**MATLAB**

MATLAB (matrix laboratory) is a fourth-generation high-level programming language and interactive environment for numerical computation, visualization and programming.

It allows matrix manipulations; plotting of functions and data; implementation of algorithms; creation of user interfaces; interfacing with programs written in other languages, including C, C++, Java, and FORTRAN; analyze data; develop algorithms; and create models and applications.

It has numerous built-in commands and math functions that help you in mathematical calculations, generating plots, and performing numerical methods.

MATLAB is used in every facet of computational mathematics. Following are some commonly used mathematical calculations where it is used most commonly −

* Dealing with Matrices and Arrays
* 2-D and 3-D Plotting and graphics
* Linear Algebra
* Algebraic Equations
* Non-linear Functions
* Statistics
* Data Analysis
* Calculus and Differential Equations
* Numerical Calculations
* Integration
* Transforms
* Curve Fitting
* Various other special functions

Features of MATLAB

Following are the basic features of MATLAB −

* It is a high-level language for numerical computation, visualization and application development.
* It also provides an interactive environment for iterative exploration, design and problem solving.
* It provides vast library of mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration and solving ordinary differential equations.
* It provides built-in graphics for visualizing data and tools for creating custom plots.
* MATLAB's programming interface gives development tools for improving code quality maintainability and maximizing performance.
* It provides tools for building applications with custom graphical interfaces.
* It provides functions for integrating MATLAB based algorithms with external applications and languages such as C, Java, .NET and Microsoft Excel.

Uses of MATLAB

MATLAB is widely used as a computational tool in science and engineering encompassing the fields of physics, chemistry, math and all engineering streams. It is used in a range of applications including −

* Signal Processing and Communications
* Image and Video Processing
* Control Systems
* Test and Measurement
* Computational Finance
* Computational Biology

Commonly used Operators and Special Characters

MATLAB supports the following commonly used operators and special characters −

|  |  |
| --- | --- |
| **Operator** | **Purpose** |
| **+** | Plus; addition operator. |
| **-** | Minus; subtraction operator. |
| **\*** | Scalar and matrix multiplication operator. |
| **.\*** | Array multiplication operator. |
| **^** | Scalar and matrix exponentiation operator. |
| **.^** | Array exponentiation operator. |
| **\** | Left-division operator. |
| **/** | Right-division operator. |
| **.\** | Array left-division operator. |
| **./** | Array right-division operator. |
| **:** | Colon; generates regularly spaced elements and represents an entire row or column. |
| **( )** | Parentheses; encloses function arguments and array indices; overrides precedence. |
| **[ ]** | Brackets; enclosures array elements. |
| **.** | Decimal point. |
| **…** | Ellipsis; line-continuation operator |
| **,** | Comma; separates statements and elements in a row |
| **;** | Semicolon; separates columns and suppresses display. |
| **%** | Percent sign; designates a comment and specifies formatting. |
| **\_** | Quote sign and transpose operator. |
| **.\_** | Nonconjugated transpose operator. |
| **=** | Assignment operator. |

Special Variables and Constants

MATLAB supports the following special variables and constants −

|  |  |
| --- | --- |
| **Name** | **Meaning** |
| **ans** | Most recent answer. |
| **eps** | Accuracy of floating-point precision. |
| **i,j** | The imaginary unit √-1. |
| **Inf** | Infinity. |
| **NaN** | Undefined numerical result (not a number). |
| **pi** | The number π |

Commands for Managing a Session

MATLAB provides various commands for managing a session. The following table provides all such commands −

|  |  |
| --- | --- |
| **Command** | **Purpose** |
| clc | Clears command window. |
| clear | Removes variables from memory. |
| exist | Checks for existence of file or variable. |
| global | Declares variables to be global. |
| help | Searches for a help topic. |
| lookfor | Searches help entries for a keyword. |
| quit | Stops MATLAB. |
| who | Lists current variables. |
| whos | Lists current variables (long display). |

Commands for Working with the System

MATLAB provides various useful commands for working with the system, like saving the current work in the workspace as a file and loading the file later.

It also provides various commands for other system-related activities like, displaying date, listing files in the directory, displaying current directory, etc.

The following table displays some commonly used system-related commands −

|  |  |
| --- | --- |
| **Command** | **Purpose** |
| cd | Changes current directory. |
| date | Displays current date. |
| delete | Deletes a file. |
| diary | Switches on/off diary file recording. |
| dir | Lists all files in current directory. |
| load | Loads workspace variables from a file. |
| path | Displays search path. |
| pwd | Displays current directory. |
| save | Saves workspace variables in a file. |
| type | Displays contents of a file. |
| what | Lists all MATLAB files in the current directory. |
| wklread | Reads .wk1 spreadsheet file. |

The **fscanf** and **fprintf** commands behave like C scanf and printf functions. They support the following format codes −

|  |  |
| --- | --- |
| **Format Code** | **Purpose** |
| **%s** | Format as a string. |
| **%d** | Format as an integer. |
| **%f** | Format as a floating point value. |
| **%e** | Format as a floating point value in scientific notation. |
| **%g** | Format in the most compact form: %f or %e. |
| **\n** | Insert a new line in the output string. |
| **\t** | Insert a tab in the output string. |

## The M Files

MATLAB allows writing two kinds of program files −

* **Scripts** − script files are program files with **.m extension**. In these files, you write series of commands, which you want to execute together. Scripts do not accept inputs and do not return any outputs. They operate on data in the workspace.
* **Functions** − functions files are also program files with **.m extension**. Functions can accept inputs and return outputs. Internal variables are local to the function.

You can use the MATLAB editor or any other text editor to create your **.m**files. In this section, we will discuss the script files. A script file contains multiple sequential lines of MATLAB commands and function calls. You can run a script by typing its name at the command line.