Interactive Programs

Graphical User Interfaces

CS112 Scientific Computation
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Properties of graphics objects

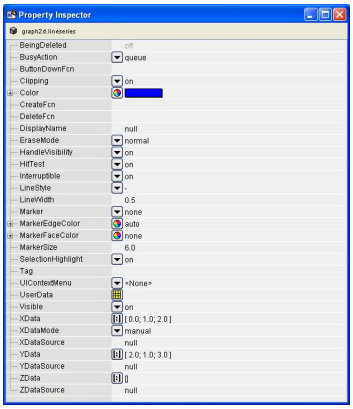
All plotting and graphics functions create graphic objects

Each graphics object is identified by a unique number called a handle that can be assigned to a variable:

```
p1 = plot([0  1  2],  [2  1  3]);
```

Graphics objects have properties that control their appearance on the screen and can be viewed with the Property Inspector:

```
inspect(p1)
```



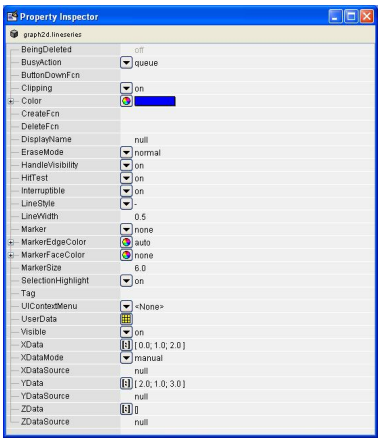
Accessing properties with MATLAB code

Graphics object properties can be accessed with the get function:

get(object, property)

For example,

```
>> get(p1, 'LineWidth');
0.5
```



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Graphics object properties can be set* by

... editing the value in the Property Inspector window

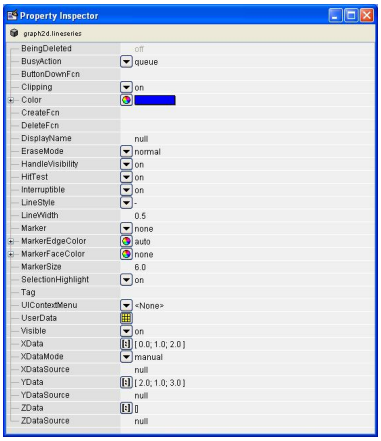
... specifying the property name and value when creating the graphics object:

```
p1 = plot([0 1 2], [2 1 3],  'LineWidth', 1);
```

... using the set function:

set(object, property, value)

```
>> set(p1, 'LineWidth', 1);
```



* true for any graphics function, e.g. figure, fill, scatter

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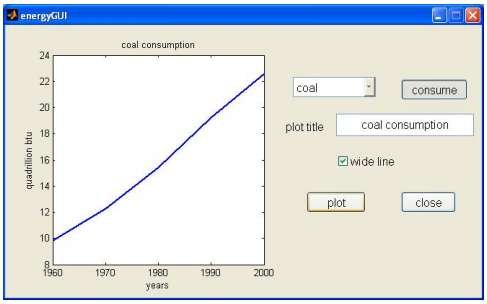
Graphical User Interface (GUI)

For our programs so far, we called a function or script from the Command Window and the program was executed with minimal input from the user



GUI-based programs put the user in the driver's seat through interactions with components of a graphical display

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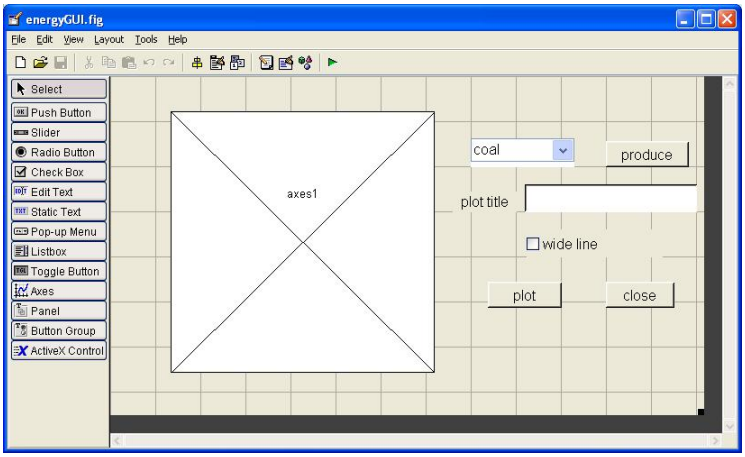
MATLAB Graphical User Interface Development Environment (GUIDE)



