Chapter Nine

Two Dimensional Plots

MATLAB contains a variety of plotting tools to represent various mathematical functions (two dimensional plots, contour plots, 3D surfaces, 3D paths of vectors) in addition to facilities for image processing and pixels control.

9.1 Parts of a two Dimensional (2D) plot

Any typical 2D plot should contain the following components as shown in (Fig. 9.1):

a) Line: Which connects the points located on the plotting area.
b) Markers: They are used to distinguish between the several lines on the same plot.
c) Legend: It is a list of each marker identification.
d) Grid: It is a mesh of horizontal and vertical dashed lines to facilitate reading the plots.
e) X−label: It is the title of the horizontal axis.
f) Y−label: It is the title of the vertical axis.
g) Title: It is a text that defines the whole plot.

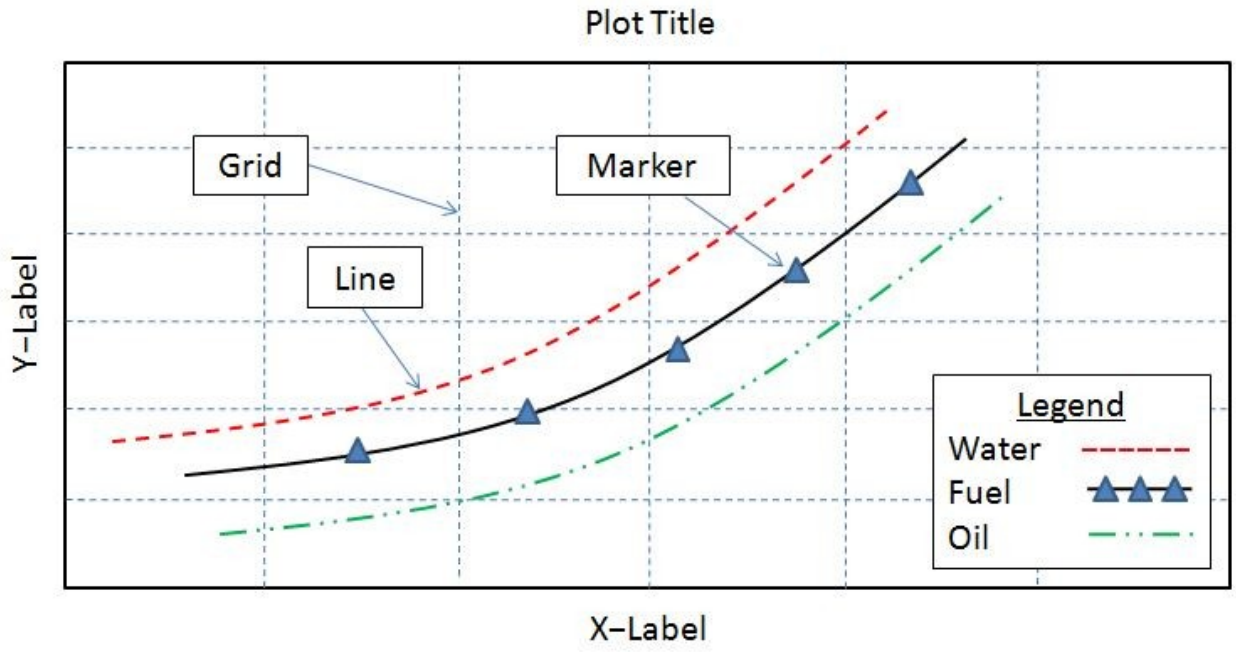


Fig. (9.1): Parts of a typical two dimensional plot.

9.2 The command (plot)

To draw a two dimensional curve between two sets of data (two matrices; x and y) the command (plot) is used as follows:

```
plot(x,y,'–mo','linewidth',2,'markersize',8,...
                    'markeredgecolor','g','markerfacecolor','y')
```

(–) : Line style identifier; [solid (–), dashed (––), dotted (:), dash–dotted (–.)]

