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MATLAB

Quality plots

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Requirements

- Produce high quality figures (e.g. for a paper)
- Fonts, line widths, etc. to be a specified size (e.g. 12pts)
- Fonts and symbols identical in figure and text
- Automate process as much as possible; figure regeneration
  - Collect additional data
  - Reuse the figure in a new publication, talk, grant etc.
  - Minor cosmetic alterations (require small amount of work)
- Reuse visualisation code

Taken from http://www.gatsby.ucl.ac.uk/~turner/TeaTalks/matlabFigs/matlabFig.pdf

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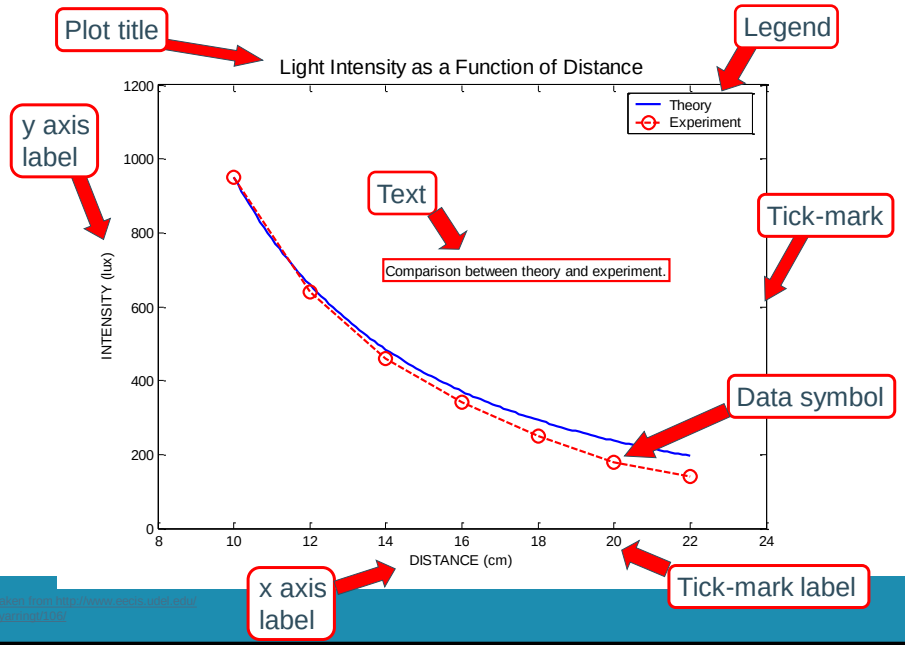

Taken from http://www.eecis.udel.edu/~weinert/106/

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Approach

As proposed by Turner / Rajashekar (http://www.gatsby.ucl.ac.uk/~turner/TeaTalks/matlabFigs/matlabFig.pdf)

Do NOT

- Modify figure properties using the mouse
- Export figures using the “export" menu function

Avoid

- Using third party graphics programs where possible

Do

- Use functions and scripts to generate plots: Reuseability
- Specify fonts, line styles, axis positions, figure sizes as variables
- Export using the print command

See also: http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

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plotting your data

- If only previewing or exploring data, steps 1 and 3 may be all you need.
- If creating presentation graphics, you may want to finetune your graph by positioning it on the page, setting line styles and colors, adding annotations,and making other such improvements.
- *File: first_plot*

1. Prepare your data	`x = 0:0.2:12;`
	`y1 = bessel(1,x);`
	`y2 = bessel(2,x);`

2. Select a window and position a plot region within the window	`figure(1)` `subplot(2,2,1)`
3. Call elementary plotting function	`h = plot(x, y1, x, y2)`

4. Select line and marker Characteristics	`set(h,'LineWidth',2,{'LineStyle'},…`
	`{'--';':'})`
	`set(h,{'Color'},{'r';'b'})`

5. Set axis limits, tick marks, and grid lines marks, and grid lines	`axis([0 12 -0.5 1])` `grid on`

6. Annotate the graph with axis labels, legend and text	`xlabel ('Time')`
	`ylabel ('Amplitude')`
	`legend(h,'First','Second')`

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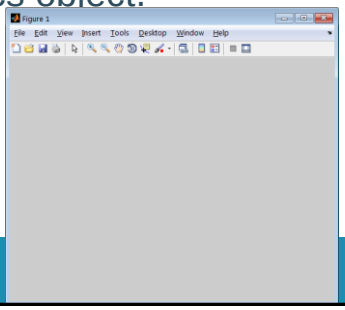
figure

- figure: fundamental container for plotting – a graph is created in a figure window
- separate from the Command Window
- can contain menus, toolbars, user-interface objects, context menus, axes, or any other type of graphics object.
- to create a new figure, use the **figure** function



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plot command

- `plot(Y)`: plots the columns of Y versus their index if Y is a real number.
- `plot(X1,Y1,...)`: plots all lines defined by Xn versus Yn pairs.
- `plot(X1,Y1,LineSpec,...)`: plots all lines defined by the Xn,Yn,LineSpec triples, where LineSpec is a line specification for line type, marker symbol, and color of the plotted lines.
- `plot(...,'PropertyName',PropertyValue,..)`: sets properties to the specified property values for all line graphics objects created by plot.

