PLOTTING

MATLAB Basics – Dr. Linda Al-Hmoud

Plotting

- MATLAB is very powerful for producing both 2D and 3D plots.
- Plots can be created and manipulated interactively or by commands.
- MATLAB offers a number of different formats for exporting plots, including EPS, PDF and JPEG, so you can easily include MATLAB plots in your reports.

Simple 2D Plotting

- **`plot(x,y)`**: the simplest and most commonly used plotting command
  - **x** and **y** are vectors containing the x and y coordinates of the data to be plotted
- **Example:** create a plot of $f(x) = e^{-\frac{x}{10}} \sin(x)$

```
>> x = 0:0.1:20;
>> y = exp(-x/10).*sin(x);
>> plot(x,y), grid on, xlabel('x'), ...
ylabel('f(x) = e^{-x/10} sin(x)'),
title('A simple plot')
```

Simple 2D Plotting

```
>> x = 0:0.1:20;
```

```
>> y = exp(-x/10).*sin(x);
```

x and y data must be the same length

displays the grid

```
>> plot(x,y), grid on, xlabel('x'), ...
ylabel('f(x) = e^{-x/10} sin(x)'), title('A
simple plot')
```

- `xlabel()`, `ylabel()`, and `title()` can be used to label the corresponding parts of the plot.
- You must enclose your labels with single quotes (‘ ’) which denotes *a string of text.*

Simple 2D Plotting

- The plot command can be used to plot multiple sets of data on the same axes,
  - i.e. `plot(x1,y1,x2,y2)`.
- **Example:**

```
>> z = exp(-x/10).*cos(x);
>> plot(x,y,x,z)
```

- `legend('y vs. x','z vs. x')` is used to place a legend and label the data-sets when you have multiple data-sets on one plot.

Simple 2D Plotting

- You can specify line style and color within the plot command
  - e. g. `plot(x1,y1,'b-',x2,y2,'r--')`.
- This command would make the first data-set a solid blue line, and the second data-set a dashed red line.

Table 3: Line styles in plots

STRING SPECIFIER	LINE STYLE
–	Solid line (default)
--	Dashed line
:	Dotted line
-.	Dash-dot line

Table 4: Colours in plots

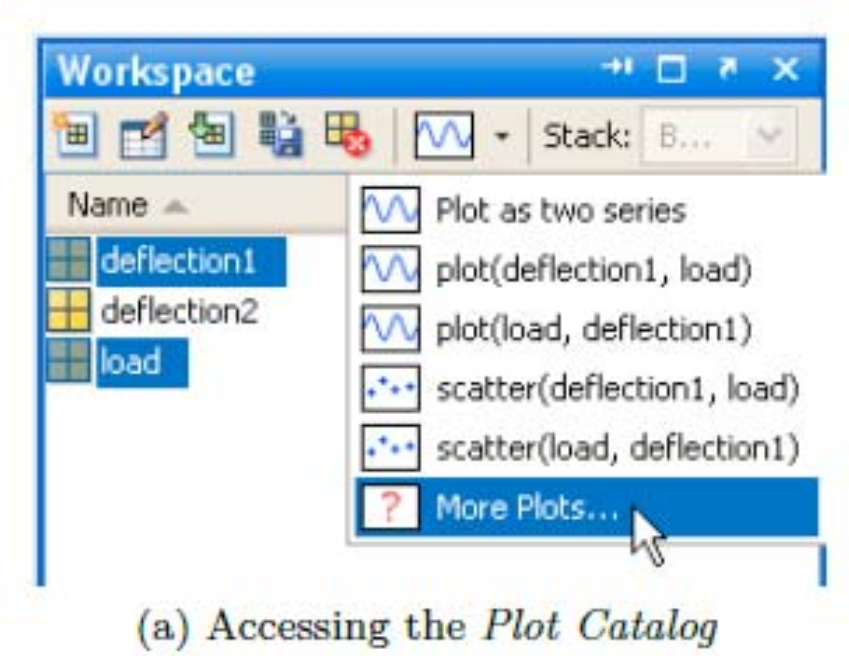
STRING SPECIFIER	LINE COLOUR
r	Red
g	Green
b	Blue (default)
w	White
k	Black