(m) : Line color identifier; [red (r), green (g), blue (b), cyan (c), magenta (m),

Yellow (y), black (k), white (w)]

(o) : Marker type identifier; [square (s), diamond (d), pentagon (p), hexagon (h),

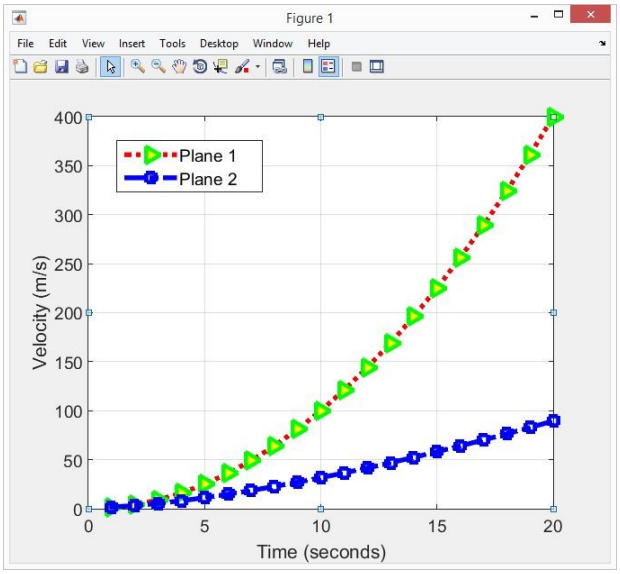
circle (o), cross (x), triangles (v, ^, >, <), plus (+), star (*), dot (.)]

Ex. 9.1 Write MATLAB program to plot the following two functions on the same figure identifying them with line styles, markers and colors. The figure should contain labels on the axes, a legend and a grid:

x values from 1 to 20

$y = x^2$

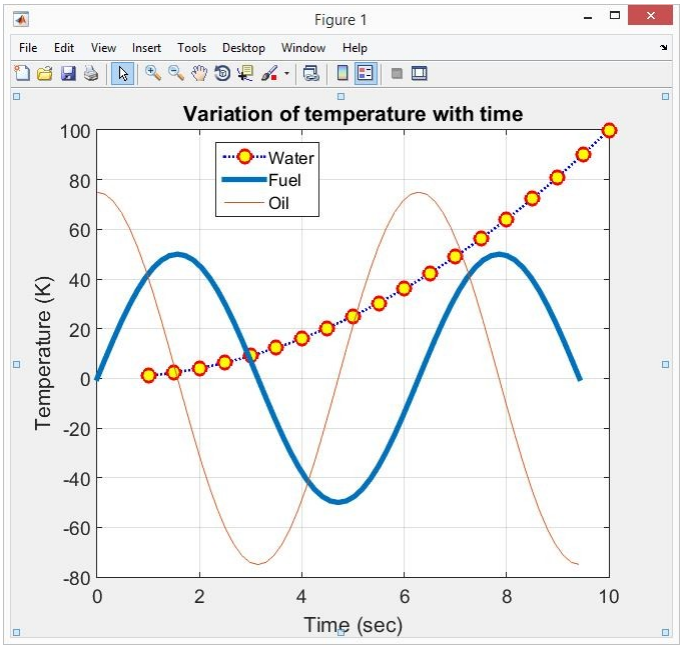
$z = \sqrt{x^3 + 2}$



Sol.

```
clear,clc
x=1:20;
y=x.^2;
z=sqrt(x.^3+2);
plot(x,y,':r>','linewidth',4,'markersize',12,...
            'markeredgecolor','g','markerfacecolor','y')
hold on
plot(x,z,'-.bs','linewidth',4,'markersize',10)
grid on
xlabel('Time (seconds)')
ylabel('Velocity (m/s)')
legend('Plane 1','Plane 2')
```

Ex. 9.2 Write MATLAB program to draw three curves on the same figure distinguishing them with line styles, markers and colors. The three plots are for $y=x^2$, sine and cosine functions. Take x values to be between 0 and 10 at a step of 0.5 unit for the first function x^2, While take the value of x to be between 0 and 3π at a step of $\pi/20$ for the sine and cosine functions. Multiply the sine and cosine functions by a scale factor of 50 and 75 respectively to be consistent with x^2 function. Add a legend reading (Water, Fuel, Oil) for the tree curves respectively. Put the titles of the x and y axes as (Time (sec)) and (Temperature (K)) respectively and add the figure title as (Variation of temperature with time).



