s_tid=srchtitle_matlab%20coder_2
		<p>Generate C and C++ code from MATLAB code</p> <p>MATLAB® Coder™ generates C and C++ code from MATLAB code for a variety of hardware platforms, from desktop systems to embedded hardware. It supports most of the MATLAB language and a wide range of toolboxes. You can integrate the generated code into your projects as source code, static libraries, or dynamic libraries. The generated code is readable and portable. You can combine it with key parts of your existing C and C++ code and libraries. You can also package the generated code as a MEX-function for use in MATLAB.</p> <p>When used with Embedded Coder®, MATLAB Coder provides code customizations, target-specific optimizations, code traceability, and software-in-the-loop (SIL) and processor-in-the-loop (PIL) verification.</p> <p>To deploy MATLAB programs as standalone applications, use MATLAB Compiler™. To generate software components for integration with other programming languages, use MATLAB Compiler SDK™.</p>	https://ww2.mathworks.cn/help/coder/index.html?lang=en

38	MATLAB Compiler	<p>基于 MATLAB 程序构建独立可执行文件和 Web 应用程序</p> <p>MATLAB Compiler™ 帮助您将 MATLAB® 程序作为独立应用程序和 Web 应用程序共享。借助 MATLAB Compiler，您也可以将 MATLAB 程序打包并部署为 MapReduce 或 Spark™ 大数据应用程序以及 Microsoft® Excel® 插件。最终用户可以使用 MATLAB Runtime 免版权费运行您的应用程序。</p> <p>为使您的 MATLAB Web 应用程序支持基于浏览器的访问，您可以使用随 MATLAB Compiler 提供的 MATLAB Web App Server™ 开发版本来托管这些 MATLAB Web 应用程序。您可以将 MATLAB 程序打包为软件组件，以便与其他编程语言集成（需要 MATLAB Compiler SDK™）。结合 MATLAB Production Server™，您还可以面向企业系统进行大规模部署。</p> <p>结合 MATLAB Coder™，您可以从 MATLAB 生成 C 和 C++ 源代码。</p> <p>开始:</p>	https://ww2.mathworks.cn/products/compiler.html?s_tid=srchtitle_matlab%20compiler_2
		<p>Build standalone executables and web apps from MATLAB programs</p> <p>MATLAB® Compiler™ enables you to share MATLAB programs as standalone applications and web apps. With MATLAB Compiler you can also package and deploy MATLAB programs as MapReduce and Spark™ big data applications and as Microsoft® Excel® add-ins. End users can run your applications royalty-free using MATLAB Runtime.</p> <p>To provide browser-based access to your MATLAB web apps, you can host them using the development version of MATLAB Web App Server included with MATLAB Compiler. MATLAB programs can be packaged into software components for integration with other programming languages (with MATLAB Compiler SDK™). Large-scale deployment to enterprise systems is supported through MATLAB Production Server™.</p>	https://ww2.mathworks.cn/help/compiler/?s_tid=srchbrcm

39	MATLAB Compiler SDK	<p>利用 MATLAB 程序生成软件组件</p> <p>MATLAB Compiler SDK™ 扩展了 MATLAB Compiler™ 的功能，可让您将 MATLAB® 程序构建成 C/C++ 共享库、Microsoft® .NET 程序集、Java® 类和 Python® 包。这些组件可以与自定义应用程序集成，然后部署到桌面、Web 和企业系统。</p> <p>MATLAB Compiler SDK 包括 MATLAB Production Server™ 的开发版本，将应用程序代码和 Excel 插件部署到 Web 应用程序和企业系统之前，可以利用该版本对其进行测试和调试。</p> <p>使用 MATLAB Compiler SDK 中的软件组件创建的应用程序可以与不需要 MATLAB 的用户共享，免特许费。这些应用程序使用 MATLAB Runtime，即可以让编译的 MATLAB 应用程序或组件执行一组共享库。</p> <p>使用 MATLAB Coder™ 从 MATLAB 生成 C 和 C++ 源代码。</p>	https://www.mathworks.cn/products/matlab-compiler-sdk.html?s_tid=srchtitle_matlab%20compiler%20SDK_2
		<p>Build software components from MATLAB programs</p> <p>MATLAB® Compiler SDK™ extends the functionality of MATLAB Compiler™ to let you build C/C++ shared libraries, Microsoft® .NET assemblies, and Java® classes from MATLAB programs. These components can be integrated with custom applications and then deployed to desktop, web, and enterprise systems.</p> <p>MATLAB Compiler SDK includes a development version of MATLAB Production Server™ for testing and debugging application code and Excel® add-ins before deploying them to web applications and enterprise systems.</p> <p>Applications created using software components from MATLAB Compiler SDK can be shared royalty-free with users who do not need MATLAB. These applications use the MATLAB Runtime, a set of shared libraries that enables the execution of compiled MATLAB applications or components. To generate C and C++ source code from MATLAB, use MATLAB Coder™</p>	https://www.mathworks.cn/help/compiler_sdk/?s_tid=srch_brcm

40	MATLAB Report Generator	<p>通过 MATLAB 应用程序设计并自动生成报告</p> <p>MATLAB Report Generator™ 提供可将报告功能集成到 MATLAB 应用程序的一些函数和 API。您可以开发程序，生成 PDF、Microsoft® Word、Microsoft PowerPoint® 和 HTML 格式报告。可以使用 MATLAB Report Generator 从自己的 MATLAB 代码中动态捕获结果和数字，并将这些结果记录在一个报告中，与所在组织的其他人共享。您可以使用预置的可自定制 Word 和 HTML 模板，或根据您所在组织的模板和标准设计报告。</p>	https://ww2.mathworks.cn/products/matlab-report-generator.html?s_tid=srchtitle_matlab%20report%20generator_2
		<p>Design and automatically generate reports from MATLAB applications</p> <p>MATLAB® Report Generator™ provides functions and APIs that integrate reporting capabilities into MATLAB applications. You can develop programs that generate reports in PDF, Microsoft® Word, Microsoft PowerPoint®, and HTML. MATLAB Report Generator enables you to dynamically capture results and figures from your MATLAB code and document those results in a single report that can be shared with others in your organization. You can use the prebuilt, customizable Word and HTML templates or design reports based on your organization's templates and standards.</p>	https://ww2.mathworks.cn/help/rptgen/?s_tid=srchbrcm

41	Mixed-Signal Blockset	<p>设计、分析和仿真模拟信号系统和混合信号系统</p> <p>Mixed-Signal Blockset™ 为设计和验证混合信号集成电路 (IC) 提供组件模型和损伤模型、分析工具以及测试平台。</p> <p>您可以对 PLL、数据转换器和其他系统进行不同抽象级别的建模。您可以使用这些模型仿真混合信号组件，以及复杂的 DSP 算法和控制逻辑。您可以对这些模型进行自定义，以包含噪声、非线性、抖动和量化效应等损伤。您可以使用 Simulink® 中的可变步长求解器进行系统级快速仿真，从而调试实现过程并识别设计缺陷，而无需对 IC 进行晶体管级仿真。</p> <p>利用混合信号分析器，您可以分析、识别混合信号数据中的趋势，并对混合信号数据进行可视化。利用 Cadence Virtuoso ADE MATLAB Integration 选项，您可以将电路级仿真结果数据库导入 MATLAB®。您也可以利用从 IC 设计中提取的寄生元件，导入 SPICE 网表并创建或修改线性时不变电路。此模块集提供了多个分析函数，可对仿真结果进行后处理，以验证规格、拟合特征并报告测量结果。</p>	https://www.mathworks.cn/products/mixed-signal.html?s_tid=srchtitle_mixed-signal%20blockset_4
		<p>Design, analyze, and simulate analog and mixed-signal systems</p> <p>Mixed-Signal Blockset™ provides models of components and impairments, analysis tools, and test benches for designing and verifying mixed-signal integrated circuits (ICs).</p> <p>You can model PLLs, data converters, and other systems at different levels of abstraction. These models can be used to simulate mixed-signal components together with complex DSP algorithms and control logic. You can customize models to include impairments such as noise, nonlinearity, jitter, and quantization effects. Rapid system-level simulation using variable-step Simulink® solvers lets you debug the implementation and identify design flaws without simulating the IC at the transistor level.</p> <p>With the Mixed-Signal Analyzer app you can analyze, identify trends in, and visualize mixed-signal data. The Cadence Virtuoso ADE MATLAB Integration option lets you import databases of circuit-level simulation results into MATLAB®. Alternatively, you can import a SPICE netlist and create or modify a linear, time-invariant circuit with parasitic elements extracted from the IC design. The blockset provides analysis functions for post-processing simulation results to verify specifications, fit characteristics, and report measurements.</p>	https://www.mathworks.cn/help/msblks/?s_tid=srchbrcm

42	Model Predictive Control Toolbox	<p>设计和仿真模型预测控制器</p> <p>Model Predictive Control Toolbox™ 提供一系列函数、App 和 Simulink® 模块，支持您利用线性和非线性模型预测控制 (MPC) 来设计和仿真控制器。您可以使用该工具箱指定被控对象和扰动模型、时域、约束和权重。通过运行闭环仿真，您可以评估控制器性能。</p> <p>通过在运行时改变控制器权重和约束，您可以调整控制器的行为。该工具箱提供了可部署的优化求解器，同时还允许您使用自定义求解器。要控制非线性被控对象，您可以实现自适应、增益调度和非线性 MPC 控制器。对于采样速率较快的应用，您可以使用该工具箱从常规控制器生成显式模型预测控制器，或者实现近似解。</p> <p>对于快速原型和嵌入式系统实现（包括优化求解器的部署），此工具箱支持 C 代码和 IEC 61131-3 结构化文本生成。</p>	https://ww2.mathworks.cn/products/model-predictive-control.html?s_tid=srchtitle_model%20predictive%20controller%20toolbox_2
		<p>Design and simulate model predictive controllers</p> <p>Model Predictive Control Toolbox™ provides functions, an app, and Simulink® blocks for designing and simulating controllers using linear and nonlinear model predictive control (MPC). The toolbox lets you specify plant and disturbance models, horizons, constraints, and weights. By running closed-loop simulations, you can evaluate controller performance.</p> <p>You can adjust the behavior of the controller by varying its weights and constraints at run time. The toolbox provides deployable optimization solvers and also enables you to use a custom solver. To control a nonlinear plant, you can implement adaptive, gain-scheduled, and nonlinear MPC controllers. For applications with fast sample rates, the toolbox lets you generate an explicit model predictive controller from a regular controller or implement an approximate solution.</p> <p>For rapid prototyping and embedded system implementation, including deployment of optimization solvers, the toolbox supports C code and IEC 61131-3 Structured Text generation.</p>	https://ww2.mathworks.cn/help/mpc/?s_tid=srchtitle_model_predictive_control_toolbox_2

43	Model-Based Calibration Toolbox	<p>复杂动力总成系统的建模和标定</p> <p>Model-Based Calibration Toolbox™ 提供了一些Apps和设计工具，用于对复杂非线性系统进行建模和标定。可用于各种各样的应用，包括动力总成系统，如发动机、电动机械、泵和风扇，以及非汽车系统，如喷气发动机、海洋水翼艇和钻探设备。对于使用传统方法必须进行穷尽测试的高自由度系统，您可以为其定义最优测试计划，自动拟合统计模型，并生成标定表和查找表。使用工具箱Apps或 MATLAB® 函数，您可以自动完成模型拟合和标定过程。</p> <p>用 Model-Based Calibration Toolbox 创建的模型可导出至 Simulink®，以支持控制设计、灵敏度分析、硬件在环测试和其他仿真活动。标定表可导出至 ETAS INCA 和 ATI VISION。</p>	https://ww2.mathworks.cn/products/mbc.html?s_tid=srchtitle_model-based%20calibration%20toolbox_2

44	Motor Control Blockset	<p>设计和实现电机控制算法</p> <p>Motor Control Blockset™ 提供一系列 Simulink® 模块，可用于为无刷电机创建和调优磁场定向控制算法和其他算法。这些模块包括帕克和克拉克变换、无传感器观测器、弱磁、空间矢量发生器和磁场定向控制 (FOC) 自动调节器。您可以使用模块集中包含的电机和逆变器模型，在闭环仿真中验证控制算法。</p> <p>您可以借助模块集参数估计工具，在电机硬件上运行预定义的测试，准确估计定子电阻、d 轴和 q 轴电感、反电动势、惯性和摩擦。您可以将这些电机参数值纳入闭环仿真，以分析控制器设计。</p> <p>通过参考示例，了解如何在桌面仿真中验证控制算法，并生成可适应生产实现执行速度的紧凑型 C 代码。借助参考示例，您还可以为模块集支持的电机控制硬件套件实现算法。</p>	https://ww2.mathworks.cn/products/motor-control.html?s_tid=srchtitle_motor%20control%20blockset_2
		<p>Design and implement motor control algorithms</p> <p>Motor Control Blockset™ provides Simulink® blocks for creating and tuning field-oriented control and other algorithms for brushless motors. Blocks include Park and Clarke transforms, sensorless observers, field weakening, a space-vector generator, and an FOC autotuner. You can verify control algorithms in closed-loop simulation using the motor and inverter models included in the blockset.</p> <p>The blockset parameter estimation tool runs predefined tests on your motor hardware for accurate estimation of stator resistance, d-axis and q-axis inductance, back EMF, inertia, and friction. You can incorporate these motor parameter values into a closed-loop simulation to analyze your controller design.</p> <p>Reference examples show how to verify control algorithms in desktop simulation and generate compact C code that supports execution rates required for production implementation. The reference examples can also be used to implement algorithms for motor control hardware kits supported by the blockset.</p>	https://ww2.mathworks.cn/help/mcb/?s_tid=srchbrcm

45	Navigation Toolbox	<p>设计、仿真和部署自主导航算法</p> <p>Navigation Toolbox™ 提供一系列算法与分析工具，用于运动规划、同步定位与地图构建 (SLAM) 和惯性导航。该工具箱包含自定义搜索和基于采样的路径规划器，以及用于验证和比较路径的指标。您可以创建二维和三维地图表示，使用 SLAM 算法生成地图，并使用 SLAM 地图生成器以交互方式可视化和调试地图的生成。该工具箱提供用于定位的传感器模型和算法。您可以仿真和可视化 IMU、GPS 和轮式编码器传感器数据，以及调节融合滤波器以用于多传感器位姿估计。</p> <p>工具箱提供自动驾驶、机器人和消费电子产品应用的参考示例。您可以直接将导航算法部署到硬件以进行测试（需要 MATLAB Coder™ 或 Simulink Coder™）。</p>	https://www.mathworks.cn/products/navigation.html?s_tid=srchtitle_navigation%20toolbox_2
		<p>Design, simulate, and deploy algorithms for autonomous navigation</p> <p>Navigation Toolbox™ provides algorithms and analysis tools for motion planning, simultaneous localization and mapping (SLAM), and inertial navigation. The toolbox includes customizable search and sampling-based path-planners, as well as metrics for validating and comparing paths. You can create 2D and 3D map representations, generate maps using SLAM algorithms, and interactively visualize and debug map generation with the SLAM map builder app. The toolbox provides sensor models and algorithms for localization. You can simulate and visualize IMU, GPS, and wheel encoder sensor data, and tune fusion filters for multi-sensor pose estimation.</p> <p>Reference examples are provided for automated driving, robotics, and consumer electronics applications. You can test your navigation algorithms by deploying them directly to hardware (with MATLAB® Coder™ or Simulink® Coder).</p>	https://www.mathworks.cn/help/navigation/?s_tid=srchtitle_navigation%20toolbox_2

46	OPC Toolbox	<p>从 OPC 服务器和历史数据中读取和写入数据</p> <p>OPC Toolbox™ 支持直接从 MATLAB® 和 Simulink® 访问实时和历史 OPC 数据。您可以基于多种设备读取、写入和记录 OPC 数据，例如分布式控制系统、监督式控制和数据采集系统，以及可编程逻辑控制器。</p> <p>您可以使用 OPC Toolbox 处理符合 OPC Data Access (DA) 标准、OPC Historical Data Access (HDA) 标准及 OPC 统一架构 (UA) 标准的实时服务器数据和历史数据。此工具箱支持您使用各种安全模式、算法和身份验证方法安全连接 OPC UA 服务器。</p> <p>该产品包括可用于在线监督式控制建模及执行硬件在环控制器测试的 Simulink 模块。</p>	https://www.mathworks.cn/products/opc.html?s_tid=srchtitle OPC%20toolbox_2
		<p>Read and write data from OPC servers and data historians</p> <p>OPC Toolbox™ provides access to live and historical OPC data directly from MATLAB® and Simulink®. You can read, write, and log OPC data from devices, such as distributed control systems, supervisory control and data acquisition systems, and programmable logic controllers.</p> <p>With OPC Toolbox you can work with data from live servers and data historians that conform to the OPC Data Access (DA) standard, the OPC Historical Data Access (HDA) standard, and the OPC Unified Architecture (UA) standard. The toolbox lets you securely connect to OPC UA servers using a variety of security modes, algorithms, and authentication methods.</p> <p>The product includes Simulink blocks that let you model online supervisory control and perform hardware-in-the-loop controller testing.</p>	https://www.mathworks.cn/help/opc/?s_tid=srchtitle OPC%20toolbox_2

