Computer Skills and Computing for BME II

Lecture 1
Introduction to Graphical User Interfaces

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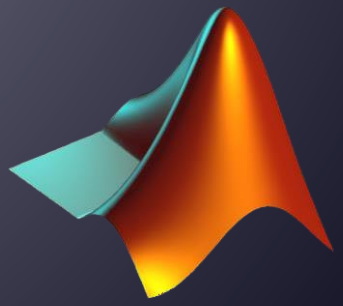


MATLAB GUI (Graphical User Interface)

- Why use a GUI in MATLAB?
- The main reason for using GUI is because it makes things easier for end-users to use the application or program, it is difficult to let users execute a program through the command window or command lines.
- Users looking for easy apps to use.
- GUI make programs friendly and attractive to be used.

Ways to Build Apps:

- There are different ways to build MATLAB apps:
- “Use App Designer”
- “Use GUIDE”
- “Use MATLAB Functions to Create Apps Programmatically”
- Each of these approaches offers a different workflow and a slightly different set of functionality. The best choice for you depends on your project requirements and how you prefer to work.

Use App Designer

App Designer is a rich drag-and-drop environment introduced in R2016a, and it is the recommended environment for building most apps. It includes a fully integrated version of the MATLAB editor. The layout and code views are tightly linked, so changes you make in one view immediately affect the other. A larger set of interactive controls is available, including gauges, lamps, knobs, and switches. Most graphics functionality is supported.

Use App Designer: Design Tools

Use GUIDE

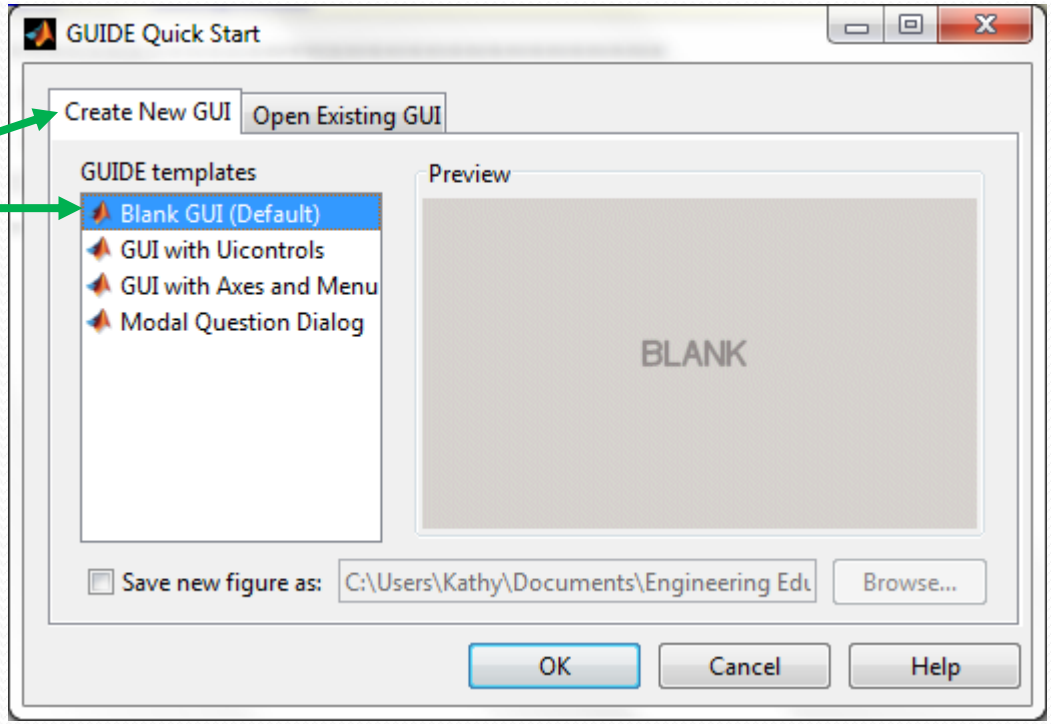
GUIDE is a drag-and-drop environment for laying out user interfaces (UIs). You code the interactive behavior of your app separately, in the MATLAB editor. Apps created with GUIDE are compatible with almost all other releases, and they support all the graphics functionality in MATLAB.