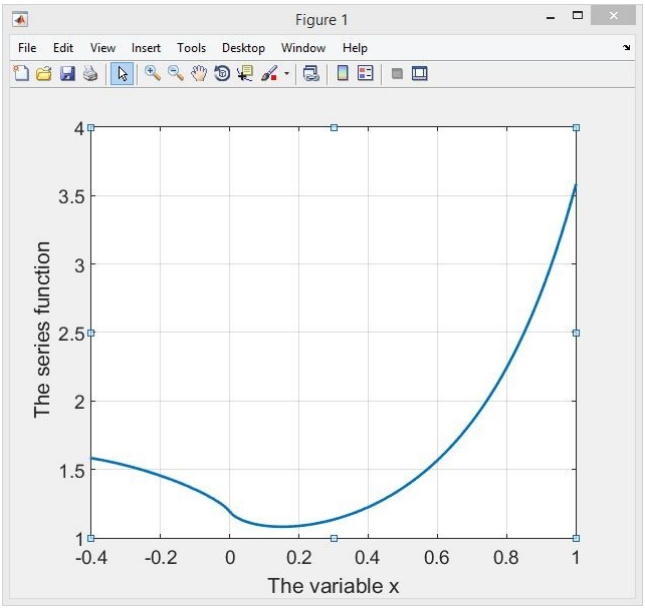
Sol.

```
clear,clc
x=1:0.5:10;
y=x.^2;
plot(x,y,':bo','linewidth',2,'markersize',10,...
                'markeredgecolor','r','markerfacecolor','y')
grid on
x1=0:pi/20:3*pi;
y1=50.*sin(x1);
z1=75.*cos(x1);
hold on
plot(x1,y1,'linewidth',4)
plot(x1,z1)
legend('Water','Fuel','Oil')
xlabel('Time (sec)')
ylabel('Temperature (K)')
title('Variation of temperature with time')
```

Ex. 9.3 Write MATLAB program to plot the following function:

$$y=\sum_{n=0}^{\infty}\frac{\left|\left(x^{2n+1}+x^{n}+x^{2}\right)^{x}\right|}{\sqrt{(2n+1)!+n!}}$$

The domain of the function (values of x) lies between −0.4 and 1 at a step of 0.01 and considering 10 terms of the series. Select a line width of 2 points and add the phrases (The variable x) and (The series function) as titles for x and y axes respectively.



Sol.

```
clear,clc
r=0;
for x=-0.4:0.01:1;
    y=0;
    for n=0:9
        A=(x^(2*n+1)+x^n+x^2)^x;
        B=factorial(2*n+1)+factorial(n);
        y=y+abs(A)/sqrt(B);
    end
    r=r+1;
    x1(r)=x;
    y1(r)=y;
end
plot(x1,y1,'linewidth',2)
xlabel('The variable x')
ylabel(' The series function')
grid on
```

Ex. 9.4 Write MATLAB program to draw the following two sets of data (x and y) and (z and w) on the same figure. Discriminate between the two curves with markers only:

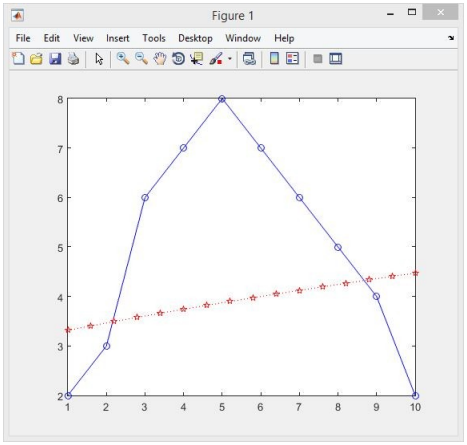
x = integers between 1 and 10

y = [2 , 3 , 6 , 7 , 8 , 7 , 6 , 5 , 4 , 2]

z = 16 numbers equally spaced between 1 1nd 10

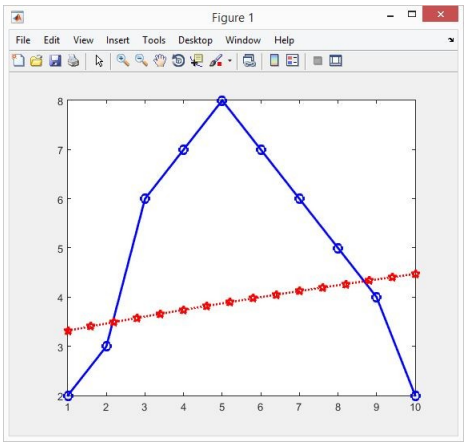
$w = \sqrt{z + 10}$

Sol.



Method (1): Limited control of the plot properties

```
clear,clc
x=1:10;
y=[2 3 6 7 8 7 6 5 4 2];
z=linspace(1,10,16);
w=sqrt(z+10);
plot(x,y,'-ob',z,w,':pr')
```



Method (2): Full control of the plot properties

```
clear,clc
x=1:10;
y=[2 3 6 7 8 7 6 5 4 2];
z=linspace(1,10,16);
w=sqrt(z+10);
plot(x,y,'-ob','markersize',8,'linewidth',2)
hold on
plot(z,w,':pr','markersize',8,'linewidth',2)
```