47	Optimization Toolbox	<p>求解线性、二次、锥、整数及非线性优化问题</p> <p>Optimization Toolbox™ 提供各种函数，可用于求最小化或最大化目标且满足约束的参数。该工具箱包含用于线性规划 (LP)、混合整数线性规划 (MILP)、二次规划 (QP)、二阶锥规划 (SOCP)、非线性规划 (NLP)、约束线性最小二乘、非线性最小二乘和非线性方程的求解器。</p> <p>您可以用函数和矩阵来定义优化问题，也可以通过指定反映底层数学关系的变量表达式来定义。使用目标函数和约束函数自动微分，更快、更准确地求解。</p> <p>您可以使用该工具箱提供的求解器求连续与离散问题的最优解、执行权衡分析，并将优化方法整合到算法和应用中。该工具箱能够执行设计优化任务，包括参数估计、分量选择和参数调整。它能帮助您在投资组合优化、能源管理和交易以及生产规划等各种应用中求最优解。</p>	https://ww2.mathworks.cn/products/optimization.html?s_tid=srchtitle_optimization%20toolbox_3
		<p>Solve linear, quadratic, conic, integer, and nonlinear optimization problems</p> <p>Optimization Toolbox™ provides functions for finding parameters that minimize or maximize objectives while satisfying constraints. The toolbox includes solvers for linear programming (LP), mixed-integer linear programming (MILP), quadratic programming (QP), second-order cone programming (SOCP), nonlinear programming (NLP), constrained linear least squares, nonlinear least squares, and nonlinear equations.</p> <p>You can define your optimization problem with functions and matrices or by specifying variable expressions that reflect the underlying mathematics. You can use automatic differentiation of objective and constraint functions for faster and more accurate solutions.</p> <p>You can use the toolbox solvers to find optimal solutions to continuous and discrete problems, perform tradeoff analyses, and incorporate optimization methods into algorithms and applications. The toolbox lets you perform design optimization tasks, including parameter estimation, component selection, and parameter tuning. It enables you to find optimal solutions in applications such as portfolio optimization, energy management and trading, and production planning.</p>	https://ww2.mathworks.cn/help/optim/index.html?lang=en

48	Parallel Computing Toolbox	<p>在多核计算机、GPU 和集群上执行并行计算</p> <p>利用 Parallel Computing Toolbox™，可以使用多核处理器、GPU 和计算机集群来解决计算问题和数据密集型问题。利用并行 for 循环、特殊数组类型和并行化数值算法等高级别构造，无需进行 CUDA 或 MPI 编程即可对 MATLAB® 应用程序进行并行化。通过该工具箱可以使用 MATLAB 和其他工具箱中支持并行的函数。你可以将该工具箱与 Simulink® 配合使用，并行运行一个模型的多个仿真。程序和模型可以在交互模式和批处理模式下运行。</p> <p>该工具箱通过在本地运行的 worker（MATLAB 计算引擎）上执行应用程序，允许你充分利用多核台式机的处理能力。无需更改代码，即可在集群或云上运行同一个应用程序（使用 MATLAB Parallel Server™）。还可以将该工具箱与 MATLAB Parallel Server 结合使用，以执行由于太大而无法装入单台机器内存的矩阵计算。</p>	https://ww2.mathworks.cn/products/parallel-computing.html?s_tid=srchtitle_parallel%20computing%20toolbox_2
		<p>Perform parallel computations on multicore computers, GPUs, and computer clusters</p> <p>Parallel Computing Toolbox™ lets you solve computationally and data-intensive problems using multicore processors, GPUs, and computer clusters. High-level constructs—parallel for-loops, special array types, and parallelized numerical algorithms—enable you to parallelize MATLAB® applications without CUDA or MPI programming. The toolbox lets you use parallel-enabled functions in MATLAB and other toolboxes. You can use the toolbox with Simulink® to run multiple simulations of a model in parallel. Programs and models can run in both interactive and batch modes.</p> <p>The toolbox lets you use the full processing power of multicore desktops by executing applications on workers (MATLAB computational engines) that run locally. Without changing the code, you can run the same applications on clusters or clouds (using MATLAB Parallel Server™). You can also use the toolbox with MATLAB Parallel Server to execute matrix calculations that are too large to fit into the memory of a single machine.</p>	https://ww2.mathworks.cn/help/parallel-computing/?s_tid=srchbrcm

49	Partial Differential Equation Toolbox	<p>利用有限元法 (FEM) 求解偏微分方程</p> <p>Partial Differential Equation Toolbox™ 提供利用有限元分析求解结构力学、热传递和一般偏微分方程 (PDE) 的函数。</p> <p>您可以执行线性静力分析以计算形变、应力和应变。对于结构动力学和振动的建模，该工具箱提供了直接时间积分求解器。您可以通过执行模态分析确定自然频率和振型，从而分析组件的结构特性。您可以对以传导为主的热传递问题进行建模，以计算温度分布、热通量和通过表面的热流率。您可以执行静电和静磁分析，也可以使用自定义 PDE 求解其他标准问题。</p> <p>Partial Differential Equation Toolbox 允许您从 STL 或网格数据导入二维和三维几何结构。您可以自动生成包含三角形和四面体单元的网格。您可以使用有限元方法求解 PDE，并对结果进行后处理以进行探索和分析。</p>	https://ww2.mathworks.cn/products/pde.html?s_tid=srchtitle_partial%20differential%20equation%20toolbox_2
		<p>Solve partial differential equations using finite element analysis</p> <p>Partial Differential Equation Toolbox™ provides functions for solving structural mechanics, heat transfer, and general partial differential equations (PDEs) using finite element analysis.</p> <p>You can perform linear static analysis to compute deformation, stress, and strain. For modeling structural dynamics and vibration, the toolbox provides a direct time integration solver. You can analyze a component's structural characteristics by performing modal analysis to find natural frequencies and mode shapes. You can model conduction-dominant heat transfer problems to calculate temperature distributions, heat fluxes, and heat flow rates through surfaces. You can also solve standard problems such as diffusion, electrostatics, and magnetostatics, as well as custom PDEs.</p> <p>Partial Differential Equation Toolbox lets you import 2D and 3D geometries from STL or mesh data. You can automatically generate meshes with triangular and tetrahedral elements. You can solve PDEs by using the finite element method, and postprocess results to explore and analyze them.</p>	https://ww2.mathworks.cn/help/pde/?s_tid=srchtitle_hbrcm

50	Phased Array System Toolbox	<p>设计和仿真传感器阵列和波束成形系统</p> <p>Phased Array System Toolbox™ 提供了各种算法和 App，可用于设计和仿真传感器阵列和波束成形系统，在无线通信、雷达、声呐、声学以及医学成像等领域应用广泛。您可以建模和分析有源阵列和无源阵列（包括子阵和任意几何结构）的行为。通过这些阵列可以发射和接收仿真信号，以进行波束成形和信号处理算法设计。</p> <p>您可以为 5G 和 LTE 蜂窝、卫星通信和 WLAN 通信系统设计多波束和电子控向天线。使用此工具箱中的算法，还可以对大规模 MIMO 和毫米波系统中的混合波束成形架构和全数字波束成形架构进行仿真。您可以仿真多径衰落环境，以测试波束成形天线阵列的性能。</p> <p>在雷达、声呐和声学系统设计中，可以使用此工具箱提供的信号处理算法进行波束成形、空时自适应处理 (STAP)、波达方向 (DOA) 估计、匹配滤波和信号检测。此工具箱还提供了连续波形和脉冲波形，可用于生成测试信号，并对目标回波、干扰和传播效应进行仿真。</p> <p>另外，此工具箱还支持生成 C 代码，以加快仿真速度或构建桌面原型。参考示例提供了从 Simulink® 模型生成 HDL 代码的工作流。</p>	https://www.mathworks.cn/products/phased-array.html?s_tid=srchtitle_phased%20array%20system%20toolbox_2
		<p>Design and simulate sensor array and beamforming systems</p> <p>Phased Array System Toolbox™ provides algorithms and apps for designing and simulating sensor array and beamforming systems in wireless communication, radar, sonar, acoustic, and medical imaging applications. You can model and analyze the behavior of active and passive arrays, including subarrays and arbitrary geometries. Simulated signals can be transmitted and received by these arrays for beamforming and signal processing algorithm design.</p> <p>For 5G and LTE cellular, SATCOM, and WLAN communications systems, you can design multibeam and electronically steerable antennas. The toolbox includes algorithms for simulating hybrid and full digital beamforming architectures for massive MIMO and millimeter wave systems. You can simulate multipath fading environments to test the performance of beamforming antenna arrays.</p> <p>For radar, sonar, and acoustic system design, the toolbox includes signal processing algorithms for beamforming, space-time adaptive processing (STAP), direction of arrival (DOA) estimation, matched filtering, and signal detection. The toolbox also provides continuous and pulsed waveforms that you can use to generate test signals and simulate target echoes, interferences, and propagation effects.</p> <p>For simulation acceleration or desktop prototyping, the toolbox supports C code generation. Reference examples provide workflows for generating HDL code from Simulink® models.</p>	https://www.mathworks.cn/help/phased/?s_tid=srchbrcm

51	Powertrain Blockset	<p>汽车动力总成系统建模和仿真</p> <p>Powertrain Blockset™ 提供了汽车动力总成的完整参考应用模型，包括汽油发动机、柴油发动机、混合动力和纯电动系统。它具有完善的组件库，可用于仿真发动机子系统、变速器总成、驱动电机、电池组和控制器模型。Powertrain Blockset 同时提供了测功机模型，可用于虚拟测试。它还支持 MDF 文件，为标定工具数据导入提供了基于标准的接口。</p> <p>Powertrain Blockset 提供的标准模型架构可在整个开发过程中重用。您可以使用它来进行设计权衡分析、组件选型、控制参数优化和硬件在环测试。您可使用自己的数据对参考应用中的组件进行参数化，也可以使用自己的模型替换某一子系统，从而实现模型的自定义。</p>	https://ww2.mathworks.cn/products/powertrain.html?s_tid=srchtitle_powertrain%20blockset_2
		<p>Model and simulate automotive powertrain systems</p> <p>Powertrain Blockset™ provides fully assembled reference application models of automotive powertrains, including gasoline, diesel, hybrid, and electric systems. It includes a component library for simulating engine subsystems, transmission assemblies, traction motors, battery packs, and controller models. Powertrain Blockset also includes a dynamometer model for virtual testing. MDF file support provides a standards-based interface to calibration tools for data import.</p> <p>Powertrain Blockset provides a standard model architecture that can be reused throughout the development process. You can use it for design tradeoff analysis and component sizing, control parameter optimization, and hardware-in-the-loop testing. You can customize models by parameterizing components in a reference application with your own data or by replacing a subsystem with your own model.</p>	https://ww2.mathworks.cn/help/autoblks/?s_tid=srchbrcm

52	Predictive Maintenance Toolbox	<p>设计和测试状态监控和预测性维护算法</p> <p>通过 Predictive Maintenance Toolbox™，您可以管理传感器数据、设计状态指标并估计机器的剩余使用寿命 (RUL)。</p> <p>该工具箱提供了多个函数和一个交互式 App，通过基于数据和基于模型的方法（包括统计、频谱和时序分析），对特征进行探索、提取和排序。您可以使用频率和时频方法从振动数据中提取特征，从而监控旋转机器的运行状况。要估计机器的故障时间，可以使用生存模型、相似性模型和基于趋势的模型来预测 RUL。</p> <p>您可以组织和分析来自本地文件、云存储和分布式文件系统的传感器数据。您可以标注从 Simulink® 模型生成的仿真故障数据。该工具箱包括电机、变速箱、电池和其他机器的参考示例，您可以重用这些示例来开发自定义的预测性维护和状态监控算法。</p> <p>为实现算法运营化，您可以生成 C/C++ 代码以部署到边缘，或创建生产应用程序以部署到云。</p>	https://www.mathworks.cn/product/s/predictive-maintenance.html?s_tid=srchtitle_predictive%20maintenance%20toolbox_2
		<p>Design and test condition monitoring and predictive maintenance algorithms</p> <p>Predictive Maintenance Toolbox™ lets you manage sensor data, design condition indicators, and estimate the remaining useful life (RUL) of a machine.</p> <p>The toolbox provides functions and an interactive app for exploring, extracting, and ranking features using data-based and model-based techniques, including statistical, spectral, and time-series analysis. You can monitor the health of rotating machines by extracting features from vibration data using frequency and time-frequency methods. To estimate a machine's time to failure, you can use survival, similarity, and trend-based models to predict the RUL.</p> <p>You can organize and analyze sensor data imported from local files, cloud storage, and distributed file systems. You can label simulated failure data generated from Simulink® models. The toolbox includes reference examples for motors, gearboxes, batteries, and other machines that can be reused for developing custom predictive maintenance and condition monitoring algorithms.</p> <p>To operationalize your algorithms, you can generate C/C++ code for deployment to the edge or create a production application for deployment to the cloud.</p>	https://www.mathworks.cn/help/predictive-maintenance/?s_tid=srchbrcm

53	Radar Toolbox	<p>设计、仿真和测试多功能雷达系统</p> <p>Radar Toolbox 包括用于设计、仿真、分析和测试多功能雷达系统的算法和工具。您可以从参考示例出发，实现机载、陆基、舰载和汽车雷达系统。Radar Toolbox 支持多个工作流，包括需求分析、设计、部署和现场数据分析。</p> <p>借助雷达设计器，您可以采用交互方式在雷达方程级别执行链路预算分析和评估设计权衡。该工具箱包括发射机、接收机、传播通道、目标、干扰器和杂波的模型。您可以使用概率模型和 I/Q 信号级别模型对不同抽象级别的雷达进行仿真。使用工具箱提供的信号和数据处理算法，您可以处理基于这些模型或基于雷达系统收集数据所生成的检测结果。您可以设计认知雷达，这种雷达能够在拥挤的射频共享频谱环境中工作。对于汽车应用，该工具箱支持在概率和物理级别对雷达传感器建模并仿真数据，包括微多普勒签名和目标列表。</p> <p>对于仿真加速或快速原型，该工具箱支持生成 C 代码。</p>	https://ww2.mathworks.cn/products/radar.html?s_tid=srchtitle_radar%20toolbox_2
		<p>Design, simulate, and test multifunction radar systems</p> <p>Radar Toolbox includes algorithms and tools for designing, simulating, analyzing, and testing multifunction radar systems. Reference examples provide a starting point for implementing airborne, ground-based, shipborne, and automotive radar systems. Radar Toolbox supports multiple workflows, including requirements analysis, design, deployment, and field data analysis.</p> <p>You can perform link budget analysis and evaluate design trade-offs at the radar equation level interactively with the Radar Designer app. The toolbox includes models for transmitters, receivers, propagation channels, targets, jammers, and clutter. You can simulate radars at different levels of abstraction using probabilistic models and I/Q signal level models. You can process detections generated from these models or from data collected from radar systems using the signal and data processing algorithms provided in the toolbox. You can design cognitive radars that operate in crowded RF shared spectrum environments. For automotive applications, the toolbox lets you model radar sensors at the probabilistic and physics-based levels and simulate data, including micro-Doppler signatures and object lists.</p> <p>For simulation acceleration or rapid prototyping, the toolbox supports C code generation.</p>	https://ww2.mathworks.cn/help/radar/?s_tid=srchbrcm