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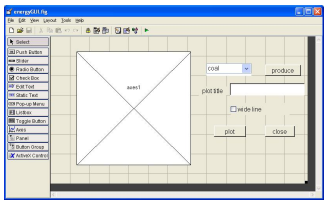
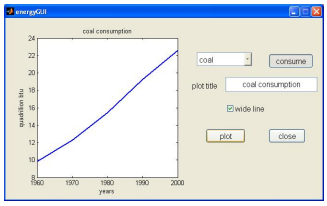
Saving the GUI layout

When our energyGUI layout is saved the first time, MATLAB generates two files:



energyGUI.fig: Layout Editor window with the developing GUI, which can be modified later by entering

>> guide energyGUI.fig



energyGUI.m: file that contains code to create the GUI display

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Functions defined in energyGUI.m

energyGUI: top-level function at the beginning of the file that is called from the Command Window. This function initializes the GUI program and opens the GUI window. *We will not modify this function*

energyGUI_OpeningFcn: executed just before the GUI window is made visible. We will modify this function to set up data for the program

energyGUI_OutputFcn: returns outputs to the Command Window. *We will not modify this function*

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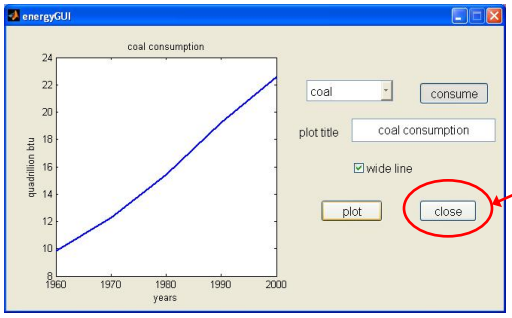
Callback functions

For each component, the header of a Callback function is created. These functions are invoked automatically when the user interacts with the corresponding component



Invokes closeButton_Callback when clicked by user

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Inputs to GUI functions

hObject is a number, the *graphics handle*, that uniquely identifies the GUI component and its associated properties

eventdata is not used in the current version of MATLAB

handles is a structure that contains information that needs to be shared between functions in this file. Initially it contains a field for each GUI component created, using Tag property as name:

handles.axes1
handles.sourceMenu
handles.sourceToggle
handles.titleLabel
handles.titleBox
handles.widthCheckbox
handles.plotButton
handles.closeButton
handles.figure1

Value of each field is the graphics handle for that component

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Adding actions

```
function energyGUI_OpeningFcn (hObject, eventdata, handles, varargin)
% setup data to use for plotting
[handles.years  handles.produce  handles.consume] = setupEnergy;

function sourceToggle_Callback (hObject, eventdata, handles)
% use state of toggle button to set text label on button
if (get(hObject, 'Value') == 0)
    set(hObject, 'String', 'produce');
else
    set(hObject, 'String' , 'consume');
end
guidata(hObject, handles);
```

copy changes to global handles structure

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More action

```
function plotButton_Callback (hObject, eventdata, handles)
% setup data source requested by user from state of toggle button
if (get(handles.sourceToggle, 'Value') == 0)
    dataSource = handles.produce;
else
     dataSource = handles.consume;
end
% get index of selected energy source
sourceIndex = get(handles.sourceMenu, 'Value');
% use state of checkbox to determine line width
linewidth = get(handles.widthCheckbox, 'Value') + 1;
% plot the data with the requested properties
plot(handles.years, dataSource(sourceIndex, :), 'Linewidth', linewidth);
xlabel('years')
ylabel('quadrillion btu')
title(get(handles.titleBox, 'String'))
```

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Time for you to leave

```
function closeButton_Callback (hObject, eventdata, handles)
% close GUI figure window
delete(handles.figure1);
```

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