GUI Development Environment (guide)

- At the command prompt in MATLAB, type

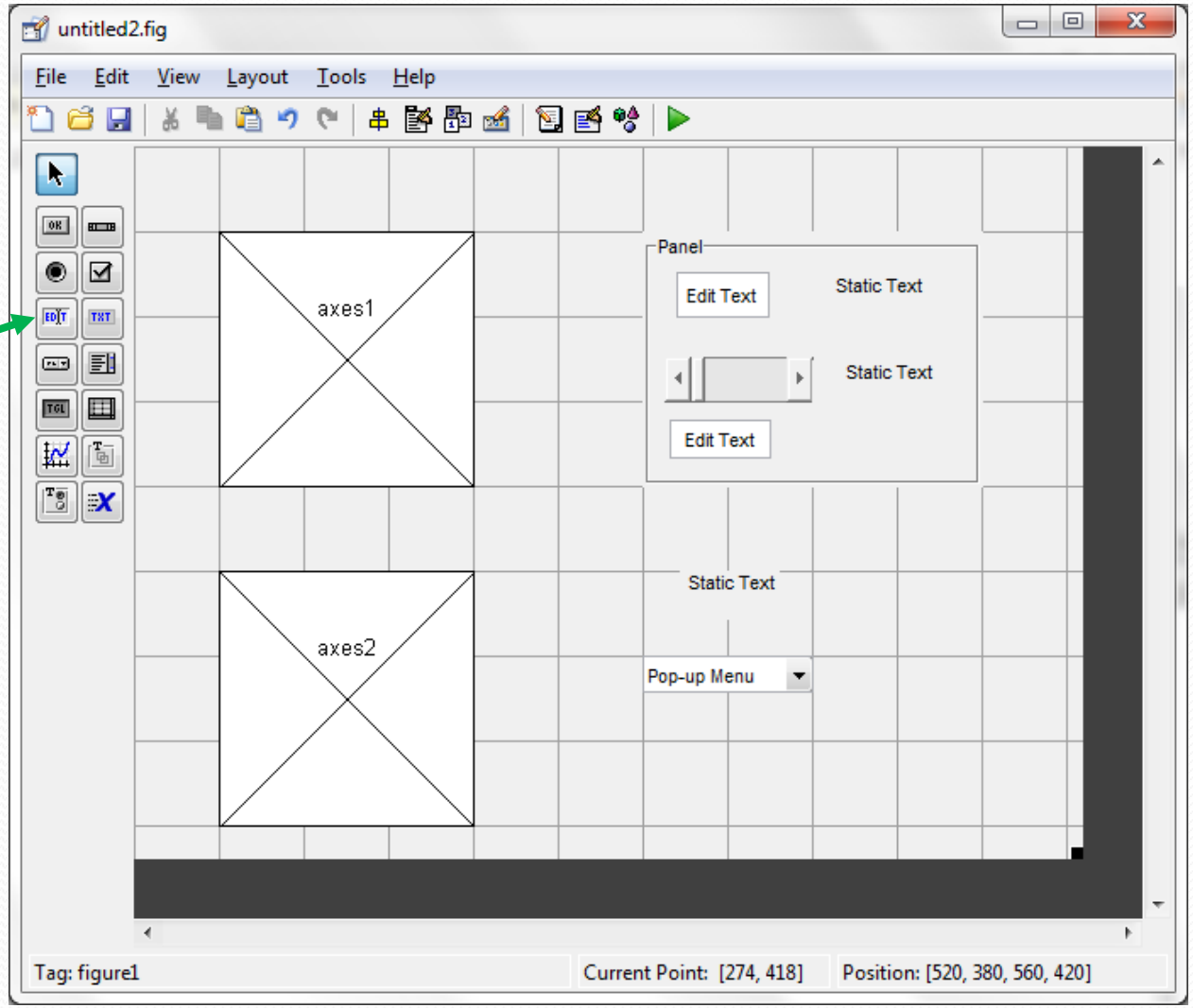
  >> guide

- Select the option to Create New GUI, Blank GUI (Default)