54	Reinforcement Learning Toolbox	<p>使用强化学习设计和训练策略</p> <p>Reinforcement Learning Toolbox™ 提供了一个 App、多个函数和一个 Simulink® 模块，可与 DQN、PPO、SAC 和 DDPG 等强化学习算法结合使用来进行策略训练。您可以使用这些策略为复杂应用（如资源分配、机器人和自主系统）实现控制器和决策算法。</p> <p>借助该工具箱，您可以使用深度神经网络或查找表来表示策略和价值函数，并使用 MATLAB® 或 Simulink 创建环境模型，通过与环境交互来训练策略和函数。您可以评估该工具箱中提供的单智能体或多智能体强化学习算法，也可以开发自己的算法。您可以使用超参数设置进行试验，监控训练进度，并通过 App 以交互方式或编程方式仿真经过训练的智能体。为了提高训练性能，可以在多个 CPU、GPU、计算机集群和云上并行运行仿真（需要 Parallel Computing Toolbox™ 和 MATLAB Parallel Server™）。</p> <p>通过 ONNX™ 模型格式，可以从 TensorFlow™ Keras 和 PyTorch 等深度学习框架导入已有策略（需要 Deep Learning Toolbox™）。您可以生成优化的 C、C++ 和 CUDA® 代码，以便将经过训练的策略部署到微控制器和 GPU。该工具箱包括参考示例，可帮助您快速入门。</p>	https://www.mathworks.cn/products/reinforcement-learning.html?s_tid=srchtitle_reinforcement%20learning%20toolbox_2
		<p>Design and train policies using reinforcement learning</p> <p>Reinforcement Learning Toolbox™ provides an app, functions, and a Simulink® block for training policies using reinforcement learning algorithms, including DQN, PPO, SAC, and DDPG. You can use these policies to implement controllers and decision-making algorithms for complex applications such as resource allocation, robotics, and autonomous systems.</p> <p>The toolbox lets you represent policies and value functions using deep neural networks or look-up tables and train them through interactions with environments modeled in MATLAB® or Simulink. You can evaluate the single- or multi-agent reinforcement learning algorithms provided in the toolbox or develop your own. You can experiment with hyperparameter settings, monitor training progress, and simulate trained agents either interactively through the app or programmatically. To improve training performance, simulations can be run in parallel on multiple CPUs, GPUs, computer clusters, and the cloud (with Parallel Computing Toolbox™ and MATLAB Parallel Server™).</p> <p>Through the ONNX™ model format, existing policies can be imported from deep learning frameworks such as TensorFlow™ Keras and PyTorch (with Deep Learning Toolbox™). You can generate optimized C, C++, and CUDA® code to deploy trained policies on microcontrollers and GPUs. The toolbox includes reference examples to help you get started.</p>	https://www.mathworks.cn/help/reinforcement-learning/?s_tid=srchbrm

55	RF Blockset	<p>设计和仿真射频系统</p> <p>借助 RF Blockset，您可以仿真射频收发机和射频前端。您可以对非线性射频放大器建模，以估计增益、噪声、奇偶阶互调失真，包括记忆效应。对于射频混频器，您可以预测镜像抑制、互易混频、本振相位噪声和直流偏移。您可以使用规格书或测得数据（如多端口 S 参数）对射频模型进行表征。然后，您可以使用这些模型准确地为自适应架构建模，包括自动增益控制 (AGC)、数字预失真 (DPD) 算法和波束成形。</p> <p>借助射频链路预算分析器，您可以自动生成收发机模型和测量测试平台，以验证性能并建立电路包络多载波仿真。</p> <p>使用 RF Blockset，您可以对射频系统进行不同抽象级别的仿真。电路包络仿真可用于针对任意拓扑结构的网络进行高保真度、多载波仿真。等效基带库支持您针对单载波级联系统进行快速的离散时间仿真。</p>	https://www.mathworks.cn/products/rf-blockset.html?s_tid=srchtitle_rf%20blockset_3
		<p>Design and simulate RF systems</p> <p>RF Blockset™ (formerly SimRF™) provides a Simulink® model library and simulation engine for designing RF communications and radar systems.</p> <p>RF Blockset lets you simulate RF transceivers and front-ends. You can model nonlinear RF amplifiers to estimate gain, noise, even-order, and odd-order intermodulation distortion, including memory effects. For RF mixers, you can predict image rejection, reciprocal mixing, local oscillator phase noise, and DC offset. RF models can be characterized using data sheet specifications or measured data such as multiport S-parameters. They can be used to accurately model adaptive architectures, including automatic gain control (AGC), digital predistortion (DPD) algorithms, and beamforming.</p> <p>The RF Budget Analyzer app lets you automatically generate transceiver models and measurement test benches to validate performance and set up a circuit envelope multicarrier simulation.</p> <p>With RF Blockset you can simulate RF systems at different levels of abstraction. Circuit envelope simulation enables high-fidelity, multicarrier simulation of networks with arbitrary topologies. The Equivalent Baseband library enables fast, discrete-time simulation of single-carrier cascaded systems.</p>	https://www.mathworks.cn/help/simrf/?s_tid=srchbrcm

56	RF PCB Toolbox	<p>对印刷电路板进行电磁分析</p> <p>RF PCB Toolbox™ 提供多种函数和 App，可用于设计、分析和可视化高速和射频多层印刷电路板 (PCB)。您可以设计具有参数化几何结构或任意几何结构的组件，包括分布式无源结构，例如走线、转弯和过孔。使用频域矩量法和其他电磁方法，您可以对耦合、色散和寄生效应进行建模。</p> <p>利用 RF PCB Toolbox，射频板、模块、MMIC 和 SiP 设计工程师可以预测 PCB 性能，并验证制造的 PCB 是否符合规范。对于射频和天线设计工程师，该工具箱提供了分布式滤波器、耦合器、分离器、匹配网络和 Gerber 文件生成等各种参数化模型。工具箱支持 ODB++ 以及 Cadence® Allegro®、Mentor Expedition、Altium® 和 Zuken 版图数据，信号完整性工程师可以方便地分析 PCB 布局的高速部分。</p>	https://www.mathworks.cn/products/rf-pcb.html?s_tid=srchtitle_rf%20PCB%20toolbox_2
		<p>Perform electromagnetic analysis of printed circuit boards</p> <p>RF PCB Toolbox™ provides functions and apps for designing, analyzing, and visualizing high-speed and RF multi-layer printed circuit boards (PCBs). You can design components with parameterized or arbitrary geometry, including distributed passive structures such as traces, bends, and vias. Using the frequency-domain method of moments (MoM) and other EM techniques, you can model coupling, dispersion, and parasitic effects.</p> <p>With RF PCB Toolbox, designers of RF boards, modules, MMICs, and SiPs can predict PCB performance and verify that the manufactured PCB meets specifications. For RF and antenna designers, the toolbox provides parameterized models of distributed filters, couplers, splitters, matching networks, and Gerber file generation. Toolbox support for ODB++ and databases from Cadence® Allegro®, Mentor Expedition, Altium®, and Zuken enables signal integrity engineers to analyze the high-speed portions of the PCB layout.</p>	https://www.mathworks.cn/help/rfp/cb/?s_tid=srchbrcm

57	RF Toolbox	<p>对射频组件网络进行设计、建模和分析</p> <p>RF Toolbox™ 提供一系列函数、对象和 App，用于射频 (RF) 组件网络的设计、建模、分析和可视化。此工具箱支持无线通信、雷达和信号完整性应用。</p> <p>您可以使用 RF Toolbox 构建包含滤波器、传输线、匹配网络、放大器和混频器等射频组件的网络。要指定组件，可以使用 Touchstone 文件等测量数据，也可以使用网络参数或物理属性。此工具箱提供了用于射频数据分析、操作和可视化的函数。您可以分析 S 参数，在 S、Y、Z、T 和其他网络参数之间进行转换，还可借助矩形图、极坐标图以及史密斯® 圆图将射频数据可视化。您还可以去嵌入、检查和强制无源性，并计算群和相位延迟。</p> <p>借助射频链路预算分析器，您可以从噪声、功率和非线性方面分析收发机链路，并为电路包络仿真生成 RF Blockset™ 模型。您可以使用有理函数拟合方法，构建背板、互连和线性组件模型，并导出为 Simulink® 模块、SPICE 网表或 Verilog® -A 模块，以用于时域仿真。</p>	https://www.mathworks.cn/products/rftoolbox.html?s_tid=srchtitle_rf%20toolbox_2
		<p>Design, model, and analyze networks of RF components</p> <p>RF Toolbox™ provides functions, objects, and apps for designing, modeling, analyzing, and visualizing networks of radio frequency (RF) components. The toolbox supports wireless communications, radar, and signal integrity projects.</p> <p>RF Toolbox lets you build networks of RF components such as filters, transmission lines, matching networks, amplifiers, and mixers. Components can be specified using measurement data such as Touchstone files, network parameters, or physical properties. The toolbox provides functions for analyzing, manipulating, and visualizing RF data. You can analyze S-parameters; convert among S, Y, Z, T, and other network parameters; and visualize RF data using rectangular and polar plots and Smith® Charts. You can also de-embed, check, and enforce passivity, and compute group and phase delay.</p> <p>The RF Budget Analyzer app lets you analyze transceiver chains in terms of noise, power, and nonlinearity and generate RF Blockset™ models for circuit envelope simulation. Using the rational function fitting method, you can model backplanes, interconnects, and linear components, and export them as Simulink® blocks, SPICE netlists, or Verilog® -A modules for time-domain simulation.</p>	https://www.mathworks.cn/help/rf/?s_tid=srchbrcm

58	Risk Management Toolbox	<p>开发风险模型，执行风险模拟</p> <p>Risk Management Toolbox™ 提供多种函数，可用于信用和市场风险的数学建模和模拟。您可以建立违约概率模型、创建信用评分卡、执行信贷资产分析、对模型执行回测，以评估财务损失的可能性。借助该工具箱，您可以评估企业和消费者信用风险以及市场风险。工具箱 App 可帮助您对信用评分卡变量进行自动和手动分箱。它还包括用于分析信贷资产风险的模拟工具，以及用于评估风险值 (VaR) 和 ES 的回测工具。您可以对存续期违约概率 (PD) 建模，用于估计存续期信用分析中的损失准备金。</p>	https://ww2.mathworks.cn/products/risk-management.html?s_tid=srchtitle_risk%20management%20toolbox_1
		<p>Develop risk models and perform risk simulation</p> <p>Risk Management Toolbox™ provides functions for mathematical modeling and simulation of credit and market risk. You can model probabilities of default, create credit scorecards, perform credit portfolio analysis, and backtest models to assess potential for financial loss. The toolbox lets you assess corporate and consumer credit risk as well as market risk. It includes an app for automatic and manual binning of variables for credit scorecards. It also includes simulation tools to analyze credit portfolio risk and backtesting tools to evaluate Value-at-Risk (VaR) and expected shortfall (ES).</p>	https://ww2.mathworks.cn/help/risk/?s_tid=srchtitle_risk%20management%20toolbox_1

59	Robotics System Toolbox	<p>设计、仿真和测试机器人应用程序</p> <p>Robotics System Toolbox™ 提供了用于设计、仿真和测试操纵器、移动机器人及人形机器人的工具和算法。对于操纵器和人形机器人，该工具箱包含了使用刚体树表示形式的碰撞检查、轨迹生成、正向和逆向运动学以及动力学算法。对于移动机器人，该工具箱包含用于映射、定位、路径规划、路径跟踪和移动控制的算法。该工具箱提供了常用工业机器人应用的参考示例。该工具箱还包含可以导入、可视化和仿真的商用工业机器人模型库。</p> <p>通过将提供的运动学模型和动力学模型进行组合，您可以开发功能性机器人原型。借助该工具箱，您可以通过直接连接 Gazebo 机器人仿真器来协同仿真您的机器人应用。要在硬件上验证您的设计，可以连接到机器人平台，然后生成并部署代码（使用 MATLAB Coder™ 或 Simulink Coder™）。</p>	https://www.mathworks.cn/products/robotics.html?s_tid=srchtitle_robotics%20system%20toolbox_2
		<p>Design, simulate, and test robotics applications</p> <p>Robotics System Toolbox™ provides tools and algorithms for designing, simulating, and testing manipulators, mobile robots, and humanoid robots. For manipulators and humanoid robots, the toolbox includes algorithms for collision checking, trajectory generation, forward and inverse kinematics, and dynamics using a rigid body tree representation. For mobile robots, it includes algorithms for mapping, localization, path planning, path following, and motion control. The toolbox provides reference examples of common industrial robot applications. It also includes a library of commercially available industrial robot models that you can import, visualize, and simulate.</p> <p>You can develop a functional robot prototype by combining the kinematic and dynamic models provided. The toolbox lets you co-simulate your robot applications by connecting directly to the Gazebo robotics simulator. To verify your design on hardware, you can connect to robotics platforms and generate and deploy code (with MATLAB® Coder™ or Simulink® Coder).</p>	https://www.mathworks.cn/help/robotics/?s_tid=srchbrcm

60	Robust Control Toolbox	<p>为带有不确定性的被控对象设计稳健的控制器</p> <p>Robust Control Toolbox™ 提供函数和模块，用于在被控对象存在不确定性的情况下分析和调节控制系统的性能和稳健性。您可以通过将标称动态与不确定元素（如不确定参数或未建模动态）相结合来创建不确定模型。您可以分析被控对象模型不确定性对控制系统性能的影响，并确定由不确定元素所导致的最差情况组合。“H 无穷”和“Mu 分析和综合”技术让您可以设计出最大化鲁棒稳定性和性能的控制器的。</p> <p>此工具箱为 Control System Toolbox™ 的自动调节功能增加了稳健的调节能力。被调节的控制器可以跨多个反馈回路并分散在多个可调节模块中。您可以优化标称对象的性能，同时在整个不确定性范围内强制减小最差性能。</p>	https://ww2.mathworks.cn/products/robust.html?s_tid=srchtitle_robust%20control%20toolbox_2
		<p>Design robust controllers for uncertain plants</p> <p>Robust Control Toolbox™ provides functions and blocks for analyzing and tuning control systems for performance and robustness in the presence of plant uncertainty. You can create uncertain models by combining nominal dynamics with uncertain elements, such as uncertain parameters or unmodeled dynamics. You can analyze the impact of plant model uncertainty on control system performance, and identify worst-case combinations of uncertain elements. H-infinity and mu-synthesis techniques let you design controllers that maximize robust stability and performance.</p> <p>The toolbox automatically tunes both SISO and MIMO controllers for plant models with uncertainty. Controllers can include decentralized, fixed-structure controllers with multiple tunable blocks spanning multiple feedback loops.</p>	https://ww2.mathworks.cn/help/robust/?s_tid=srchbrcm

61	ROS Toolbox	<p>设计、仿真和部署基于 ROS 的应用程序</p> <p>ROS 工具箱为 MATLAB® 和 Simulink® 与机器人操作系统 (ROS 和 ROS 2) 相互连接提供了一个接口, 以便您能够创建一个 ROS 节点网络。该工具箱包含 MATLAB 的各种功能以及用于导入、分析和回放 rosbag 文件中记录的 ROS 数据的 Simulink 模块。您还可以连接到实时 ROS 网络以访问 ROS 消息。</p> <p>该工具箱可让您连接到 Gazebo 等外部机器人仿真器, 通过桌面仿真的方式来验证 ROS 节点。ROS 工具箱支持 C++ 代码生成 (使用 MATLAB Coder™ 和 Simulink Coder™), 方便您从 Simulink 模型自动生成 ROS 节点, 然后部署到仿真硬件或物理硬件。借助 Simulink 外部模式支持, 当模型在硬件上运行时, 您将能够查看消息和更改参数。</p> <p>开始:</p>	https://www.mathworks.cn/products/ros.html?s_tid=srchtitle_ROS%20toolbox_2
		<p>Design, simulate, and deploy ROS-based applications</p> <p>ROS Toolbox provides an interface connecting MATLAB® and Simulink® with the Robot Operating System (ROS and ROS 2), enabling you to create a network of ROS nodes. The toolbox includes MATLAB functions and Simulink blocks to import, analyze, and play back ROS data recorded in rosbag files. You can also connect to a live ROS network to access ROS messages.</p> <p>The toolbox lets you verify ROS nodes via desktop simulation and by connecting to external robot simulators such as Gazebo. ROS Toolbox supports C++ code generation (with Simulink Coder™), enabling you to automatically generate ROS nodes from a Simulink model and deploy to simulated or physical hardware. Support for Simulink external mode lets you view messages and change parameters while your model is running on hardware.</p>	https://www.mathworks.cn/help/ros/?s_tid=srchtitle

