Getting Started with MATLAB/SIMULINK

Course Overview
MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualisation, data analysis, and numeric computation. Using MATLAB, you can solve technical computing problems faster than with traditional programming languages, such as C, C++, and Fortran.

You can use MATLAB in a wide range of applications, including signal and image processing, communications, control design, test and measurement, financial modeling and analysis, and computational biology. Add-on toolboxes (collections of special-purpose MATLAB functions, available separately) extend the MATLAB environment to solve particular classes of problems in these application areas. MATLAB provides a number of features for documenting and sharing your work. You can integrate your MATLAB code with other languages and applications, and distribute your MATLAB algorithms and applications. MATLAB is an integrated technical computing environment that combines numeric computation, advanced graphics and visualisation, and a high-level programming language.

Whatever the objective - an algorithm, analysis, graph, report, or simulation - MATLAB gets you there. The flexible, interactive MATLAB language lets engineers, scientists and business analysts express their technical ideas simply. The extensive and powerful numeric computing methods and graphics allows testing and exploring alternative ideas easily, while the integrated development environment makes it easy to produce fast, practical results.

MATLAB is used in a wide variety of areas in industry including process industries, automotive, finance and economics, biotech/pharmaceutical and education. The open architecture makes it easy to use MATLAB and companion products to explore data and create custom tools that provide early insights and competitive advantages. MATLAB also features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment in order to solve particular classes of problems. Researched and developed by experts in their fields, toolboxes let you learn, apply, and compare best-of-class techniques, allowing you to evaluate different approaches without writing the code. Probably the most important feature of MATLAB is its easy extensibility. You can also link to external software and data from MATLAB. MATLAB code and data formats are platform independent, so sharing your ideas and designs across PC, Unix and Macintosh platforms is seamless.

Simulink is a platform for multidomain simulation and Model-Based Design of dynamic systems. It provides an interactive graphical environment and a customisable set of block libraries that let you accurately design, simulate, implement, and test control, signal processing, communications, and other time-varying systems. Add-on products extend the Simulink environment with tools for specific modeling and design tasks and for code generation, algorithm implementation, test, and verification.

Simulink is integrated with MATLAB, providing immediate access to an extensive range of tools for algorithm development, data visualisation, data analysis and access, and numerical computation.

Simulink is a block-diagram modelling environment for simulating dynamic systems, evaluating performance, and refining control, DSP, and communications system designs. Simulink block diagrams
provide a highly interactive environment for nonlinear simulation. You can run simulations from both pull-down menus or in batch mode from the command line. Results are displayed “live” during simulations using scope and graph blocks.

Where MATLAB offers a familiar programming environment, Simulink and Stateflow provide a graphical design environment for modelling and simulating complex control, DSP and supervisory logic systems. Built on MATLAB, these products can call any MATLAB function including user-written routines, allowing you to combine the best of both approaches. Even toolbox functions can be embedded within Simulink block-diagram models.

**Simulink Blocksets** provide specialist block components for use in your Simulink Models. There are blocksets for DSP, Fixed Point, Power Systems, Dials and Gauges, Communications, CDMA reference, nonlinear control design, aerospace, mechanical systems, virtual reality and various DSP targets. A list of all Simulink related products can be found here.

**Generate C and C++ code from Simulink and Stateflow models**

Simulink Coder™ (formerly Real-Time Workshop®) generates and executes C and C++ code from Simulink® diagrams, Stateflow® charts, and MATLAB® functions. The generated source code can be used for real-time and nonreal-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.

**Generate C and C++ code optimized for embedded systems**

Embedded Coder™ generates readable, compact, and fast C and C++ code for use on embedded processors, on-target rapid prototyping boards, and microprocessors used in mass production. Embedded Coder enables additional MATLAB Coder™ and Simulink Coder™ configuration options and advanced optimizations for fine-grain control of the generated code's functions, files, and data. These optimizations improve code efficiency and facilitate integration with legacy code, data types, and calibration parameters used in production. You can incorporate a third-party development environment into the build process to produce an executable for turnkey deployment on your embedded system.

**Course Objectives:**

This course provides a comprehensive introduction to the MATLAB technical computing environment. This course is intended for beginning users and also for those looking for a review. No prior programming experience or knowledge of MATLAB is assumed, and the course is structured to allow thorough assimilation of ideas through hands-on examples and exercises. MATLAB competency is developed in a natural way, with an emphasis on practical application. Themes of data analysis, visualization, modeling, and programming are explored throughout the course.

This course also focuses on the details of data management and visualization techniques, from reading various formats of data files to producing customized publication-quality graphics. The course emphasizes creating scripts that extend the basic features provided by MATLAB. Hands-on examples explore features for efficiently organizing and presenting data, providing a practical set of tools for further data analysis.

It also provides hands-on experience using the features in the MATLAB language to write efficient, robust, and well-organized code. These concepts form the foundation for writing full applications,
developing algorithms, and extending built-in MATLAB capabilities. Details of performance optimization are covered throughout the one-day course, as well as tools for writing, debugging, and profiling code.

It provides details about how to build GUIs in MATLAB from the command line by using GUIDE, the GUI development environment. The course introduces concepts for designing and laying out GUIs. Demos show how you can link actions defined by code to a user interface object, such as a push button. You will also learn how to create custom menus for GUIs.

This course is for engineers who are new to system and algorithm modeling and design validation in Simulink. It demonstrates how to apply basic modeling techniques and tools to develop Simulink block diagrams. Topics include:

- Creating and modifying Simulink models and simulating system dynamics
- Modeling continuous-time, discrete-time, and hybrid systems
- Modifying solver settings for simulation accuracy and speed
- Building hierarchy into a Simulink model
- Creating reusable model components using subsystems, libraries, and model references

**Intended Audience:**
This training course in MATLAB is ideal for any person beginning to use MATLAB and/or would like to learn about finer points of the MATLAB environment. The course would be particularly beneficial for individuals working in a team with other MATLAB-based designers who are required to get “up to speed” quickly. The training course also provides an opportunity to evaluate the MATLAB product for future or more extensive use in your Organization or Institute.

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- The MATLAB System
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- Starting and Quitting MATLAB
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**Desktop Tools**

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