Simple 2D Plotting

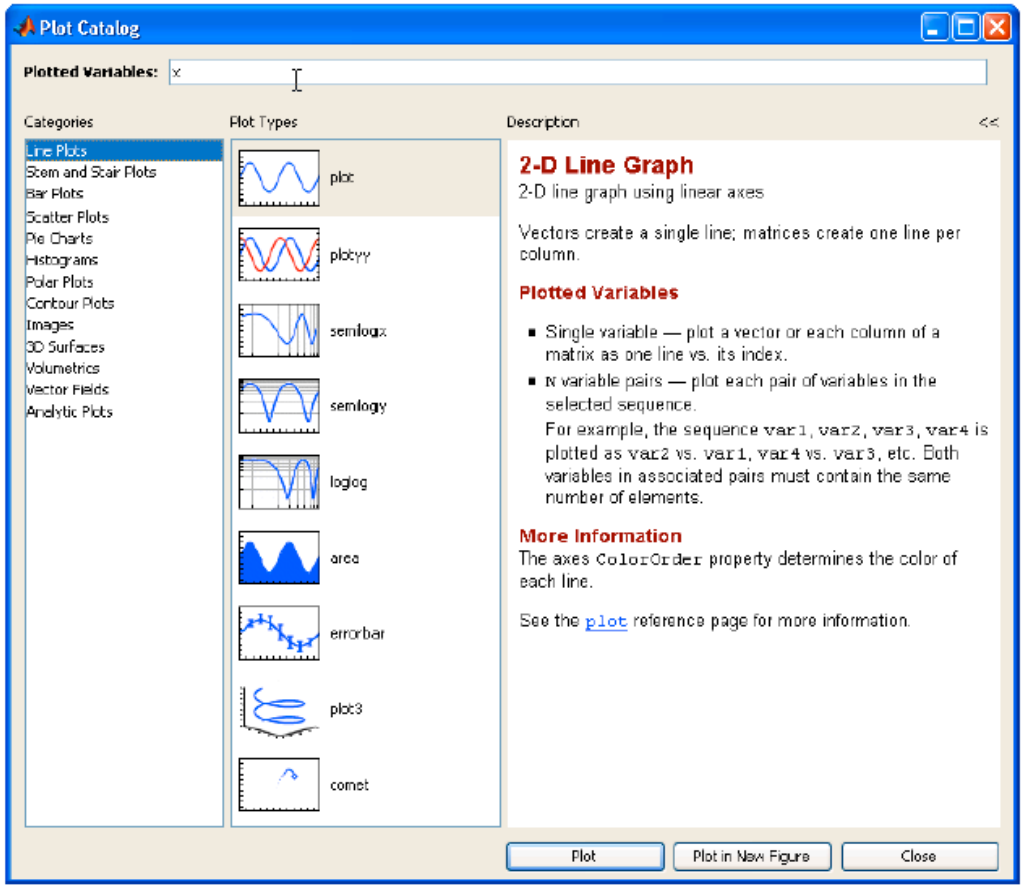
- Plot properties can also be manipulated interactively (*without having to issue commands*) by clicking on the ***Show Plot Tools*** icon in the **Figure Window toolbar**

- **Plot properties**
  - Axis limits
  - Gridlines
  - Line style, color and thickness
  - Text font type and size,
  - Legend

Built-in Plot Types



(a) Accessing the *Plot Catalog*



Exercise 3, Q2, page 24

- Given the following function:

$$S = \text{acos}(\theta) + \sqrt{b^2 - (\text{asin}(\theta) - c)^2}$$

- Plot S (with blue dashed line 'b--') as a function of angle θ when a = 1, b = 1.5, c = 0.3, and $0 \leq \theta \leq 360°$.
- Turn the `grid on` in your plot, and remember to label your axes and use a title.