62	Satellite Communications Toolbox	<p>仿真、分析和测试卫星通信系统和链路</p> <p>Satellite Communications Toolbox 提供一系列基于标准的工具，用于设计、仿真和验证卫星通信系统和链路。该工具箱可用于对卫星轨道进行建模和可视化，以及执行链路分析和接入计算。您还可以设计物理层算法以及射频组件和地面站接收机，生成测试波形，执行黄金参考设计验证。</p> <p>借助该工具箱，您可以配置、仿真、测量和分析端到端卫星通信链路。您还可以创建和重用测试，以验证您的设计、原型和实现是否符合卫星通信和导航标准 DVB-S2X、DVB-S2、CCSDS 和 GPS。</p>	https://ww2.mathworks.cn/products/satellite-communications.html?s_tid=srchtitle_satellite%20communications%20toolbox_2
		<p>Simulate, analyze, and test satellite communications systems and links</p> <p>Satellite Communications Toolbox provides standards-based tools for designing, simulating, and verifying satellite communications systems and links. The toolbox enables you to model and visualize satellite orbits and perform link analysis and access calculations. You can also design physical layer algorithms together with RF components and ground station receivers, generate test waveforms, and perform golden reference design verification.</p> <p>With the toolbox you can configure, simulate, measure, and analyze end-to-end satellite communications links. You can also create and reuse tests to verify that your designs, prototypes, and implementations comply with satellite communications and navigations standards, including DVB-S2X, DVB-S2, CCSDS, and GPS.</p>	https://ww2.mathworks.cn/help/satcom/?s_tid=srchbrcm

63	Sensor Fusion and Tracking Toolbox	<p>设计、仿真和测试多传感器跟踪和定位系统</p> <p>Sensor Fusion and Tracking Toolbox™ 提供算法和工具，用于设计、仿真和测试系统，这些系统融合来自多个传感器的数据，可保持态势感知及定位。您可以从参考示例出发，为监控系统和自主系统（包括机载、星载、陆基、舰载和水下系统）开发多目标跟踪和传感器融合。</p> <p>您可以融合来自真实传感器的数据，包括有源和无源雷达、声纳、激光雷达、EO/IR、IMU 和 GPS。您也可以通过虚拟传感器生成合成数据，在不同场景下测试算法。该工具箱包含多目标跟踪器和估计滤波器，可用于评估综合了网格级、检测级以及目标级或轨道级融合的架构。同时，工具箱还提供包括 OSPA 和 GOSPA 在内的多项指标，以便根据真值场景验证性能。</p> <p>对于仿真加速或快速原型，该工具箱支持生成 C 代码。</p>	https://ww2.mathworks.cn/products/sensor-fusion-and-tracking.html
		<p>Design, simulate, and test multisensor tracking and positioning systems</p> <p>Sensor Fusion and Tracking Toolbox™ includes algorithms and tools for designing, simulating, and testing systems that fuse data from multiple sensors to maintain situational awareness and localization. Reference examples provide a starting point for multi-object tracking and sensor fusion development for surveillance and autonomous systems, including airborne, spaceborne, ground-based, shipborne, and underwater systems.</p> <p>You can fuse data from real-world sensors, including active and passive radar, sonar, lidar, EO/IR, IMU, and GPS. You can also generate synthetic data from virtual sensors to test your algorithms under different scenarios. The toolbox includes multi-object trackers and estimation filters for evaluating architectures that combine grid-level, detection-level, and object-or track-level fusion. It also provides metrics, including OSPA and GOSPA, for validating performance against ground truth scenes.</p> <p>For simulation acceleration or rapid prototyping, the toolbox supports C code generation.</p>	https://ww2.mathworks.cn/help/fusion/?s_tid=srchbrcm

64	SerDes Toolbox	<p>设计 SerDes 系统并为高速数字互联生成 IBIS-AMI 模型</p> <p>SerDes Toolbox™ 提供 MATLAB® 和 Simulink® 模型库以及一系列分析工具和 App，可用于设计和验证串行器/解串器 (SerDes) 系统或 DDR5 等高速存储器物理层。</p> <p>借助 SerDes 设计器，您可以运用统计分析功能来快速设计有线通信链路。该 App 提供参数化的模型和算法，让您能够探索各种均衡器配置，从而提高通道性能。您可以评估眼图、浴缸曲线和通道裕量 (COM) 等指标，包括抖动和串扰效应。</p> <p>借助 CTLE、DFE、FFE 和 CDR 等基于 MATLAB 的构建模块，您可以采用数据表或测量数据来描述您选择的架构，也可以仿真控制和自适应算法。工具箱提供 PCIe、USB、以太网和 DDR 等典型应用的白盒示例，您可以在这些参考设计的基础上开展设计。</p> <p>SerDes Toolbox 支持自动生成 IBIS-AMI 双模型，以进行统计分析和时域仿真。这些模型可与第三方通道仿真器配合使用，进行系统集成和验证。</p>	https://ww2.mathworks.cn/products/serdes.html?s_tid=srchtitle_serdes%20toolbox_2
		<p>Design SerDes systems and generate IBIS-AMI models for high-speed digital interconnects</p> <p>SerDes Toolbox™ provides a MATLAB® and Simulink® model library and a set of analysis tools and apps for the design and verification of serializer/deserializer (SerDes) systems or high-speed memory PHYs such as DDR5.</p> <p>With the SerDes Designer app, you can use statistical analysis to rapidly design wired communications links. The app provides parameterized models and algorithms that let you explore a wide range of equalizer configurations to improve channel performance. You can assess metrics such as eye diagram, bathtub curve, and channel operating margin (COM), including the effects of jitter and crosstalk.</p> <p>With MATLAB based building blocks such as CTLE, DFE, FFE, and CDR, you can describe your chosen architecture using datasheets or measurement data and simulate control and adaptive algorithms. White-box examples of typical applications such as PCIe, USB, Ethernet, and DDR provide reference designs that you can use as a basis for your own designs.</p> <p>SerDes Toolbox supports automatic generation of dual IBIS-AMI models for statistical analysis and time-domain simulation. These models can be used with third-party channel simulators for system integration and verification.</p>	https://ww2.mathworks.cn/help/serdes/?s_tid=srchbrcm

65	Signal Integrity Toolbox	<p>对高速串行和并行链路进行仿真和分析</p> <p>Signal Integrity Toolbox™ 提供多种函数和 App，用于设计高速串行和并行链路。您可以生成涵盖多个参数的试验，提取设计指标，以及可视化波形和结果。您可以通过分析发射机、接收机和通道交互来预测工作裕量和链路性能。</p> <p>该工具箱支持符合标准的 IBIS-AMI 模型，可用于统计和时域仿真，以分析均衡和时钟还原。您可以使用多端口 S 参数数据、IBIS、HSPICE 和解析模型来描述通道。</p> <p>您可以使用 Signal Integrity Toolbox 分析波形和眼图并测量通道质量，同时观察 ISI、抖动和噪声等影响。您可以在频域中分析通道的插入损耗、回波损耗和串扰，并验证是否符合行业标准，包括 IEEE® 802.3、OIF、PCIe 和 DDR。</p>	https://ww2.mathworks.cn/products/signal-integrity.html?s_tid=srchtitle_signal%20integrity%20toolbox_2
		<p>Simulate and analyze high-speed serial and parallel links</p> <p>Signal Integrity Toolbox™ provides functions and apps for designing high-speed serial and parallel links. You can generate experiments covering multiple parameters, extract design metrics, and visualize waveforms and results. You can predict operating margins and link performance by analyzing transmitter, receiver, and channel interactions.</p> <p>The toolbox supports standard-compliant IBIS-AMI models for statistical and time-domain simulation to analyze equalization and clock recovery. You can describe the channel using multiport S-parameter data, IBIS, HSPICE, and analytical models.</p> <p>Signal Integrity Toolbox lets you analyze waveforms and eye diagrams and measure channel quality while observing effects such as ISI, jitter, and noise. You can analyze the channel in the frequency domain for insertion loss, return loss, and crosstalk, and verify compliance with industry standards including IEEE 802.3, OIF, PCIe, and DDR.</p> <p>Before layout, you can evaluate tradeoffs and optimize parallel and serial links for cost, performance, reliability, and compliance. You can then perform post-layout verification of the system and correlate simulation results with measurement data.</p>	https://ww2.mathworks.cn/help/signal-integrity/?s_tid=srchbr cm

66	Signal Processing Toolbox	<p>执行信号处理和分析</p> <p>Signal Processing Toolbox™ 提供多种函数和 App，可用于均匀和非均匀采样信号的分析、预处理和特征提取。该工具箱包含一系列工具，可用于滤波器设计和分析、重采样、平滑处理、去趋势和功率谱估计。该工具箱还具备以下功能：提取变化点和包络等特征、查找峰值和信号模式、量化信号相似性，以及执行 SNR 和失真等测量。您还可以执行振动信号的模式和阶次分析。</p> <p>借助 Signal Analyzer，您无需编写代码，就可以在时域、频域和时频域同时预处理和分析多个信号，探查长信号，并提取关注区域。借助 Filter Designer，您可以选择各种算法和响应来设计和分析数字滤波器。这两个 App 都能够生成 MATLAB® 代码。</p>	https://ww2.mathworks.cn/products/signal.html?s_tid=srchtitle_signal%20processing%20toolbox_2
		<p>Perform signal processing and analysis</p> <p>Signal Processing Toolbox™ provides functions and apps to analyze, preprocess, and extract features from uniformly and nonuniformly sampled signals. The toolbox includes tools for filter design and analysis, resampling, smoothing, detrending, and power spectrum estimation. The toolbox also provides functionality for extracting features like changepoints and envelopes, finding peaks and signal patterns, quantifying signal similarities, and performing measurements such as SNR and distortion. You can also perform modal and order analysis of vibration signals.</p> <p>With the Signal Analyzer app you can preprocess and analyze multiple signals simultaneously in time, frequency, and time-frequency domains without writing code; explore long signals; and extract regions of interest. With the Filter Designer app you can design and analyze digital filters by choosing from a variety of algorithms and responses. Both apps generate MATLAB® code.</p>	https://ww2.mathworks.cn/help/signal/index.html?lang=en

67	SimBiology	<p>对生物系统进行建模、仿真和分析</p> <p>SimBiology® 提供一系列 App 和可编程工具，用于对动态系统进行建模、仿真和分析，主要用于定量系统药理学 (QSP)、基于生理学的药代动力学 (PBPK) 和药代动力学/药效动力学 (PK/PD) 应用。您可以使用 SimBiology 模块图编辑器交互式构建模型，或使用 MATLAB® 语言以编程方式构建模型。您可以从头开始创建模型，可以采用 SBML 格式化文件形式导入模型，也可以在 SimBiology 模型示例的基础上构建模型。</p> <p>SimBiology 提供了多种方法，用于分析不同复杂度、不同大小的基于 ODE 的模型。您可以运行仿真来评估靶标可行性、预测药物功效和安全性，并确定最佳给药方案。您可以使用局部和全局敏感度分析来确定重要通路和参数，并通过运行参数扫描来评估生物学差异。要估计参数，可以使用非线性回归和非线性混合效应方法对数据进行拟合，并执行非房室模型分析 (NCA)。</p>	https://www.mathworks.cn/products/simbiology.html?s_tid=srchtitle_simbiology_2
		<p>Model, simulate, and analyze biological systems</p> <p>SimBiology® provides apps and programmatic tools for modeling, simulating, and analyzing dynamic systems, focusing on quantitative systems pharmacology (QSP), physiologically-based pharmacokinetic (PBPK), and pharmacokinetic/pharmacodynamic (PK/PD) applications. You can build models interactively using the SimBiology block diagram editor or programmatically using the MATLAB® language. Your models can be created from scratch, imported as SBML formatted files, or built on the model examples provided in SimBiology.</p> <p>SimBiology provides a variety of techniques for analyzing ODE-based models ranging in complexity and size. You can run simulations to assess target feasibility, predict drug efficacy and safety, and identify optimal dosing schedules. You can identify key pathways and parameters using local and global sensitivity analyses and assess biological variability by running parameter sweeps. To estimate parameters you can fit data using nonlinear regression and nonlinear mixed-effects techniques and perform non-compartmental analysis (NCA).</p>	https://www.mathworks.cn/help/simbio/?s_tid=srchbrcm

68	SimEvents	<p>消息通信和离散事件系统建模与仿真</p> <p>SimEvents® 包含离散事件仿真引擎和组件库，可用于对 Simulink 中基于消息的通信或任何事件驱动的流程进行建模，以分析事件驱动系统模型以及优化延迟、吞吐量和丢包等性能特征。队列、服务器、开关和其他预定义模块则可用于对路由、处理延迟以及调度和通信优先级建模。</p> <p>使用 SimEvents，您可以研究任务定时和资源使用对分布式控制系统、软件和硬件架构及通信网络性能产生的影响。此外，还可以对有关预测、产能规划和供应链管理的决策进行运营研究。</p>	https://ww2.mathworks.cn/products/simevents.html?s_tid=srchtitle_simevents_2
		<p>Model and simulate discrete-event systems</p> <p>SimEvents® provides a discrete-event simulation engine and component library for analyzing event-driven system models and optimizing performance characteristics such as latency, throughput, and packet loss. Queues, servers, switches, and other predefined blocks enable you to model routing, processing delays, and prioritization for scheduling and communication.</p> <p>With SimEvents, you can study the effects of task timing and resource usage on the performance of distributed control systems, software and hardware architectures, and communication networks. You can also conduct operational research for decisions related to forecasting, capacity planning, and supply-chain management.</p>	https://ww2.mathworks.cn/help/simevents/?s_tid=srchbrcm

69	Simscape	<p>建模和仿真多域物理系统</p> <p>Simscape™ 可让您在 Simulink® 环境中迅速创建物理系统的模型。通过 Simscape，您可以基于物理连接直接相连模块框图建立物理组件模型。通过将基础组件依照原理图装配，为电机、桥式整流器、液压致动器和制冷系统等系统建模。Simscape 附加产品提供了更多复杂组件和分析功能。</p> <p>Simscape 可帮助您开发控制系统并测试系统级性能。您可以利用基于 MATLAB® 的 Simscape 语言，使用文本定义物理建模组件、域和库，从而创建自定义组件模型。您可以利用 MATLAB 变量和表达式参数化您的模型，使用 Simulink 设计用于物理系统的控制系统。为了将模型部署到其他仿真环境，包括硬件在环 (HIL) 系统，Simscape 还支持生成 C 代码。</p>	https://www.mathworks.cn/products/simscape.html?s_tid=srchtitle_simscape_1
		<p>Model and simulate multidomain physical systems</p> <p>Simscape™ enables you to rapidly create models of physical systems within the Simulink® environment. With Simscape you build physical component models based on physical connections that directly integrate with block diagrams and other modeling paradigms. You model systems such as electric motors, bridge rectifiers, hydraulic actuators, and refrigeration systems by assembling fundamental components into a schematic. Simscape add-on products provide more complex components and analysis capabilities.</p> <p>Simscape helps you develop control systems and test system-level performance. You can create custom component models using the MATLAB® based Simscape language, which enables text-based authoring of physical modeling components, domains, and libraries. You can parameterize your models using MATLAB variables and expressions, and design control systems for your physical system in Simulink. To deploy your models to other simulation environments, including hardware-in-the-loop (HIL) systems, Simscape supports C-code generation.</p>	https://www.mathworks.cn/help/physmod/simscape/?s_tid=srchbrcm

70	Simscape Driveline	<p>转动和平移机械系统的建模和仿真</p> <p>Simscape Driveline™（以前称为 SimDriveline™）为转动和平移机械系统建模和仿真提供组件库。它包括蜗杆齿轮、导螺杆和车辆组件（如发动机、轮胎、变速器和扭矩转换器）的模型。可以使用这些组件对直升机传动系统、工业机器、汽车动力系统和其他应用领域中的机械动力传动进行建模。您可以利用 Simscape™ 产品系列中的组件，将电气系统、液压系统、气动系统和其他物理系统集成到您的模型中。</p> <p>Simscape Driveline 可帮助您开发控制系统并测试系统级性能。您可以借助基于 MATLAB® 的 Simscape 语言，使用文本定义物理建模组件、域和库，从而创建自定义组件模型。您可以利用 MATLAB 变量和表达式参数化您的模型，使用 Simulink® 设计用于物理系统的控制系统。Simscape Driveline 还支持生成 C 代码，您可以模型部署到其他仿真环境，包括硬件在环 (HIL) 系统。</p>	https://www.mathworks.cn/products/simscape-driveline.html?s_tid=srchtitle_simscape%20driveline_1
		<p>Model and simulate rotational and translational mechanical systems</p> <p>Simscape™ Driveline™ provides component libraries for modeling and simulating rotational and translational mechanical systems. It includes models of worm gears, lead screws, and vehicle components such as engines, tires, transmissions, and torque converters. You can use these components to model the transmission of mechanical power in helicopter drivetrains, industrial machinery, automotive powertrains, and other applications. You can integrate electrical, hydraulic, pneumatic, and other physical systems into your model using components from the Simscape family of products.</p> <p>Simscape Driveline helps you develop control systems and test system-level performance. You can create custom component models with the MATLAB® based Simscape language, which enables text-based authoring of physical modeling components, domains, and libraries. You can parameterize your models using MATLAB variables and expressions, and design control systems for your physical system in Simulink®. To deploy your models to other simulation environments, including hardware-in-the-loop (HIL) systems, Simscape Driveline supports C-code generation.</p>	https://www.mathworks.cn/help/physmod/sdl/?s_tid=srchbrcm