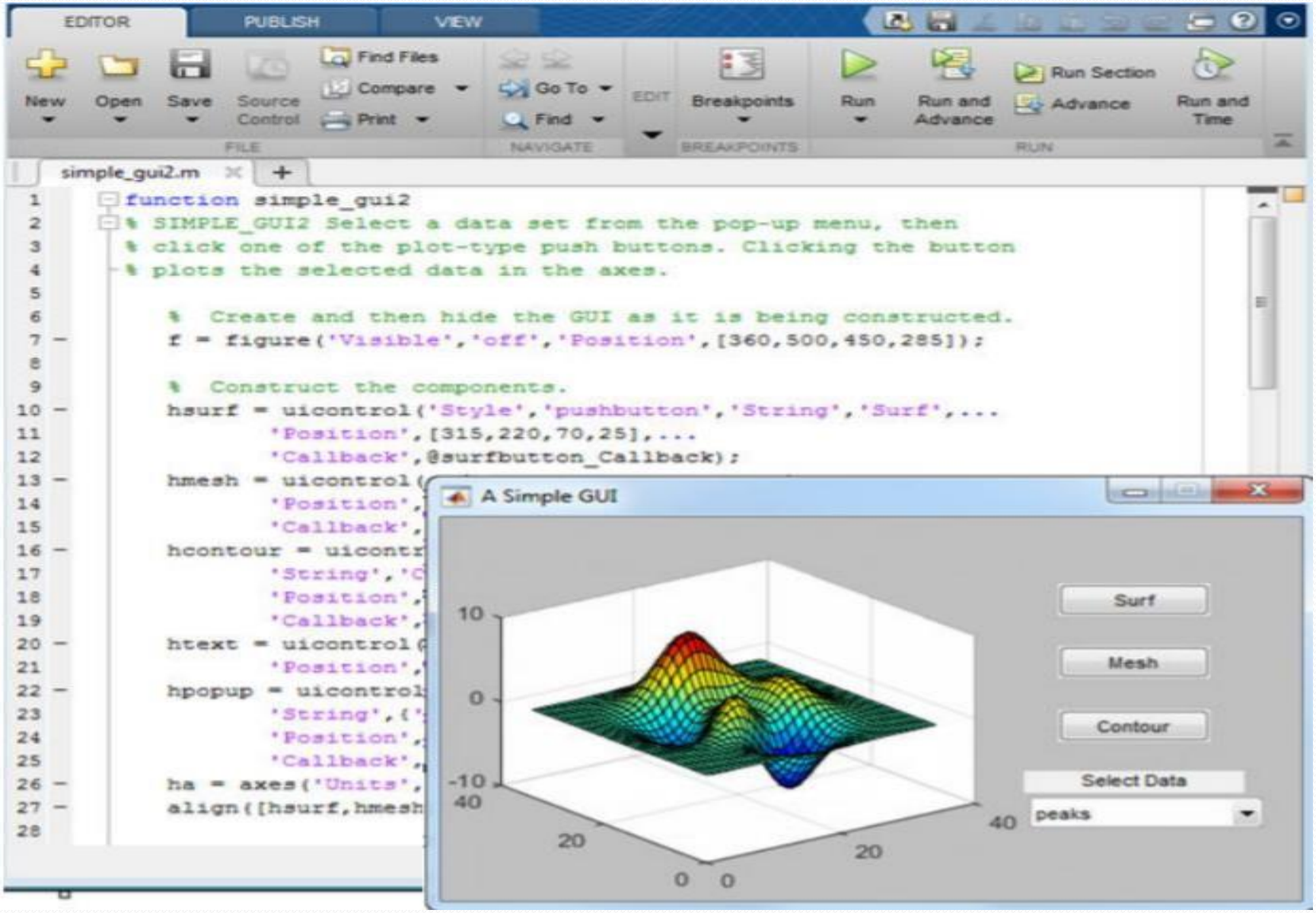
Add Objects

- Drag and drop components from the menu of icons to create this GUI:



MATLAB Function

- Use MATLAB Functions to Create Apps Programmatically You can also code the layout and behavior of your app entirely using MATLAB functions.
- In this approach, you create a traditional figure and place interactive components in that figure programmatically. These apps support the same types of graphics and interactive components that GUIDE supports, as well as tabbed panels.

