# MATLAB & DSP

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# MATLAB Installation

- Link: provided in urls.txt file
- 30 days free trail period is provided by MATLAB
- MATLAB Online: can be accessed through any standard web browser.
  - No need for downloads or installations
  - Access to MATLAB and Simulink
  - https://in.mathworks.com/products/matlab-online.html
- Detailed installation of matlab installation pdf is attached.

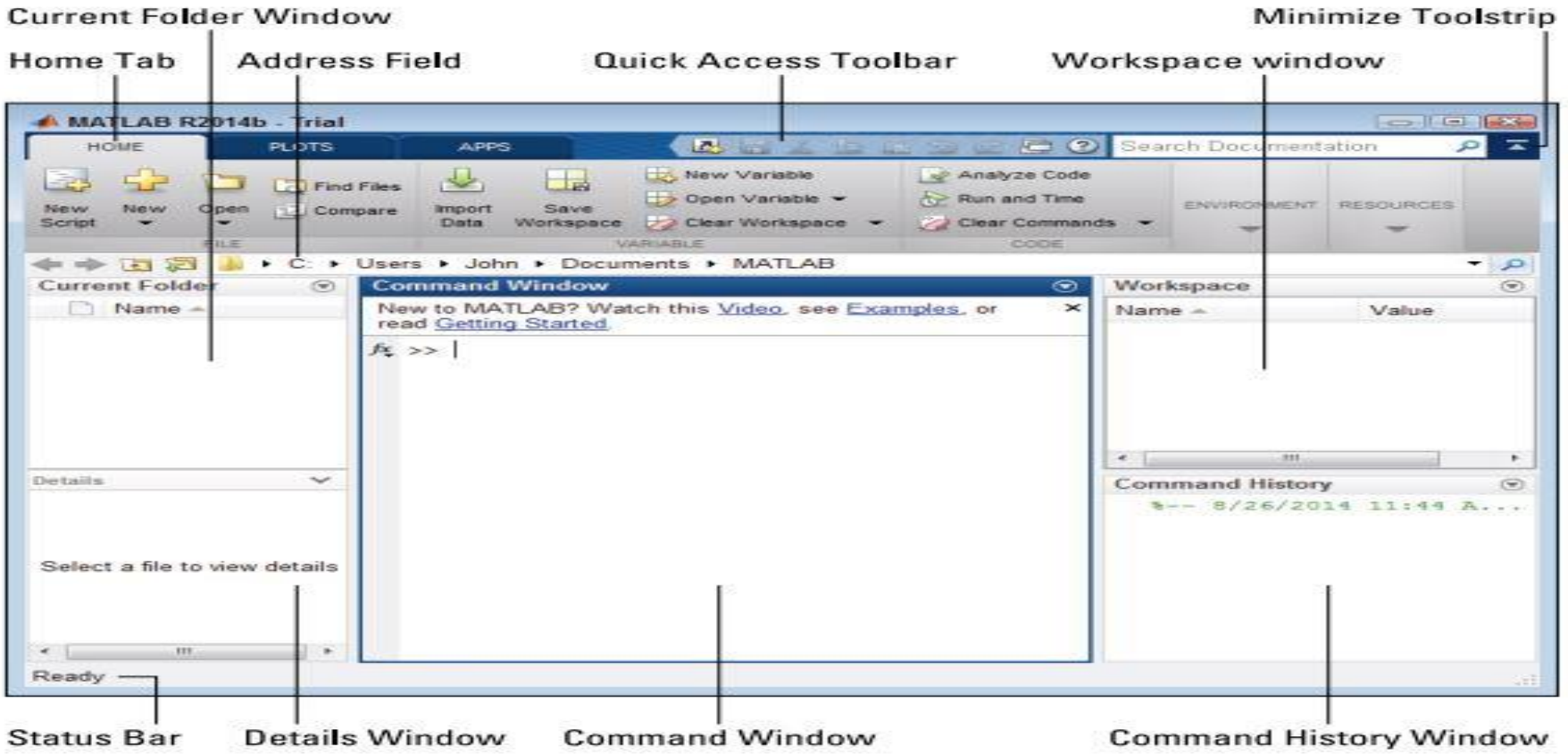
# About MATLAB

- MATLAB is a high-performance language for technical computing.
- It integrates computation, visualization, and programming in an easy-to-use environment
- Some MATLAB use cases include:
  - Math and computation
  - Algorithm development
  - Data analysis, exploration, and visualization
  - Scientific and engineering graphics
  - Modelling, simulation, and prototyping
  - Application development, including Graphical User Interface building