71	Simscape Electrical	<p>电子、机电和电力系统建模和仿真</p> <p>Simscape Electrical™ (以前称为 SimPowerSystems™ 和 SimElectronics®) 提供了用于电子、机电和电力系统建模和仿真的组件库。它提供了各种组件模型, 包括半导体、电机以及用于诸如机电驱动器、智能电网和可再生能源系统等应用的组件。您可以使用这些组件来评估模拟电路架构、开发带电气驱动器的机电系统, 以及分析电网级别的发电、电能转换、输电和耗电情况。</p> <p>Simscape Electrical 可帮助您开发控制系统并测试系统级性能。您可以利用 MATLAB® 变量和表达式参数化您的模型, 在 Simulink® 环境下设计电力控制系统。您可以通过 Simscape 产品系列中的组件将机械系统、液压系统、热系统和其他物理系统集成到您的模型中。为了将模型部署到其他仿真环境, 包括硬件在环 (HIL) 系统, Simscape Electrical 还支持生成 C 代码。</p> <p>Simscape Electrical 是协同 Hydro-Québec of Montreal 共同开发的。</p>	https://www.mathworks.cn/products/simscape-electrical.html?s_tid=srchtitle_simscape%20electrical_2
		<p>Model and simulate electronic, mechatronic, and electrical power systems</p> <p>Simscape™ Electrical™ (formerly SimPowerSystems™ and SimElectronics®) provides component libraries for modeling and simulating electronic, mechatronic, and electrical power systems. It includes models of semiconductors, motors, and components for applications such as electromechanical actuation, smart grids, and renewable energy systems. You can use these components to evaluate analog circuit architectures, develop mechatronic systems with electric drives, and analyze the generation, conversion, transmission, and consumption of electrical power at the grid level.</p> <p>Simscape Electrical helps you develop control systems and test system-level performance. You can parameterize your models using MATLAB® variables and expressions, and design control systems for electrical systems in Simulink®. You can integrate mechanical, hydraulic, thermal, and other physical systems into your model using components from the Simscape family of products. To deploy models to other simulation environments, including hardware-in-the-loop (HIL) systems, Simscape Electrical supports C-code generation.</p> <p>Simscape Electrical was developed in collaboration with Hydro-Québec of Montreal.</p>	https://www.mathworks.cn/help/physmod/sps/?s_tid=srchbrcm

72	Simscape Fluids	<p>流体系统建模和仿真</p> <p>Simscape Fluids™（前身为 SimHydraulics®）为流体系统建模和仿真提供组件库。它包括液压泵、阀门、作动器、管道和换热器的模型。您可以使用这些组件来开发流体动力系统，例如前端装载机、动力转向装置和起落架作动系统。使用 Simscape Fluids，还可以开发发动机冷却系统、齿轮箱润滑系统和燃油供应系统。您可以通过 Simscape™ 产品系列中的组件将机械系统、电气系统、热系统和其他物理系统集成到您的模型中。</p> <p>Simscape Fluids 可帮助您开发控制系统并测试系统级性能。您可以借助基于 MATLAB® 的 Simscape 语言，使用文本定义物理建模组件、域和库，从而创建自定义组件模型。您可以利用 MATLAB 变量和表达式参数化您的模型，使用 Simulink® 设计用于液压系统的控制系统。为了将模型部署到其他仿真环境中，包括硬件在环 (HIL) 系统，Simscape Fluids 还支持生成 C 代码。</p>	https://ww2.mathworks.cn/products/simscape-fluids.html?s_tid=srchtitle_simscape%20fluids_1
		<p>Model and simulate fluid systems</p> <p>Simscape™ Fluids™ provides component libraries for modeling and simulating fluid systems. It includes models of hydraulic pumps, valves, actuators, pipelines, and heat exchangers. You can use these components to develop fluid power systems such as front-loader, power steering, and landing gear actuation systems. Simscape Fluids also enables you to develop engine cooling, gearbox lubrication, and fuel supply systems. You can integrate mechanical, electrical, thermal, and other physical systems into your model using components from the Simscape family of products.</p> <p>Simscape Fluids helps you develop control systems and test system-level performance. You can create custom component models with the MATLAB® based Simscape language, which enables text-based authoring of physical modeling components, domains, and libraries. You can parameterize your models using MATLAB variables and expressions, and design control systems for your hydraulic system in Simulink®. To deploy models to other simulation environments, including hardware-in-the-loop (HIL) systems, Simscape Fluids supports C-code generation.</p>	https://ww2.mathworks.cn/help/physmod/hydro/?s_tid=srchbrcm

73	Simscape Multibody	<p>多体机械系统的建模和仿真</p> <p>Simscape Multibody™（前身为 SimMechanics™）提供了适用于 3D 机械系统（例如机器人、汽车悬架、建筑设备和飞机起落架）的多体仿真环境。您可以使用表示刚体、关节、约束、力元件和传感器的模块对多体系统进行建模。Simscape Multibody 会建立整个机械系统的运动方程并进行求解。您可将完整的 CAD 装配件（包括质量、惯性、关节、约束和 3D 几何结构）导入到模型。您可在自动生成的 3D 动画中查看系统动态。</p> <p>Simscape Multibody 可帮助您开发控制系统并测试系统级性能。您可以使用 MATLAB® 变量和表达式对模型进行参数赋值，在 Simulink® 中设计多体系统的控制算法。您可以利用 Simscape™ 产品系列中的组件，将液压系统、电气系统、气动系统和其他物理系统集成到模型中。为了将模型部署到其他仿真环境，比如硬件在环 (HIL) 系统，Simscape Multibody 还支持生成 C 代码。</p>	https://www.mathworks.cn/products/simscape-multibody.html?s_tid=srchtitle_simscape%20multibody_1
		<p>Model and simulate multibody mechanical systems</p> <p>Simscape™ Multibody™ provides a multibody simulation environment for 3D mechanical systems, such as robots, vehicle suspensions, construction equipment, and aircraft landing gear. You can model multibody systems using blocks representing bodies, joints, constraints, force elements, and sensors. Simscape Multibody formulates and solves the equations of motion for the complete mechanical system. You can import complete CAD assemblies, including all masses, inertias, joints, constraints, and 3D geometry, into your model. An automatically generated 3D animation lets you visualize the system dynamics.</p> <p>Simscape Multibody helps you develop control systems and test system-level performance. You can parameterize your models using MATLAB® variables and expressions, and design control systems for your multibody system in Simulink®. You can integrate hydraulic, electrical, pneumatic, and other physical systems into your model using components from the Simscape family of products. To deploy your models to other simulation environments, including hardware-in-the-loop (HIL) systems, Simscape Multibody supports C-code generation.</p>	https://www.mathworks.cn/help/physmod/sm/?s_tid=srchbrcm

74	Simulink 3D Animation	<p>在虚拟现实环境中实现动态系统行为可视化</p> <p>Simulink 3D Animation™ 将 Simulink® 模型和 MATLAB® 算法与虚拟现实场景中的三维图形对象相关联。通过在桌面或实时仿真过程中更改位置、旋转、缩放比例和其他对象属性，可以用动画呈现虚拟世界。您还可以感知虚拟世界中的碰撞和其他事件，并将其馈送回您的 MATLAB 和 Simulink 算法中。来自虚拟摄像机的视频可以流式传输到 Simulink 进行进一步处理。</p> <p>Simulink 3D Animation 包括用于虚拟场景渲染与交互的编辑器和查看器。使用 3D World Editor，您可以导入 CAD 和 URDF 格式的文件，并使用三维对象组装创建详细场景。该工具支持采用立体视觉沉浸式查看三维世界。您可以在 MATLAB 图窗内集成多个三维场景视图，并使用力反馈操纵杆、三维鼠标或其他硬件设备与虚拟世界交互。Simulink 3D Animation 支持 X3D，这是一种 ISO 标准文件格式和运行时架构，用于三维场景和对象的表示和通信。</p>	https://www.mathworks.cn/products/3d-animation.html?s_tid=srchtitle_simulink%203D%20animation_3
		<p>Visualize dynamic system behavior in a virtual reality environment</p> <p>Simulink® 3D Animation™ links Simulink models and MATLAB® algorithms to 3D graphics objects in virtual reality scenes. You can animate a virtual world by changing position, rotation, scale, and other object properties during desktop or real-time simulation. You can also sense collisions and other events in the virtual world and feed them back into your MATLAB and Simulink algorithms. Video from virtual cameras can be streamed to Simulink for processing.</p> <p>Simulink 3D Animation includes editors and viewers for rendering and interacting with virtual scenes. With the 3D World Editor, you can import CAD and URDF file formats as well as author detailed scenes assembled from 3D objects. The 3D world can be viewed immersively using stereoscopic vision. You can incorporate multiple 3D scene views inside MATLAB figures, and interact with the virtual world using a force-feedback joystick, space mouse, or other hardware device. Simulink 3D Animation supports X3D, an ISO standard file format and run-time architecture for representing and communicating with 3D scenes and objects.</p>	https://www.mathworks.cn/help/sl3d/?s_tid=srchbrcm

75	Simulink Check	<p>衡量设计质量、跟踪验证活动并验证标准合规性</p> <p>Simulink Check™ 可对您的模型、需求和测试进行分析，以评估设计质量和标准合规性。它提供行业认可的检查和规范，用于识别开发过程中违反建模标准和指南的情况。支持的高完整性软件开发标准包括 ISO 26262、DO-178C、DO-254、IEC 61508、ISO 25119、IEC 62304 和 MathWorks 咨询委员会 (MAB) 风格指南。Simulink Check 还支持 CERT C、CWE 和 ISO/IEC TS 17961 等安全编码标准。您可以创建自定义检查以针对自己的标准或指南实现合规。编辑时检查可在编辑过程中识别合规性问题。</p> <p>Simulink Check 提供了规模和复杂度等指标，以评估设计的状态和质量。模型测试仪表板可整合来自基于需求的测试活动的的数据，以跟踪测试状态。自动模型重构可用于替换建模克隆件，降低设计复杂度，并识别可重用的内容。模型分块器工具可以隔离模型中有问题的行为，并生成简化模型以用于调试。</p>	https://ww2.mathworks.cn/products/simulink-check.html?s_tid=srchtitle_simulink%20check_2
		<p>Measure design quality, track verification activities, and verify compliance with standards</p> <p>Simulink® Check™ analyzes your models, requirements, and tests to assess design quality and compliance with standards. It provides industry-recognized checks and metrics that identify modeling standard and guideline violations during development. Supported high-integrity software development standards include ISO 26262, DO-178C, DO-254, IEC 61508, ISO 25119, IEC 62304, and MathWorks Advisory Board (MAB) style guidelines. Simulink Check also supports secure coding standards such as CERT C, CWE, and ISO/IEC TS 17961. You can create custom checks to comply with your own standards or guidelines. Edit-time checks identify compliance issues as you edit.</p> <p>Simulink Check provides metrics such as size and complexity for assessing the status and quality of your design. The model testing dashboard consolidates data from your requirements-based testing activities to track testing status. Automatic model refactoring lets you replace modeling clones, reduce design complexity, and identify reusable content. The Model Slicer tool isolates problematic behavior in models and generates simplified models for debugging.</p> <p>Support for industry standards is available through IEC Certification Kit (for ISO 26262 and IEC 61508) and DO Qualification Kit (for DO-178).</p>	https://ww2.mathworks.cn/help/slc/check/index.html?lang=en

76	Simulink Code Inspector	<p>自动审查和管理源代码以满足安全标准</p> <p>Simulink Code Inspector™ 自动将生成的代码与其源模型进行比较，以满足 DO-178 及其他高完整性标准中的代码审查目标。该代码检查器会系统地检查模型中的模块、状态图、参数和设置，以确定它们在功能上是否与所生成代码中的运算、运算符和数据等效。</p> <p>Simulink Code Inspector 提供详细的模型到代码以及代码到模型可追溯性分析。它会生成功能等效及可追溯性报告，您可以将这些报告提交给认证机构，以满足 DO-178 软件编码验证目标。它提供一个 App，可用于检查模型兼容性并检查代码。代码检查结果显示在模型和关联代码中。</p> <p>配合 DO Qualification Kit (for DO-178)，该产品还可实现对行业标准的支持。</p>	https://ww2.mathworks.cn/products/simulink-code-inspector.html?s_tid=srchtitle_simulink%20code%20inspector_3
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77	Simulink Coder	<p>从 Simulink 和 Stateflow 模型生成 C 和 C++ 代码</p> <p>Simulink Coder™（以前称为 Real-Time Workshop®）可从 Simulink® 模型、Stateflow® 图和 MATLAB® 函数生成并执行 C 和 C++ 代码。生成的源代码可用于实时和非实时应用，包括仿真加速、快速原型建立和硬件在环测试。可以使用 Simulink 对生成的代码进行调试和监测，或在 MATLAB 和 Simulink 之外运行代码并与之交互。</p>	https://ww2.mathworks.cn/product/simulink-coder.html?s_tid=srchtitle_simulink%20coder_2
		<p>Generate C and C++ code from Simulink and Stateflow models</p> <p>Simulink® Coder™ (formerly Real-Time Workshop®) generates and executes C and C++ code from Simulink models, Stateflow® charts, and MATLAB® functions. The generated source code can be used for real-time and non-real-time applications, including simulation acceleration, rapid prototyping, and hardware-in-the-loop testing. You can tune and monitor the generated code using Simulink or run and interact with the code outside MATLAB and Simulink.</p>	https://ww2.mathworks.cn/help/rtw/index.html?lang=en

78	Simulink Compiler	<p>将仿真作为独立可执行程序、Web App 和功能样机单元 (FMU) 共享</p> <p>Simulink Compiler™ 支持您将 Simulink® 仿真作为独立可执行程序共享。要构建可执行程序，只需将编译好的 Simulink 模型和用于设置、运行和分析仿真的 MATLAB® 代码一起打包。独立可执行程序可以是使用 MATLAB 图形并由 MATLAB App 设计工具设计 UI 的完整仿真应用程序。要在外部仿真环境进行协同仿真，您可以生成符合功能样机接口 (FMI) 标准的独立功能样机单元 (FMU) 二进制文件。</p> <p>为使部署的仿真支持基于浏览器的访问，您可以使用 MATLAB Web App Server™ 创建和托管 Web App。Simulink 仿真可以打包到软件组件中，以便与其他编程语言集成（需要 MATLAB Compiler SDK™）。结合 MATLAB Production Server™，您还可以面向企业系统进行大规模部署。</p> <p>要从 Simulink 生成 C 和 C++ 源代码，请使用 Simulink Coder™。</p>	https://www.mathworks.cn/products/simulink-compiler.html?s_tid=srchtitle_simulink%20compiler_1
		<p>Share simulations as standalone executables, web apps, and Functional Mockup Units (FMUs)</p> <p>Simulink® Compiler™ enables you to share Simulink simulations as standalone executables. You can build the executables by packaging the compiled Simulink model and the MATLAB® code used to set up, run, and analyze a simulation. Standalone executables can be complete simulation apps that use MATLAB graphics and UIs designed with MATLAB App Designer. To cosimulate with an external simulation environment, you can generate standalone Functional Mockup Unit (FMU) binaries that adhere to the Functional Mockup Interface (FMI) standard.</p> <p>To provide browser-based access to your deployed simulation, you can create a web app and host it with MATLAB Web App Server™. Simulink simulations can be packaged into software components for integration with other programming languages (with MATLAB Compiler SDK™). Large-scale deployment to enterprise systems is supported through MATLAB Production Server™.</p> <p>To generate C and C++ source code from Simulink, use Simulink Coder™.</p>	https://www.mathworks.cn/help/slc/compiler/?s_tid=srchbrm