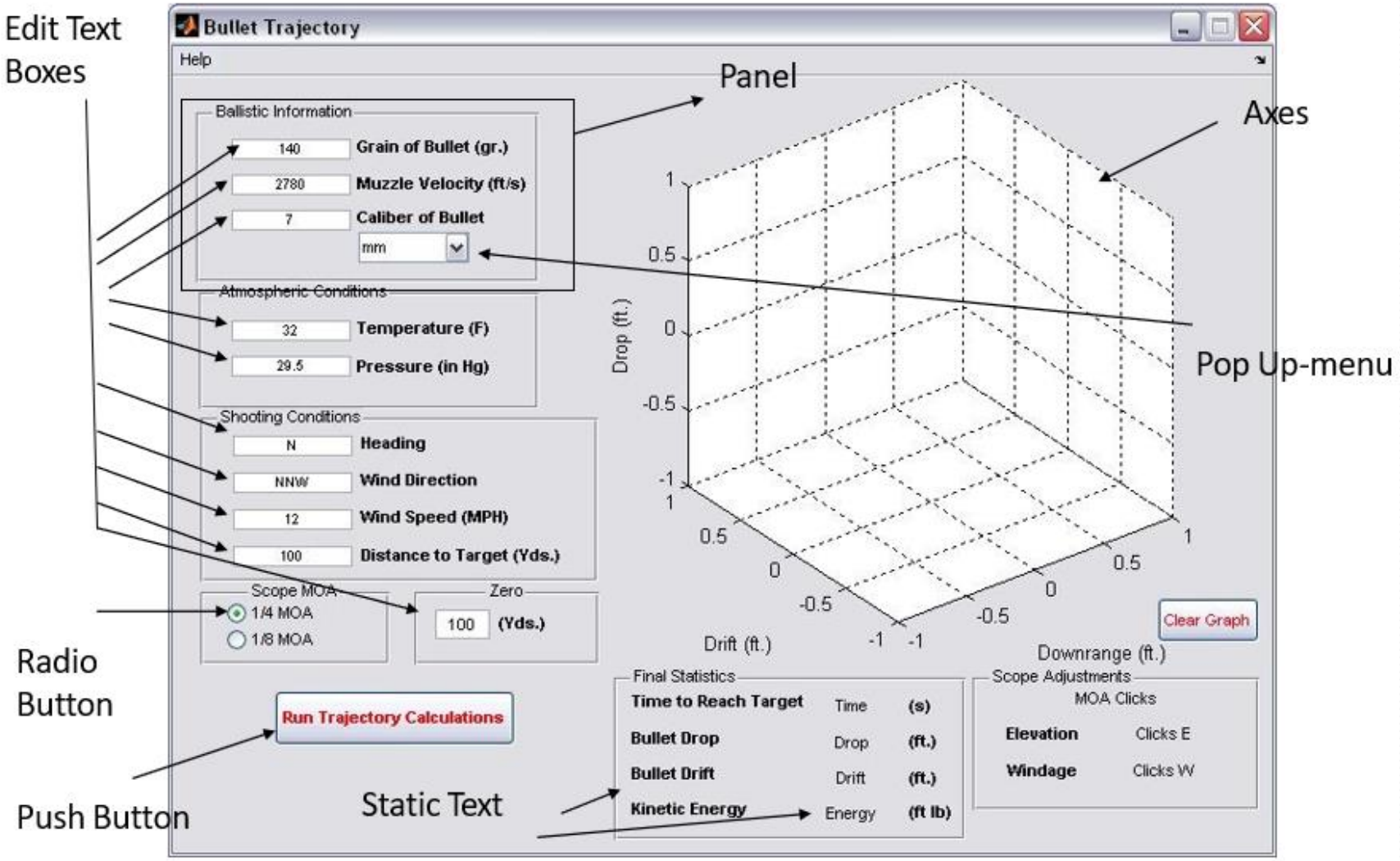

EDITOR
PUBLISH
VIEW
New
Open
Save
Source Control
Find Files
Compare
Print
Go To
Find
EDIT
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
FILE
NAVIGATE
BREAKPOINTS
RUN
simple_gui2.m
function simple_gui2
% SIMPLE_GUI2 Select a data set from the pop-up menu, then
% click one of the plot-type push buttons. Clicking the button
% plots the selected data in the axes.
% Create and then hide the GUI as it is being constructed.
f = figure('Visible','off','Position',[360,500,450,285]);
% Construct the components.
hsurf = uicontrol('Style','pushbutton','String','Surf',...
'Position',[315,220,70,25],...
'Callback',@surfbutton_Callback);
hmesh = uicontrol(
'Position',
'Callback',
hcontour = uicontr
'String','C
'Position',
'Callback',
htext = uicontrol(
'Position',
hpopup = uicontrol
'String',{'
'Position',
'Callback',
ha = axes('Units',
align([hsurf,hmesh
A Simple GUI
Surf
Mesh
Contour
Select Data
peaks
10
0
-10
40
20
0
0
20
40

MATLAB GUI (Graphical User Interface)

- GUI's in MATLAB consists of two files:
  - An "m-file" [******.m]
  - A "fig-file" [******.fig]

  - The m-file has all of the code that controls the GUI
  - The fig-file has all of the graphical objects, positions, and default values, and links it all together.