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plot: line specs

line specifications:

- LineStyle:
  - solid line (default)
  -- dashed line
  : dotted line
  -. dash-dot line
- Marker: Marker symbol.
  + o * . x(cross) s(square) d(diamond) ^ > < p(pentagram) h(hexagram)
- Color:
  y m g r c b (=blue) k (= black) w

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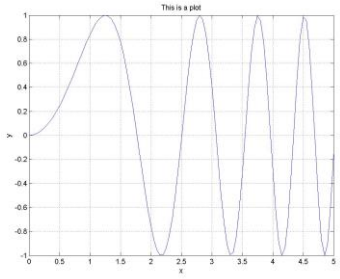
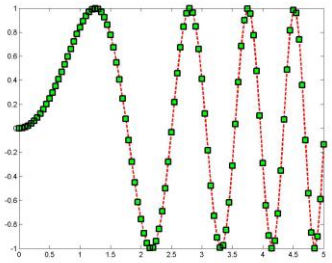
plot

- File:
  plot2D_simple.m
  plot2D_simple_02.m
  plot2D_plot_2.m

```
x=0:0.05:5;
y=sin(x.^2);
plot(x,y);
```

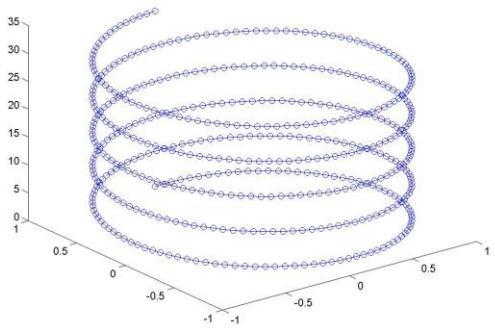
```
plot(x,y,'--rs',...
  'LineWidth',2,...
  'MarkerEdgeColor','k',...
  'MarkerFaceColor','g',...
  'MarkerSize',10)
```





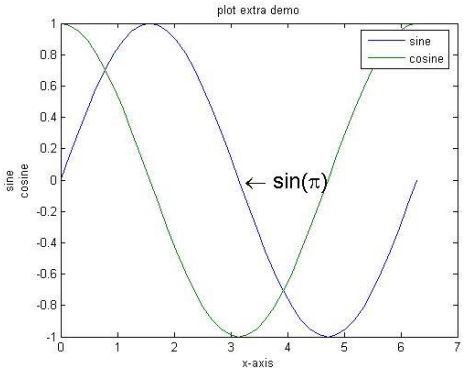
plot3

- `plot3` displays a three-dimensional plot of a set of data points.
- *File: plot3D_plot3_1.m*



Extra information

- `xlabel, ylabel, zlabel`:
  - Label the x-, y-, and z-axis
- `title`:
  - places a title on your plot
- `legend`:
  - adds a legend to your plot
- File: *plot2D_extra*
  plot2D_legend



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Extra information

- `text`:
  - creates a text object in current axes
- `grid on/off`
  - adds/removes grid lines
- `box on/off`
  - adds/removes axes box
- *File: plot2D_extra2.m*

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axes control

- `axis([xmin xmax ymin ymax])`: sets the limits for the x- and y-axis of the current axis
- `axis auto` : default behavior of computing the current axes' limits automatically,
- `axis tight`: sets the axis limits to the range of the data.
- `axis square`: square dimensions
- `axis equal`: equal unit spacing on x and y axes; ensures correct aspect ratio
- `axis off`: hides the axes, tickmarks, labels
- File: *plot2D_axis.m*

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multiple graphs

- In the same axes: `hold on`
- In the same window: `subplot`
- In different windows: `figure`
- Change between windows: `figure(figure_number)`
- Clear the graphics: `clf, cla`
- Close a window: `close(figure_number), close all`
- *Files:*
  plot2D_multiple.m
  demo_differentfont.m

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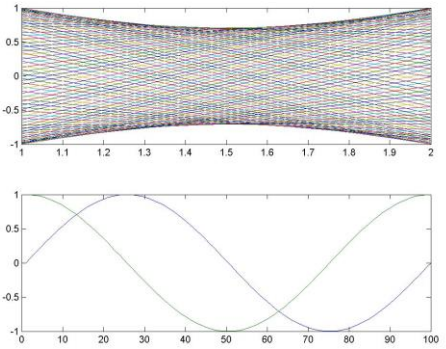
subplot

- multiple plots can be set in 1 figure using `subplot`
- `subplot(m,n,p)` creates an axes in the pth pane of a figure divided into an m-by-n matrix of rectangular panes.
- *Files:*
  plot2D_subplot
  plot2D_subplot_extra



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export

- Print a figure with `print`, usually providing a better quality than saveas
- Check the documentation
- *File: demo_print_figure.m*
- Look at exportgraphics
  - https://nl.mathworks.com/help/matlab/ref/exportgraphics.html

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Quality prints

- Check paper Damiano Varagnolo http://staff.www.ltu.se/~damvar/Matlab/HowToMakePrettyFiguresWithMatlab.pdf
- https://dgleich.wordpress.com/2013/06/04/creating-high-quality-graphics-in-matlab-for-papers-and-presentations/
- http://steventhornton.ca/publication-quality-plots-with-matlab/
- http://blogs.mathworks.com/loren/2007/12/11/making-pretty-graphs/
- http://fundamentalthinking.blogspot.com/2012/01/generating-publication-quality-figures.html

Quality prints

- Check out Matlab Central
  - Oliver Woodword / Yair Altman: export_fig https://nl.mathworks.com/matlabcentral/fileexchange/23629-export_fig https://github.com/altmany/export_fig
  - Peder Axenstein: savefig https://nl.mathworks.com/matlabcentral/fileexchange/10889-savefig