79	Simulink Control Design	<p>线性化模型并设计控制系统</p> <p>Simulink Control Design™ 支持您设计和分析用 Simulink® 建模的控制系统。您可以自动调节任意 SISO 和 MIMO 控制架构，包括 PID 控制器。PID 自动调节功能可以部署到嵌入式软件，以便实时自动计算 PID 增益。如果您的应用要求控制器适应不断变化的被控对象工况，您可以实现无模型极值搜索控制和模型参考自适应控制。</p> <p>您可以找到各个工况点，计算 Simulink 模型在不同工况下的精确线性化。借助 Simulink Control Design 提供的工具，您无需修改模型，就可以计算基于仿真的频率响应。</p>	https://ww2.mathworks.cn/products/simcontrol.html?s_tid=srchtitle_simulink%20control%20design_2
		<p>Linearize models and design control systems</p> <p>Simulink® Control Design™ lets you design and analyze control systems modeled in Simulink. You can automatically tune arbitrary SISO and MIMO control architectures, including PID controllers. PID autotuning can be deployed to embedded software for automatically computing PID gains in real time. You can also implement model-free extremum-seeking control and model reference adaptive control for applications where the controller must adapt to changing plant conditions.</p> <p>You can find operating points and compute exact linearizations of Simulink models at various operating conditions. Simulink Control Design provides tools that let you compute simulation-based frequency responses without modifying your model.</p>	https://ww2.mathworks.cn/help/simcontrol/?s_tid=srchbrm

80	Simulink Coverage	<p>测量模型和生成的代码的测试覆盖率</p> <p>Simulink Coverage™ 执行模型和代码覆盖率分析，以测量模型和生成的代码的测试完整度。它应用决策、条件、修正条件/决策覆盖率 (MC/DC) 和关系边界覆盖率等行业标准指标来评估模型、软件在环 (SIL) 和处理器在环 (PIL) 仿真测试的有效性。您可以通过缺失覆盖率数据来发现测试缺口、缺失需求或非预期功能。</p> <p>Simulink Coverage 生成交互式报告，显示您的模型、C/C++ S-Function、MATLAB® 函数和 Embedded Coder® 生成的代码中有多少已被执行。您可以在模块和子系统中高亮覆盖率结果，以直观地显示测试缺口。为了评估测试的完整度，您可以累积多次测试运行的覆盖率数据，并查看通过单元和系统测试实现的覆盖率。覆盖率结果可以追溯到需求和测试。您可以应用筛选器从覆盖率中排除部分模块，或者解释报告中的缺失覆盖率。</p> <p>结合 DO Qualification Kit 和 IEC Certification Kit，该工具还可支持行业标准。</p>	https://ww2.mathworks.cn/products/simulink-coverage.html?s_tid=srchtitle_simulink%20coverage_2
		<p>Measure test coverage in models and generated code</p> <p>Simulink® Coverage™ performs model and code coverage analysis that measures testing completeness in models and generated code. It applies industry-standard metrics such as decision, condition, modified condition/decision coverage (MCDC), and relational boundary coverage to assess the effectiveness of simulation testing in models, software-in-the-loop (SIL), and processor-in-the-loop (PIL). You can use missing coverage data to find gaps in testing, missing requirements, or unintended functionality.</p> <p>Simulink Coverage produces interactive reports showing how much of your model, C/C++ S-functions, MATLAB® functions, and code generated by Embedded Coder® has been exercised. You can highlight coverage results in blocks and subsystems to visualize gaps in testing. To assess testing completeness, you can accumulate coverage data from multiple test runs, as well as view coverage achieved through unit and system tests. Coverage outcomes can be traced to requirements and tests. You can apply filters to exclude blocks from coverage and justify missing coverage in reports.</p> <p>Support for industry standards is available through DO Qualification Kit and IEC Certification Kit.</p>	https://ww2.mathworks.cn/help/slc/coverage/?s_tid=srchbrm

81	Simulink Design Optimization	<p>分析模型敏感度并调优模型参数</p> <p>Simulink Design Optimization™ 提供一系列函数、交互式工具和模块，可用于模型参数分析和调优。您可以确定模型的敏感度，将模型拟合到测试数据，并调优模型以满足要求。使用蒙特卡罗仿真和试验设计等方法，您可以探索设计空间并计算参数对模型行为的影响。</p> <p>Simulink Design Optimization 可以帮助您提高模型准确度。您可以对测试数据进行预处理，自动估计摩擦系数和空气动力系数等模型参数，并验证估计结果。</p> <p>为了改进响应时间、带宽和能耗等系统设计特性，您可以同时优化物理被控对象参数和算法或控制器增益。您可以调优参数，以满足时域和频域要求（例如过冲和相位裕度）以及自定义要求。</p>	https://ww2.mathworks.cn/products/sl-design-optimization.html?s_tid=srchtitle_simulink%20design%20optimization_2
		<p>Analyze model sensitivity and tune model parameters</p> <p>Simulink® Design Optimization™ provides functions, interactive tools, and blocks for analyzing and tuning model parameters. You can determine the model's sensitivity, fit the model to test data, and tune it to meet requirements. Using techniques like Monte Carlo simulation and Design of Experiments, you can explore your design space and calculate parameter influence on model behavior.</p> <p>Simulink Design Optimization helps you increase model accuracy. You can preprocess test data, automatically estimate model parameters such as friction and aerodynamic coefficients, and validate the estimation results.</p> <p>To improve system design characteristics such as response time, bandwidth, and energy consumption, you can jointly optimize physical plant parameters and algorithmic or controller gains. These parameters can be tuned to meet time-domain and frequency-domain requirements, such as overshoot and phase margin, and custom requirements.</p>	https://ww2.mathworks.cn/help/sldo/?s_tid=srchbrcm

82	Simulink Design Verifier	<p>识别设计错误、证明需求合规及生成测试</p> <p>Simulink Design Verifier™ 使用形式化方法来识别模型中隐藏的设计错误。它检测模型中导致整数溢出、死逻辑、数组访问越界和除以零的块。它可以形式化验证设计是否符合功能需求。对于每个设计错误或需求违规项，它会生成一个仿真测试用例以供调试。</p> <p>Simulink Design Verifier 可以生成测试用例以满足模型覆盖率和自定义目标，从而扩展现有的基于需求的测试用例。这些测试用例有助于您的模型满足条件覆盖率、决策覆盖率、修正条件/决策覆盖率 (MCDC) 以及自定义覆盖率目标。除了满足覆盖率目标外，您还可以指定自定义的测试目标来自动生成基于需求的测试用例。</p> <p>配合 IEC Certification Kit (for ISO 26262 and IEC 61508) 和 DO Qualification Kit (for DO-178 and DO-254)，可实现对行业标准的支持。</p>	https://ww2.mathworks.cn/products/simulink-design-verifier.html?s_tid=srchtitle_simulink%20design%20verifier_2
		<p>Identify design errors, prove requirements compliance, and generate tests</p> <p>Simulink® Design Verifier™ uses formal methods to identify hidden design errors in models. It detects blocks in the model that result in integer overflow, dead logic, array access violations, and division by zero. It can formally verify that the design meets functional requirements. For each design error or requirements violation, it generates a simulation test case for debugging.</p> <p>Simulink Design Verifier generates test cases for model coverage and custom objectives to extend existing requirements-based test cases. These test cases drive your model to satisfy condition, decision, modified condition/decision (MCDC), and custom coverage objectives. In addition to coverage objectives, you can specify custom test objectives to automatically generate requirements-based test cases.</p> <p>Support for industry standards is available through IEC Certification Kit (for IEC 61508 and ISO 26262) and DO Qualification Kit (for DO-178).</p>	https://ww2.mathworks.cn/help/sldv/?s_tid=srchbrcm

83	Simulink Desktop Real-Time	<p>在您的计算机上实时运行 Simulink 模型</p> <p>Simulink Desktop Real-Time™ 提供实时内核，用于在装有 Windows® 或 macOS® 的笔记本电脑或台式机执行 Simulink® 模型。它包含模块库，可连接到特定的 I/O 设备。您可以在 PC 或 Mac 计算机上使用 Simulink 创建实时系统，并将其连接到物理设备。</p> <p>请参考 Simulink Real-Time™ 实现高效实时仿真，并使用 Speedgoat™ 目标计算机硬件进行测试。</p>	https://ww2.mathworks.cn/products/simulink-desktop-real-time.html?s_tid=srchtitle_simulink%20desktop%20real-time_2
		<p>Run Simulink models in real time on your computer</p> <p>Simulink® Desktop Real-Time™ provides a real-time kernel for executing Simulink models on a Windows® or Mac laptop or desktop. It includes library blocks that connect to a range of I/O devices. You can create and tune a real-time system for rapid prototyping or hardware-in-the-loop simulation with your computer.</p> <p>Simulink Desktop Real-Time supports real-time performance with lower sample rate for Connected IO mode simulation in Simulink, and supports higher sample rates for Run in Kernel mode simulation in Simulink with Simulink Coder™.</p>	https://ww2.mathworks.cn/help/sldrt/?s_tid=srchbrcm

84	Simulink PLC Coder	<p>为 PLC 和 PAC 生成 IEC 61131-3 结构化文本和梯形图</p> <p>Simulink PLC Coder™ 可从 Simulink® 模型、Stateflow® 图和 MATLAB® 函数生成独立于硬件的 IEC 61131-3 结构化文本和梯形图。生成的结构化文本可采用 PLCopen XML 格式，也可采用主流集成开发环境 (IDE) 支持的其他文件格式，这些 IDE 包括 3S-Smart Software Solutions CODESYS®、Rockwell Automation Studio 5000、Siemens TIA Portal 和 Omron® Sysmac® Studio。生成的梯形图使用 Rockwell Automation Studio 5000 支持的文件格式。因此，您可以编译您的应用程序，并将其部署到多台可编程逻辑控制器 (PLC) 和可编程自动化控制器 (PAC) 设备上。</p> <p>Simulink PLC Coder 可以生成测试平台，帮助您使用 PLC、PAC IDE 和仿真工具验证结构化文本和梯形图。它还提供代码生成报告，其中包含静态代码指标以及模型与代码之间的双向可追溯性。配合 IEC Certification Kit (for IEC 61508 and IEC 61511)，该产品还可实现对行业标准的支持。</p>	https://www.mathworks.cn/products/simulink-plc-coder.html?s_tid=srchtitle_simulink%20PLC%20coder%20_2
		<p>Generate IEC 61131-3 Structured Text and Ladder Diagrams for PLCs and PACs</p> <p>Simulink® PLC Coder™ generates hardware-independent IEC 61131-3 Structured Text and Ladder Diagrams from Simulink models, Stateflow® charts, and MATLAB® functions. Structured Text is generated in PLCopen XML and other file formats supported by widely used integrated development environments (IDEs) including 3S-Smart Software Solutions CODESYS, Rockwell Automation® Studio 5000, Siemens® TIA Portal, and OMRON® Sysmac® Studio. Ladder diagrams are generated in file formats supported by Rockwell Automation Studio 5000. As a result, you can compile and deploy your application to numerous programmable logic controller (PLC) and programmable automation controller (PAC) devices.</p> <p>Simulink PLC Coder generates test benches that help you verify the Structured Text and Ladder Diagrams using PLC and PAC IDEs and simulation tools. It also provides code generation reports with static code metrics and bidirectional traceability between model and code. Support for industry standards is available through IEC Certification Kit (for IEC 61508 and IEC 61511).</p>	https://www.mathworks.cn/help/plc-coder/?s_tid=srchbrm

85	Simulink Real-Time	<p>构建、运行和测试实时应用</p> <p>通过 Simulink Real-Time™, 您可以基于 Simulink® 模型创建实时应用, 并在连接到物理系统的 Speedgoat 目标计算机硬件上运行。该产品专为处理实时仿真和测试任务而设计, 包括快速控制原型 (RCP)、DSP 和视觉系统原型, 以及硬件在环 (HIL) 仿真。</p> <p>有了 Simulink Real-Time, 您可以借助 Speedgoat I/O 驱动模块扩展 Simulink 模型, 并自动构建实时应用。测试可以自动执行, 也可以在配备有实时内核、多核 CPU、I/O 和协议接口以及 FPGA 的 Speedgoat 目标计算机上以交互方式运行。</p> <p>Simulink Real-Time 和 Speedgoat 目标计算机硬件相辅相成, 共同打造适用于桌面、实验室和现场环境的实时系统。这套软硬件解决方案支持最新版本的 MATLAB® 和 Simulink。</p>	https://ww2.mathworks.cn/products/simulink-real-time.html?tid=srchtitle_simulink%20real-time_3
		<p>Build, run, and test real-time applications</p> <p>Simulink® Real-Time™ lets you create real-time applications from Simulink models and run them on Speedgoat® target computer hardware connected to your physical system. It is designed for real-time simulation and testing tasks, including rapid control prototyping (RCP), DSP and vision system prototyping, and hardware-in-the-loop (HIL) simulation.</p> <p>With Simulink Real-Time you can extend your Simulink models with blocks from the Speedgoat I/O Blockset and automatically build real-time applications. Tests can be automated or run interactively on a Speedgoat target computer equipped with a real-time kernel, multicore CPUs, I/O and protocol interfaces, and FPGAs.</p> <p>Simulink Real-Time and Speedgoat target computer hardware are designed to work together to create real-time systems for desktop, lab, and field environments. The software and hardware solution supports the latest versions of MATLAB® and Simulink.</p>	https://ww2.mathworks.cn/help/slrealtime/?s_tid=srchbrm

86	Simulink Report Generator	<p>通过 Simulink 模型和仿真设计并自动生成报告</p> <p>Simulink Report Generator™ 提供的功能和 API 让您可以在报告中加入模块图形、Stateflow® 图表、MATLAB® Function 模块、真值表、数据字典和其他模型元素。您可以设计和生成 PDF、Microsoft® Word®、Microsoft PowerPoint® 和 HTML 格式的 report。您可以生成系统设计说明书等标准报告，也可以生成自定义报告，其包含设计输出，例如生成的代码、需求追溯链接、文档和测试结果。另外，还可以生成包含符合 DO-178、ISO 26262、IEC 61508 以及相关行业标准的输出物。</p> <p>借助 Simulink Report Generator，您可以创建无需 Simulink 许可证即可通过 Web 浏览器查看、浏览和共享 Simulink 模型的 Web 视图，可以在 HTML 代码生成、需求、覆盖率和其他类型的报告中嵌入模型 Web 视图。</p>	https://ww2.mathworks.cn/products/simulink-report-generator.html?s_tid=srchtitle_simulink%20report%20generator_2
		<p>Design and automatically generate reports from Simulink models and Stateflow charts</p> <p>Simulink® Report Generator™ provides functions and APIs that enable you to include block diagrams, Stateflow® charts, MATLAB® Function blocks, truth tables, data dictionaries, and other model elements in your reports. You can design and generate reports in PDF, Microsoft® Word, Microsoft PowerPoint®, and HTML. You can generate standard reports such as system design descriptions, as well as custom reports containing design artifacts such as generated code, requirements traceability, documentation, and test results. Artifacts for DO-178, ISO 26262, IEC 61508, and related industry standards can also be included.</p> <p>Simulink Report Generator enables you to create web views that let you view, navigate, and share Simulink models from a web browser without a Simulink license. You can embed model web views in HTML code generation, requirements, coverage, and other types of reports.</p>	https://ww2.mathworks.cn/help/rptgenext/?s_tid=srchbrm

87	Simulink Requirements	<p>编写需求、管理需求并将需求追溯到模型、生成的代码和测试用例</p> <p>您可以使用 Simulink Requirements™ 在 Simulink® 中编写、分析和管理需求。您可以使用自定义属性创建富文本需求，并将其链接到设计、代码和测试。您可以从外部源导入需求，并在需求发生变更时收到自动通知。您可以同时查看需求和设计，使用拖放操作建立链接，使用需求内容对图表进行注释，分析需求可追溯性，以及在需求、设计、生成的代码和测试之间导航。</p> <p>当链接的需求、设计或测试发生变更时，Simulink Requirements 会相应指示。它计算需求的实现和验证状态，您可由此评估工程的完成情况。配合 IEC Certification Kit (for ISO 26262 and IEC 61508) 和 DO Qualification Kit (for DO-178)，还可实现对行业标准的支持。</p>	https://ww2.mathworks.cn/products/simulink-requirements.html?s_tid=srchtitle_simulink%20requirements_2
		<p>Author, manage, and trace requirements to models, generated code, and test cases</p> <p>Simulink® Requirements™ lets you author, analyze, and manage requirements within Simulink. You can create rich text requirements with custom attributes and link them to designs, code, and tests. Requirements can be imported from external sources and you can receive automatic notification when requirements change. You can view the requirements and design together, establish links with drag and drop, annotate diagrams with requirements content, analyze requirements traceability, and navigate between requirements, designs, generated code, and tests.</p> <p>Simulink Requirements indicates when changes occur to linked requirements, designs, or tests. It calculates the implementation and verification status of your requirements, enabling you to assess project completeness.</p> <p>Support for industry standards is available through IEC Certification Kit (for ISO 26262 and IEC 61508) and DO Qualification Kit (for DO-178).</p>	https://ww2.mathworks.cn/help/slr/requirements/?s_tid=src_hbrcm