MULTIPLE PLOTS & 3D PLOTTING

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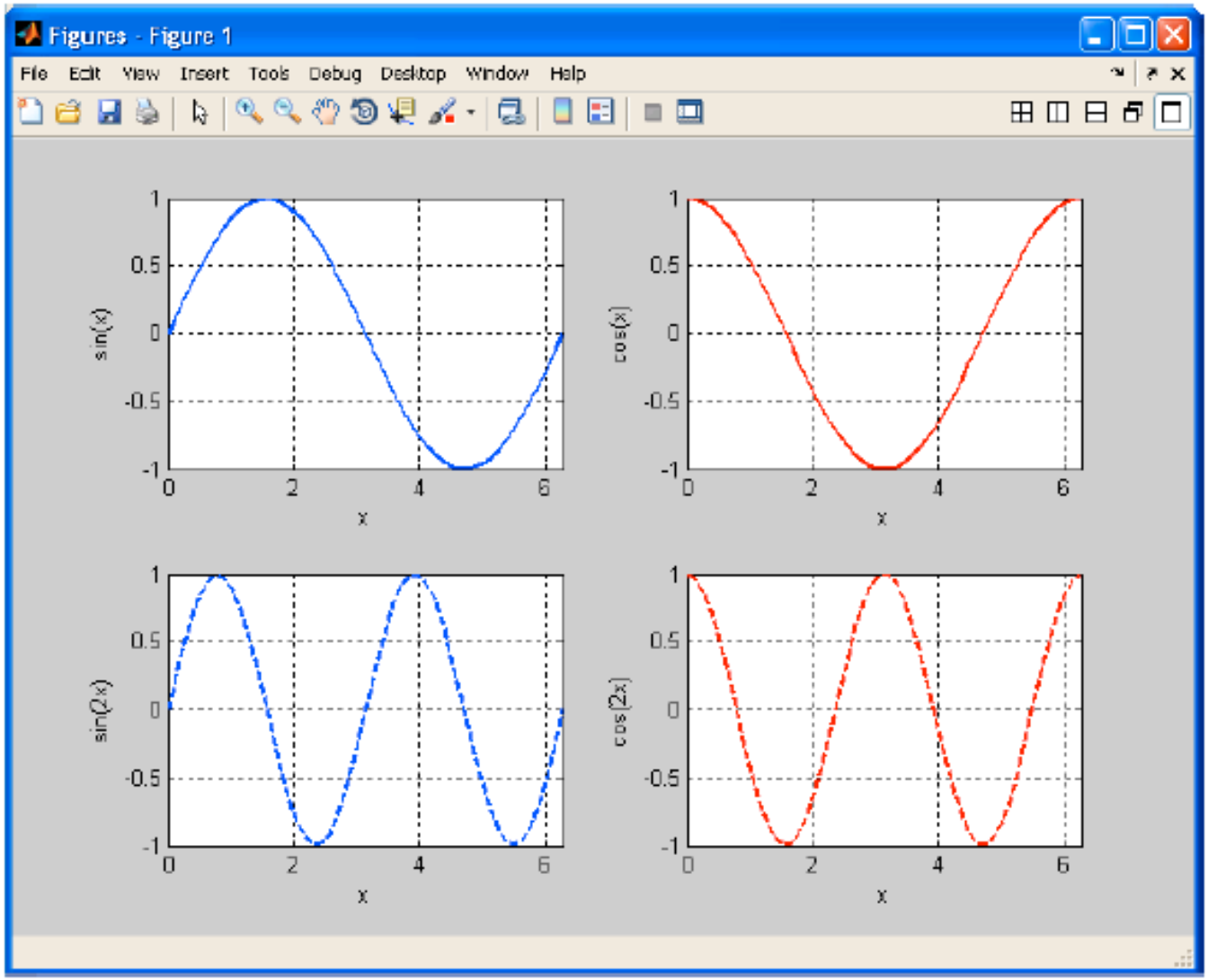
Multiple Plots in One Figure Window

- **`subplot(2,2,1)`** specifies that
  - the Figure Window will be divided into 2 rows and 2 columns of plots, and
  - selects the first subplot to plot into
- **Example:**

```
>> x = linspace(0,2*pi,50);
>> subplot(2,2,1),plot(x,sin(x)),xlabel('x'),ylabel('sin(x)');
>> subplot(2,2,2),plot(x,cos(x)),xlabel('x'),ylabel('cos(x)');
>> subplot(2,2,3),plot(x,sin(2*x)),xlabel('x'),ylabel('sin(2x)');
>> subplot(2,2,4),plot(x,cos(2*x)),xlabel('x'),ylabel('cos(2x)');
```

Multiple Plots in One Figure Window



3D Plotting using PLOT3 and SURF

- **Example:**

```
>> t = 0:pi/50:10*pi;
>> plot3(sin(t),cos(t),t,'r.'),grid on, ...
xlabel('x'),ylabel('y'),zlabel('z'), ...
title('3D helix')
```

Exercise 4, Q1(a), page 30

- Plot the following 3D curve using the `plot3` function:
  - *Spherical helix* (**c = 5 and 0 ≤ t ≤ 10π**)

$$x = \sin\left(\frac{t}{2c}\right)\cos(t)$$

$$y = \sin\left(\frac{t}{2c}\right)\sin(t)$$

$$z = \cos\left(\frac{t}{2c}\right)$$