MATLAB GUI


Edit Text Boxes
Bullet Trajectory
Help
Panel
Axes
Ballistic Information
140
Grain of Bullet (gr.)
2780
Muzzle Velocity (ft/s)
7
Caliber of Bullet
mm
Pop Up-menu
Atmospheric Conditions
32
Temperature (F)
29.5
Pressure (in Hg)
Shooting Conditions
N
Heading
NNW
Wind Direction
12
Wind Speed (MPH)
100
Distance to Target (Yds.)
Scope MOA
1/4 MOA
1/8 MOA
Zero
100
(Yds.)
Drop (ft.)
Drift (ft.)
Downrange (ft.)
Clear Graph
Radio Button
Run Trajectory Calculations
Push Button
Static Text
Final Statistics
Time to Reach Target
Time
(s)
Bullet Drop
Drop
(ft.)
Bullet Drift
Drift
(ft.)
Kinetic Energy
Energy
(ft lb)
Scope Adjustments
MOA Clicks
Elevation
Clicks E
Windage
Clicks W

Handle Graphics

- Handle graphics are low-level graphic functions that control characteristics generated by MATLAB.
- They allow the programmer to have precise control of the appearance of plots and graphics.
- Each component has a list of properties that define what it looks like and how it behaves.
- Plot Something:
- Figure Window → View → Property inspector → More Properties

Handle Graphics

- The ‘set’ and ‘get’ commands
- These are the primary commands that you use to … set and get information about graphic objects, they update the graphical object immediately
- Syntax: ‘set’

```
>> set(object_hndl,'PropertyName',propvalue);
```

- Syntax: ‘get’

```
>> propvalue = get(object_hndl,'PropertyName');
```

Creating a GUI

- Step 1: Create the graphical components.

- Using the GUIDE

- Manually configure each component

- Step 2: Program Components.

-The GUIDE will generate the primary file, you must add to this file all of the actions your components will take.

- Step 3: Interface with your analysis tools.

The components and their names are visible

- To add a component to the workspace, you select it and drop it there. The size of the components can be changed by dragging the edges. Changing the position can be done by double-clicking and dragging it.

Let's look at each of the components before using them.

1. Push Button – Its function is to call the callback function for the execution of different programs.

Con.

2. Slider - It is similar to a scroll bar with a numerical value. The callback function is called and executed when the user changes the pad position. The pad position can be changed by dragging the pad to the required position or clicking the forward or backward arrow.
3. Radio Button – It has on and off states. Its state can be changed by clicking on it. When the button contains a solid circle within the hollow circle, then it is on. But when the hollow circle is empty, it is off. They are grouped and only one can be on at a time.

Con.

4. Check Box – It has the on and off state. The on the state is represented by a tick inside the box. They are grouped and several checkboxes can be on at the same time.
5. Edit Text – Is for getting strings as an input from the user. The input can then be modified to numbers using str2num or the str2double function.
6. Static Text – Is to add labels that remain unchanged on the GUI and have no callbacks.

Con.

7. Pop-up Menu – It is for listing selections. You click on it to view the selections and the callback function is executed depending on the selection.
8. List box – It shows a list of selections just like the pop-up menu. In the list box, all the selections are visible throughout, unlike the pop-up menu where only the current selection is visible.
9. Toggle Button – It functions similarly to the radio button but different appearance in the GUI. It's the appearance that makes the difference.

Con.

10. Table – It is used for the addition of a spreadsheet to the GUI. In case of a modification in the input, the callback is executed.
11. Axes – Are for the addition of images, charts, and plots to the GUI. They have no callback function.
12. Panel – It is used to group several components and names according to functionality. It doesn't have a callback function.
13. Button Group – It is just like the panel but used to group radio buttons. When we group the radio buttons here. Similar to a panel, we first add the button group before adding the radio buttons.

Activate Your GUI

- Click on the Green Play arrow to activate the GUI.
- Save the GUI under some name (FirstGui).
- Note: name must follow the same rules as naming variables in MATLAB!
- An m-file will automatically open (with the same name)
- The GUI which currently does almost nothing at this point will launch.
- The m-file has ***callback*** functions where code can be added to control what the various objects (pushbuttons, drop-down menus, plots, etc) will do. Any executable MATLAB code can be placed within these functions.