88	Simulink Test	<p>开发、管理和执行基于仿真的测试</p> <p>Simulink Test™ 提供了一些工具，用于为模型、生成的代码和仿真的硬件或物理 硬件编写、管理和执行基于仿真的系统化测试。其中包含仿真、基准和等价测试 模板，让您能够使用软件在环 (SIL)、处理器在环 (PIL) 和实时硬件在环 (HIL) 模式执行功能测试、单元测试、回归测试和背对背测试。</p> <p>利用 Simulink Test 可以创建非介入式测试框架，隔离待测试组件。可以使用基 于文本的语言定义基于需求的评估，并采用各种格式（包括 Microsoft® Excel®）指定测试输入、预期输出和容差。Simulink Test 包括 Test Sequence 模块和测试管理器，前者可用来构造复杂的测试序列和评估，后者用于管理和执行测 试。Observer 模块让您能够访问设计中的任何信号，而无需更改模型或模型接 口。可以组织大型测试集，并行执行或在持续集成系统上执行。</p> <p>您可以将测试追溯到需求（使用 Simulink Requirements™），利用 Simulink Coverage™ 生成包含测试覆盖率信息的报告。</p> <p>通过 IEC Certification Kit（for ISO 26262 and IEC 61508）和 DO Qualification Kit（for DO-178 and DO-254），可提供对行业标准的支持。</p>	https://ww2.mathworks.cn/products/simulink-test.html?s_tid=srchtitle_simulink%20test_2
		<p>Develop, manage, and execute simulation-based tests</p> <p>Simulink® Test™ provides tools for authoring, managing, and executing systematic, simulation-based tests of models, generated code, and simulated or physical hardware. It includes simulation, baseline, and equivalence test templates that let you perform functional, unit, regression, and back-to-back testing using software-in-the-loop (SIL), processor-in-the-loop (PIL), and real-time hardware-in-the-loop (HIL) modes.</p> <p>With Simulink Test you can create nonintrusive test harnesses to isolate the component under test. You can define requirements-based assessments using a text-based language, and specify test input, expected outputs, and tolerances in a variety of formats, including Microsoft® Excel®. Simulink Test includes a Test Sequence block that lets you construct complex test sequences and assessments, and a test manager for managing and executing tests. Observer blocks let you access any signal in the design without changing the model or the model interface. Large sets of tests can be organized and executed in parallel or on continuous integration systems.</p> <p>You can trace tests to requirements (with Simulink Requirements™) and generate reports that include test coverage information from Simulink Coverage™.</p> <p>Support for industry standards is available through IEC Certification Kit (for IEC 61508 and ISO 26262) and DO Qualification Kit (for DO-178).</p>	https://ww2.mathworks.cn/help/slst/?s_tid=srchtitle_simulink%20test_2

89	SoC Blockset	<p>设计、评估和实现 SoC 硬件和软件架构</p> <p>SoC Blockset™ 提供多个 Simulink® 模块和可视化工具，可用于 ASIC、FPGA、可编程片上系统 (SoC) 以及多核微控制器/微处理器的硬件和软件架构建模、仿真以及分析。</p> <p>SoC Blockset 支持您使用生成的测试流量或真实 I/O 数据来仿真内存与内部和外部连接，以及调度和 OS 效果。您可以快速探索不同的系统架构，估计硬件和软件分区的接口复杂度，并评估软件性能和硬件利用率。</p> <p>配合 Embedded Coder 和 HDL Coder，SoC Blockset 可针对赛灵思 (Xilinx®) 与英特尔 (Intel®) FPGA、可编程 SoC（如赛灵思 UltraScale+™ MPSoC 与 RFSoc 器件）以及多核微控制器/微处理器（如德州仪器 C2000™ MCU）实现应用。</p>	https://www.mathworks.cn/products/soc.html?s_tid=srchtitle_SOC%20blockset_2
		<p>Design, evaluate, and implement SoC hardware and software architectures</p> <p>SoC Blockset™ provides Simulink® blocks and visualization tools for modeling, simulating, and analyzing hardware and software architectures for ASICs, FPGAs, and systems on a chip (SoC). You can build your system architecture using memory models, bus models, and I/O models, and simulate the architecture together with the algorithms.</p> <p>SoC Blockset lets you simulate memory and internal and external connectivity, as well as scheduling and OS effects, using generated test traffic or real I/O data. You can quickly explore different system architectures, estimate interface complexity for hardware and software partitioning, and evaluate software performance and hardware utilization.</p> <p>SoC Blockset exports reference designs for Xilinx® and Intel® FPGA devices and SoC platforms, including Zynq®-7000, UltraScale+™, and Intel SoC FPGAs. These reference designs can be used with Xilinx and Intel design tools.</p>	https://www.mathworks.cn/help/soc/?s_tid=srchbrcm

90	Spreadsheet Link (for Microsoft Excel)	<p>在 Microsoft Excel 中使用 MATLAB</p> <p>Spreadsheet Link™ 将 Excel® 电子表格软件与 MATLAB® 工作区相连接，支持用户通过 Excel 电子表格访问 MATLAB 环境。Spreadsheet Link 软件可帮助您在 MATLAB 与 Excel 之间交换数据，让您在熟悉的 Excel 界面中利用 MATLAB 的计算性能和可视化功能。</p>	https://ww2.mathworks.cn/products/spreadsheet-link.html?s_tid=srchtitle_spreadsheet%20link_2
		<p>Use MATLAB from Microsoft Excel</p> <p>Spreadsheet Link™ connects Excel® spreadsheet software with the MATLAB® workspace, enabling you to access the MATLAB environment from an Excel spreadsheet. With Spreadsheet Link software, you can exchange data between MATLAB and Excel, taking advantage of the familiar Excel interface while accessing the computational speed and visualization capabilities of MATLAB.</p>	https://ww2.mathworks.cn/help/exlink/?s_tid=srchbrcm

91	Stateflow	<p>使用状态机与流程图进行决策逻辑的建模和仿真</p> <p>Stateflow® 提供图形化语言，包括状态转换图状态转移图、流程图、状态转换表状态转移表和真值表。您可以使用 Stateflow 来描述 MATLAB® 算法和 Simulink® 模型如何对输入信号、事件和基于时间的条件作出反应。</p> <p>Stateflow 使您能够设计和开发调度控制、任务调度、故障管理、通信协议、用户界面和混合系统。</p> <p>使用 Stateflow 可以对组合和时序决策逻辑建模，将其作为 Simulink 模型内的一个模块进行仿真，或作为 MATLAB 中的一个对象加以执行。利用图形动画，您可以在逻辑正在执行时对其进行分析和调试。编辑时和运行的时检查可确保在实现前的设计一致性和完整性。</p>	https://ww2.mathworks.cn/products/stateflow.html?s_tid=srchtitle_stateflow_2
		<p>Model and simulate decision logic using state machines and flow charts</p> <p>Stateflow® provides a graphical language that includes state transition diagrams, flow charts, state transition tables, and truth tables. You can use Stateflow to describe how MATLAB® algorithms and Simulink® models react to input signals, events, and time-based conditions.</p> <p>Stateflow enables you to design and develop supervisory control, task scheduling, fault management, communication protocols, user interfaces, and hybrid systems.</p> <p>With Stateflow, you model combinatorial and sequential decision logic that can be simulated as a block within a Simulink model or executed as an object in MATLAB. Graphical animation enables you to analyze and debug your logic while it is executing. Edit-time and run-time checks ensure design consistency and completeness before implementation.</p>	https://ww2.mathworks.cn/help/stateflow/index.html?lang=en

92	Statistics and Machine Learning Toolbox	<p>使用统计信息和机器学习来分析数据并为数据建模</p> <p>Statistics and Machine Learning Toolbox™ 提供了用于描述数据、分析数据以及为数据建模的函数和 App。您可以使用描述性统计量、可视化和聚类进行探索性数据分析，对数据进行概率分布拟合，生成进行蒙特卡罗模拟的随机数，以及执行假设检验。回归和分类算法允许您使用分类和回归学习器以交互方式，或使用 AutoML 以编程方式从数据做出推断并构建预测模型。</p> <p>对于多维数据分析和特征提取，工具箱提供主成分分析 (PCA)、正则化、降维和特征选择方法，使您能够识别具有最佳预测能力的变量。</p> <p>工具箱提供有监督、半监督和无监督的机器学习算法，包括支持向量机 (SVM)、提升决策树、k-均值和其他聚类方法。您可以应用部分依赖图和 LIME 等可解释性方法，并自动生成 C/C++ 代码用于嵌入式部署。许多工具箱算法可用于太大而无法放入内存的数据集。</p>	https://ww2.mathworks.cn/products/statistics%20and%20machine%20learning%20toolbox_2
		<p>analyze and model data using statistics and machine learning</p> <p>Statistics and Machine Learning Toolbox™ provides functions and apps to describe, analyze, and model data. You can use descriptive statistics, visualizations, and clustering for exploratory data analysis, fit probability distributions to data, generate random numbers for Monte Carlo simulations, and perform hypothesis tests. Regression and classification algorithms let you draw inferences from data and build predictive models either interactively, using the Classification and Regression Learner apps, or programmatically, using AutoML.</p> <p>For multidimensional data analysis and feature extraction, the toolbox provides principal component analysis (PCA), regularization, dimensionality reduction, and feature selection methods that let you identify variables with the best predictive power.</p> <p>The toolbox provides supervised, semi-supervised and unsupervised machine learning algorithms, including support vector machines (SVMs), boosted decision trees, k-means, and other clustering methods. You can apply interpretability techniques such as partial dependence plots and LIME, and automatically generate C/C++ code for embedded deployment. Many toolbox algorithms can be used on data sets that are too big to be stored in memory.</p>	https://ww2.mathworks.cn/help/stats/index.html?lang=en

93	Symbolic Math Toolbox	<p>执行符号数学计算</p> <p>Symbolic Math Toolbox™ 提供求解、绘制和操作符号数学方程的函数。您可以创建、运行和共享符号数学代码。MATLAB® 实时编辑器提供下一步操作建议，可引导您完成符号工作流。该工具箱提供多个常见数学领域的函数，涉及微积分、线性代数、代数和微分方程、方程化简和方程操作。</p> <p>Symbolic Math Toolbox 支持您以解析方式执行微分、积分、化简、变换和方程求解。您可以进行量纲计算并对单位进行转换。您可以采用解析法或者可变精度算术进行计算，并以数学排版呈现结果。</p> <p>您可以将符号计算成果作为实时脚本共享给其他 MATLAB 用户，也可将其转换为 HTML、Word、LaTeX 或 PDF 文档进行发布。您可以从直接符号表达式生成 MATLAB 函数、Simulink® 函数模块和 Simscape™ 方程。</p>	https://www.mathworks.cn/products/symbolic.html?s_tid=srchtitle_symbolic%20math%20to%20toolbox_2
		<p>Perform symbolic math computations</p> <p>Symbolic Math Toolbox™ provides functions for solving, plotting, and manipulating symbolic math equations. You can create, run, and share symbolic math code. In the MATLAB® Live Editor, you can get next-step suggestions for symbolic workflows. The toolbox provides functions in common mathematical areas such as calculus, linear algebra, algebraic and differential equations, equation simplification, and equation manipulation.</p> <p>Symbolic Math Toolbox lets you analytically perform differentiation, integration, simplification, transforms, and equation solving. You can perform dimensional computations and convert between units. Your computations can be performed either analytically or using variable-precision arithmetic, with the results displayed in mathematical typeset.</p> <p>You can share your symbolic work with other MATLAB users as live scripts or convert them to HTML, Word, LaTeX or PDF documents. You can generate MATLAB functions, Simulink® function blocks, and Simscape™ equations directly from symbolic expressions.</p>	https://www.mathworks.cn/help/symbolic/?s_tid=srchbrm

94	System Composer	<p>设计和分析系统架构与软件架构</p> <p>System Composer™ 支持通过指定和分析架构来进行基于模型的系统工程和软件架构建模。使用 System Composer，您可以在细化架构模型的同时分配需求，然后使用 Simulink® 设计和仿真该模型。</p> <p>架构模型由组件和接口组成，可以直接创建、从其他工具导入，或使用 Simulink 设计的架构元素来填充。您可以使用多个架构模型来描述您的系统，并通过模型到模型分配在其间建立有向关系。您可以使用序列图、状态图或 Simulink 模型来捕获行为。您可以定义和仿真组件函数的执行顺序，并从软件架构模型生成代码（需要 Simulink 和 Embedded Coder®）。</p> <p>要调查特定设计或分析问题，您可以创建模型的自定义实时视图。架构模型可用于分析需求、通过构造型捕获属性、执行权衡研究，以及生成规格和接口控制文档 (ICD)。</p>	https://ww2.mathworks.cn/products/system-composer.html?s_tid=srchtitle_system%20composer_2
		<p>Design and analyze system and software architectures</p> <p>System Composer™ enables the specification and analysis of architectures for model-based systems engineering and software architecture modeling. With System Composer, you allocate requirements while refining an architecture model that can then be designed and simulated in Simulink®.</p> <p>Architecture models consisting of components and interfaces can be authored directly, imported from other tools, or populated from the architectural elements of Simulink designs. You can describe your system using multiple architecture models and establish direct relationships between them via model-to-model allocations. Behaviors can be captured in sequence diagrams, state charts, or Simulink models. You can define and simulate the execution order of component functions and generate code from your software architecture models (with Simulink and Embedded Coder®).</p> <p>To investigate specific design or analysis concerns, you can create custom live views of the model. Architecture models can be used to analyze requirements, capture properties via stereotyping, perform trade studies, and produce specifications and interface control documents (ICDs).</p>	https://ww2.mathworks.cn/help/systemcomposer/?s_tid=srchbrcm

95	System Identification Toolbox	<p>基于测得的输入-输出数据创建线性 and 非线性动态系统模型</p> <p>System Identification Toolbox™ 提供一系列 MATLAB® 函数、Simulink® 模块和一个 App，支持基于测得的输入-输出数据构造动态系统的数学模型。它支持您对那些难以基于第一性原理或规范建模的动态系统进行建模并加以使用。您可以使用时域和频域输入-输出数据来确定连续时间和离散时间传递函数、过程模型和状态-空间模型。该工具箱还提供嵌入式在线参数估计算法。</p> <p>该工具箱提供了极大似然、预测误差最小化 (PEM)、子空间系统辨识等辨识方法。要表示非线性系统动态，您可以通过小波网络、树分割和 S 型网络非线性估计器来估计 Hammerstein-Weiner 模型和非线性 ARX 模型。该工具箱可执行灰箱系统辨识以估计用户定义模型的参数。您可以使用辨识的模型来预测系统响应以及在 Simulink 中为被控对象建模。该工具箱还支持时序数据建模和时序预测。</p>	https://ww2.mathworks.cn/products/sysid.html?s_tid=srchtitle_system%20identification%20toolbox_2
		<p>Create linear and nonlinear dynamic system models from measured input-output data</p> <p>System Identification Toolbox™ provides MATLAB® functions, Simulink® blocks, and an app for constructing mathematical models of dynamic systems from measured input-output data. It lets you create and use models of dynamic systems not easily modeled from first principles or specifications. You can use time-domain and frequency-domain input-output data to identify continuous-time and discrete-time transfer functions, process models, and state-space models. The toolbox also provides algorithms for embedded online parameter estimation.</p> <p>The toolbox provides identification techniques such as maximum likelihood, prediction-error minimization (PEM), and subspace system identification. To represent nonlinear system dynamics, you can estimate Hammerstein-Weiner models and nonlinear ARX models with wavelet network, tree-partition, and sigmoid network nonlinearities. The toolbox performs grey-box system identification for estimating parameters of a user-defined model. You can use the identified model for system response prediction and plant modeling in Simulink. The toolbox also supports time-series data modeling and time-series forecasting.</p>	https://ww2.mathworks.cn/help/ident/?s_tid=srchbrcm