# MATLAB Basics

- MATrix LABoratory
  - The basic variable is a matrix or an array.
- MATLAB Window
- Built-in functions
- Variable creation
- Hiding Output
- Clearing commands

# MATLAB Basics



## Display Windows:

MATLAB has three display windows. They are

1. A **Command Window** which is used to enter commands
2. A **Graphics Window** which is used to display plots and graphs.
3. An **Editor Window** which is used to create and modify m-files. m-files are files that contain a program or script of MATLAB commands.

# Inputs and Outputs

- Matrix Operations
- Creating a matrix
- Scalar functions
- Vector functions
- Matrix functions
- Colon operator
- Linspace
- ... or ellipsis

# Inputs and Outputs

- Built-in array functions
- Matrix operators vs Array operators
- Round-off functions
- Predefined variables
- Help & Documentation usage

# Scripts vs functions

- Scripts vs functions
  - Ignoring function outputs
- Live scripts
- Input from Command Window
- Displaying on Command Window
- Conditional Statements: if, if-else, for, …
- Conditional equality(==)
- Logical Operators & Relational Operators
- Break Points

# Structures and cell arrays

- Structures: Array that groups related data using fields.
  - Fields can be accessed using dot operator.
  - Fields can be of different type and size
- Cell Arrays: similar to structures that can contain data of varying types and sizes.
  - use class function to see what it returns to.
  - Accessing cell data using {}
- Conversion from cell array to structure array and vice-versa.

# Saving workspace data

- Saving Workspace
- Loading Workspace
- Saving Command window

# Plotting data

- Plot Command
- Grid
- Axis
- Labeling
- Title
- Hold
- Subplots
- Color, line-style & Marker style
- Legend

# Generation of signals

- Sinusoidal signal
- Random signal
- Basic signal operations
- AM-DSBFC
  - Under-modulated
  - Over-modulated

# Polynomials

- How to write Polynomial as a vector
- Finding the Value of a polynomial at a specified Point : polyval
- Finding the roots of Polynomial : roots
- Generate Polynomial for the given roots : poly
- Polynomial: ax^n + bx^(n-1) + cx^(n-2)+ ……+px + q
- If order of polynomial is ‘n’ the no. of terms in equation is ‘n+1’

# Basic DSP functions

- Interpolation
- Decimation
- Generating Analytic signal
- Magnitude of complex signal

# Transforms

- DFT algorithms

- DFT using FFT algorithm
  - Single sided spectrum
  - Double sided spectrum
  - Removing mirror-image from spectrum

# DSP

- DSP hardware allows programmable operations
  - Through software we can easily modify the processing functions.
  - It offers greater degree of flexibility in system design.
  - Higher order of precision can be achievable compared to other processing systems.
  - Digital signals are easy to store and reproduce.
- DSP is not proper solution for all signal processing problems
  - For extremely wide band-width signals real-time processing is a requirement.
  - For these signals, analog or optical signal processing is the only possible solution.
  - If the Digital circuits have sufficient speed to perform the DSP is preferred.

# Filters & Windowing Techniques

- Writing filters using own scripts
- Using Filter design tools
- Using one filter coefficients for realization of other filter

- Windowing techniques
- Generating using own scripts
- Using designer tools

# Basic statastical data operations

- Mean
- Standard deviation
- Supression of side lobes using windowing techniques

# File handling in MATLAB

- Exporting data in to excel file or text file
- Importing data from excel file or text file

# GUI

- GUI design
  - Creating basic user dialog box
  - Creating dailog box for selection of file
  - switch-case user dialog box
- Creating Stand-alone application
- Creating MATLAB APP
- Convertion of MATLAB function in to c-code
- Using MATLAB Convert C-code in other IDE

# References


- Digital Signal Processing John G. Proakis, Dimitris K Manolakis - (2007, Pearson)
- Digital Signal Processing Using Matlab_ A Problem Solving Companion. Vinay K. Ingle, John G. Proakis 4 ed.-Cengage Learning (2016)
- https://in.mathworks.com/help/matlab/index.html

# Interview Q & A Discussion

Q&A

# Doubts

Q&A

# End of the Module

Thank You