96	Text Analytics Toolbox	<p>分析文本数据并建模</p> <p>Text Analytics Toolbox™ 提供多种算法和可视化，可用于文本数据的预处理、分析和建模。使用该工具箱创建的模型可用于情感分析、预测性维护和主题建模等应用。</p> <p>Text Analytics Toolbox 中的工具可用于处理不同来源（例如设备日志、新闻提要、调查、操作员报告和社交媒体）的原始文本。您可以从常用文件格式中提取文本、预处理原始文本、提取单个单词、将文本转换为数字表示以及构建统计模型。</p> <p>借助 LSA、LDA 和词嵌入等机器学习方法，您可以在高维文本数据集中查找簇并由此创建特征。您可以将使用 Text Analytics Toolbox 创建的特征与来自其他数据源的特征相结合，以构建综合运用文本、数字和其他类型数据的机器学习模型。</p>	https://www.mathworks.cn/products/text-analytics.html?s_tid=srchtitle_text%20analytics%20toolbox_2
		<p>Analyze and model text data</p> <p>Text Analytics Toolbox™ provides algorithms and visualizations for preprocessing, analyzing, and modeling text data. Models created with the toolbox can be used in applications such as sentiment analysis, predictive maintenance, and topic modeling.</p> <p>Text Analytics Toolbox includes tools for processing raw text from sources such as equipment logs, news feeds, surveys, operator reports, and social media. You can extract text from popular file formats, preprocess raw text, extract individual words, convert text into numerical representations, and build statistical models.</p> <p>Using machine learning techniques such as LSA, LDA, and word embeddings, you can find clusters and create features from high-dimensional text datasets. Features created with Text Analytics Toolbox can be combined with features from other data sources to build machine learning models that take advantage of textual, numeric, and other types of data.</p>	https://www.mathworks.cn/help/textanalytics/?s_tid=srchbrcm

97	UAV Toolbox	<p>设计、仿真和部署无人机应用</p> <p>UAV Toolbox 提供各种工具和参考应用，可用于设计、仿真、测试以及部署无人机 (UAV) 和无人机应用。您可以设计自主飞行算法、无人机任务和飞行控制器。飞行日志分析器可帮助您交互式地分析三维飞行路径、遥测信息和常见飞行日志格式的传感器读数。</p> <p>您可以生成和仿真无人机场景，用于自主飞行算法和飞行控制器的桌面仿真和硬件在环 (HIL) 测试。您可以在逼真的三维环境或 2.5 维仿真环境中模拟相机、激光雷达、IMU 和 GPS 传感器输出。</p> <p>UAV Toolbox 针对无人机的常见用途提供各种参考应用示例，例如多旋翼无人机自主包裹递送。该工具箱支持 C/C++ 代码生成，可用于快速原型、HIL 测试，以及 Pixhawk® Autopilot 等硬件的独立部署（需要 Embedded Coder®）</p>	https://www.mathworks.cn/products/uav.html?s_tid=srchtitle_UAV%20toolbox_2
		<p>Design, simulate, and deploy UAV applications</p> <p>UAV Toolbox provides tools and reference applications for designing, simulating, testing, and deploying unmanned aerial vehicle (UAV) and drone applications. You can design autonomous flight algorithms, UAV missions, and flight controllers. The Flight Log Analyzer app lets you interactively analyze 3D flight paths, telemetry information, and sensor readings from common flight log formats.</p> <p>For desktop simulation and hardware-in-the-loop (HIL) testing of autonomous flight algorithms and flight controllers, you can generate and simulate UAV scenarios. You can simulate camera, lidar, IMU, and GPS sensor outputs in a photorealistic 3D environment or in a 2.5D simulation environment.</p> <p>UAV Toolbox provides reference application examples for common UAV usages, such as autonomous drone package delivery with multirotor UAV. The toolbox supports C/C++ code generation for rapid prototyping, HIL testing, and standalone deployment to hardware such as the Pixhawk® Autopilot.</p>	https://www.mathworks.cn/help/uav/?s_tid=srchtitle_UAV%20toolbox_2

98	Vehicle Dynamics Blockset	<p>在虚拟三维环境下对车辆动力学进行建模和仿真</p> <p>Vehicle Dynamics Blockset™ 提供了完整的参考应用模型，可在三维环境中仿真驾驶操作。您可以使用预置场景来可视化道路、交通标志、树木、建筑物和车辆周围的其他物体。您可以自定义参考模型，包括使用自己的数据，以及用自己的模型替换子系统。该模块集包含一个组件库，用于对动力系统、转向系统、悬架、车身、制动和轮胎进行建模。</p> <p>Vehicle Dynamics Blockset 提供的标准模型架构可在整个开发过程中使用。它支持平顺性和操纵稳定性分析、底盘控制开发、软件集成测试和硬件在环测试。通过将车辆动力学模型与三维环境集成，您可以测试 ADAS 和自动驾驶感知、规划和控制软件。这些模型支持您使用标准驾驶操作（如双移线）或自定义场景来测试车辆。</p>	https://ww2.mathworks.cn/products/vehicle-dynamics.html?s_tid=srchtitle_vehicle%20dynamics%20blockset_3
		<p>Model and simulate vehicle dynamics in a virtual 3D environment</p> <p>Vehicle Dynamics Blockset™ provides fully assembled reference application models that simulate driving maneuvers in a 3D environment. You can use the prebuilt scenes to visualize roads, traffic signs, trees, buildings, and other objects around the vehicle. You can customize the reference models by using your own data or by replacing a subsystem with your own model. The blockset includes a library of components for modeling propulsion, steering, suspension, vehicle bodies, brakes, and tires.</p> <p>Vehicle Dynamics Blockset provides a standard model architecture that can be used throughout the development process. It supports ride and handling analyses, chassis controls development, software integration testing, and hardware-in-the-loop testing. By integrating vehicle dynamics models with a 3D environment, you can test ADAS and automated driving perception, planning, and control software. These models let you test your vehicle with standard driving maneuvers such as a double lane change or with your own custom scenarios.</p>	https://ww2.mathworks.cn/help/vdynblks/?s_tid=srchbrm

99	Vehicle Network Toolbox	<p>使用 CAN、J1939 和 XCP 协议与车载网络通信</p> <p>Vehicle Network Toolbox™ 提供用来发送、接收、编码和解码 CAN、CAN FD、J1939 和 XCP 报文的 MATLAB® 函数和 Simulink® 模块。该工具箱支持您使用行业标准 CAN 数据库文件识别和解析特定信号，然后使用 CAN 资源管理器和 CAN FD 资源管理器可视化解码的信号。使用 A2L 描述文件，可以在 CAN 或以太网上通过 XCP 连接到 ECU。您可以访问 MDF 文件中存储的报文和测量数据。</p> <p>该工具箱可以简化与车载网络的通信，并帮助您监视、筛选和分析实时 CAN 总线数据，或录制报文供以后分析和重播。您可以在虚拟 CAN 总线上模拟报文流，或连接到实时网络或 ECU。Vehicle Network Toolbox 支持 Vector、Kvaser、PEAK-System 和 NI® 的 CAN 接口设备。</p>	https://www.mathworks.cn/products/vehicle-network.html?s_tid=srchtitle_vehicle%20network%20toolbox_2
		<p>Communicate with in-vehicle networks using CAN, J1939, and XCP protocols</p> <p>Vehicle Network Toolbox™ provides MATLAB® functions and Simulink® blocks for sending, receiving, encoding, and decoding CAN, CAN FD, J1939, and XCP messages. The toolbox lets you identify and parse specific signals using industry-standard CAN database files and then visualize the decoded signals using the CAN Explorer and CAN FD Explorer apps. Using A2L description files, you can connect to an ECU via XCP on CAN or Ethernet. You can access messages and measurement data stored in MDF files.</p> <p>The toolbox simplifies communication with in-vehicle networks and lets you monitor, filter, and analyze live CAN bus data or log and record messages for later analysis and replay. You can simulate message traffic on a virtual CAN bus or connect to a live network or ECU. Vehicle Network Toolbox supports CAN interface devices from Vector, Kvaser, PEAK-System, and NI®.</p>	https://www.mathworks.cn/help/vnt/index.html?lang=en

100	Vision HDL Toolbox	<p>为 FPGA 和 ASIC 设计图像处理、视频和计算机视觉系统</p> <p>Vision HDL Toolbox™ 为在 FPGA 和 ASIC 上进行视觉系统设计和实现提供了像素流处理算法。它提供一个设计架构，可支持各类接口类型、帧尺寸和帧率。工具箱中的图像处理、视频和计算机视觉算法均采用适合 HDL 实现的架构。</p> <p>该工具箱算法旨在生成 VHDL® 和 Verilog®（使用 HDL Coder™）的可读取、可综合的代码。生成的 HDL 代码经过 FPGA 验证、适用于高达 8k 分辨率的帧尺寸和高帧率 (HFR) 视频。</p> <p>工具箱功能以 MATLAB® 功能、System objects™ 和 Simulink® 块的形式提供。</p>	https://www.mathworks.cn/products/vision-hdl.html?s_tid=srchtitle_vision%20hdl%20toolbox_3
		<p>Design image processing, video, and computer vision systems for FPGAs and ASICs</p> <p>Vision HDL Toolbox™ provides pixel-streaming algorithms for the design and implementation of vision systems on FPGAs and ASICs. It provides a design framework that supports a diverse set of interface types, frame sizes, and frame rates. The image processing, video, and computer vision algorithms in the toolbox use an architecture appropriate for HDL implementations.</p> <p>The toolbox algorithms are designed to generate readable, synthesizable code in VHDL® and Verilog® (with HDL Coder™). The generated HDL code is FPGA-proven for frame sizes up to 8k resolution and for high frame rate (HFR) video.</p> <p>Toolbox capabilities are available as MATLAB® functions, System objects and Simulink® blocks.</p>	https://www.mathworks.cn/help/visionhdl/?s_tid=srchbrcm

101	Wavelet Toolbox	<p>使用小波分析并合成信号和图像</p> <p>Wavelet Toolbox™ 提供用于分析和合成信号与图像的 App 及函数。您可以检测异常、变化点和瞬变等事件，并对数据进行去噪和压缩。小波和其他多尺度方法可用于分析不同时间和频率分辨率的数据，并将信号和图像分解成不同分量。您可以使用小波方法来降维，并从信号和图像中提取有区别的特征来训练机器学习和深度学习模型。</p> <p>使用 Wavelet Toolbox，您能够以交互方式对信号进行去噪，执行多分辨率和小波分析，并生成 MATLAB® 代码。该工具箱包括连续和离散小波分析、小波包分析、多分辨率分析、小波散射和其他多尺度分析的算法。</p> <p>许多工具箱函数支持 C/C++ 和 CUDA® 代码生成，可用于桌面原型和嵌入式系统部署。</p>	https://ww2.mathworks.cn/products/wavelet.html?s_tid=srchtitle_wavelet%20toolbox_2
		<p>Analyze and synthesize signals and images using wavelets</p> <p>Wavelet Toolbox™ provides apps and functions for analyzing and synthesizing signals and images. You can detect events like anomalies, change points, and transients, and denoise and compress data. Wavelet and other multiscale techniques can be used to analyze data at different time and frequency resolutions and to decompose signals and images into their various components. You can use wavelet techniques to reduce dimensionality and extract discriminating features from signals and images to train machine and deep learning models.</p> <p>With Wavelet Toolbox you can interactively denoise signals, perform multiresolution and wavelet analysis, and generate MATLAB® code. The toolbox includes algorithms for continuous and discrete wavelet analysis, wavelet packet analysis, multiresolution analysis, wavelet scattering, and other multiscale analysis.</p> <p>Many toolbox functions support C/C++ and CUDA® code generation for desktop prototyping and embedded system deployment.</p>	https://ww2.mathworks.cn/help/wavelet/?s_tid=srchbrcm

102	Wireless HDL Toolbox	<p>为 FPGA、ASIC 和 SoC 设计并实现 5G 和 LTE 通信子系统</p> <p>Wireless HDL Toolbox™（前身为 LTE HDL Toolbox™）为开发 5G、LTE 和基于 OFDM 的自定义无线通信应用提供了预先验证且硬件就绪的 Simulink® 模块和子系统。它包含参考应用、IP 模块以及基于帧与基于采样的处理之间的网关。</p> <p>你可以修改参考应用以集成到自己的设计中。该工具箱算法的 HDL 实现针对原型设计或 FPGA、ASIC 和 SoC 设备上的生产部署进行了优化，能够更有效地使用资源，且性能更佳。</p> <p>该工具箱的算法适于生成可读、可合成的 VHDL® 和 Verilog® 代码（需要 HDL Coder™）。要对 5G、LTE 和基于 OFDM 的自定义设计进行无线测试，您可以将发射机和接收机模型连接到无线电设备（需要 Communications Toolbox™ 硬件支持包）。</p>	https://www.mathworks.cn/products/wireless-hdl.html?s_tid=srchtitle_wireless%20hdl%20toolbox_2
		<p>Design and implement 5G and LTE communications subsystems for FPGAs, ASICs, and SoCs</p> <p>Wireless HDL Toolbox™ (formerly LTE HDL Toolbox™) provides pre-verified, hardware-ready Simulink® blocks and subsystems for developing 5G, LTE, and custom OFDM-based wireless communication applications. It includes reference applications, IP blocks, and gateways between frame- and sample-based processing.</p> <p>You can modify the reference applications for integration into your own design. HDL implementations of the toolbox algorithms are optimized for efficient resource usage and performance for prototyping or for production deployment on FPGA, ASIC, and SoC devices.</p> <p>The toolbox algorithms are designed to generate readable, synthesizable code in VHDL® and Verilog® (with HDL Coder™). For over-the-air testing of 5G, LTE, and custom OFDM-based designs, you can connect transmitter and receiver models to radio devices (with Communications Toolbox™ hardware support packages).</p>	https://www.mathworks.cn/help/wireless-hdl/?s_tid=srchbrcm

103	WLAN Toolbox	<p>仿真、分析和测试 WLAN 通信系统</p> <p>WLAN Toolbox™ 为设计、仿真、分析和测试无线局域网通信系统提供了符合标准的函数。它包括面向 IEEE® 802.11 标准系列的可配置物理层波形。它还提供发射机、信道建模和接收机操作，例如信道编码、调制、空间流映射和 MIMO 接收机。</p> <p>该工具箱提供了参考设计，可帮助您执行基带链路级仿真和多节点系统级仿真。您可以通过编程方式或使用无线波形发生器交互式生成波形并自定义测试平台。您可以生成并解析常见的 MAC 帧。您还可以针对信道功率、频谱模板和占用的带宽等进行信号测量，并创建 WLAN 通信链路端到端仿真的测试平台。</p> <p>您可以研究射频设计和干扰对系统性能的影响。使用 WLAN Toolbox 并配合射频仪器或硬件支持数据包，您可以将发射机和接收机模型连接到无线设备，并通过无线传输和接收来验证您的设计。</p>	https://ww2.mathworks.cn/products/wlan.html?s_tid=srchtitle_wlan%20toolbox_2
		<p>Simulate, analyze, and test WLAN communications systems</p> <p>WLAN Toolbox™ provides standards-compliant functions for the design, simulation, analysis, and testing of wireless LAN communications systems. It includes configurable physical layer waveforms for the IEEE® 802.11 family of standards. It also provides transmitter, channel modeling, and receiver operations, including channel coding, modulation, spatial stream mapping, and MIMO receivers.</p> <p>The toolbox provides reference designs to help you perform baseband link-level simulations and multi-node system-level simulations. You can generate waveforms and customize test benches, either programmatically or interactively, using the Wireless Waveform Generator app. You can generate and parse common MAC frames. You can also perform signal measurements such as channel power, spectrum mask, and occupied bandwidth, and create test benches for the end-to-end simulation of WLAN communications links.</p> <p>You can study the effects of RF designs and interference on system performance. Using WLAN Toolbox with RF instruments or hardware support packages, you can connect your transmitter and receiver models to radio devices and verify your designs via over-the-air transmission and reception.</p>	https://ww2.mathworks.cn/help/wlan/?s_tid=srchtitle_wlan%20toolbox_2

		<p>注： 以上工具箱功能介绍，会随着MATLAB版本的升级更新有所变化，此文件说明及链接为其2021b版本。</p> <p>电院软件学院 无人系统设计课程 2022.02.</p>	