Lab Manual 6

Basic Plotting-2D and 3D

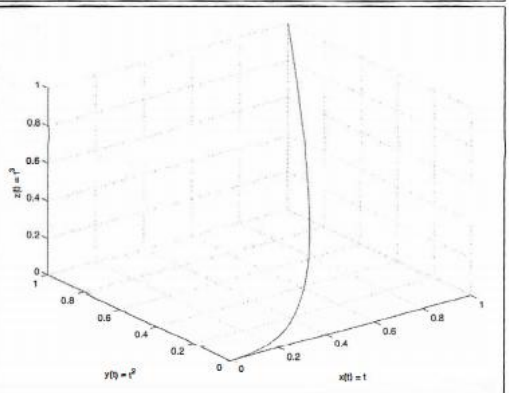
Course Objective: understand the basic features and commands of MATLAB

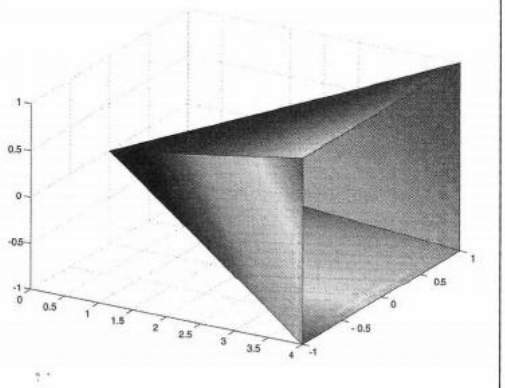
Part A: Theory

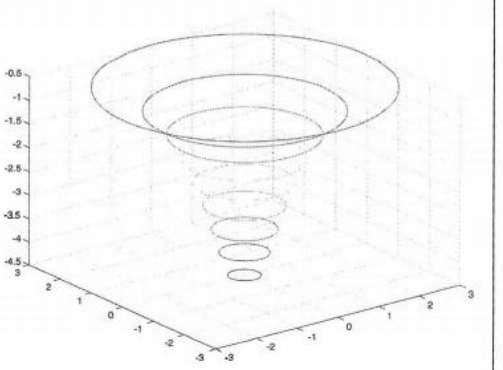
`plot3`	plots curves in space,
`stem3`	creates discrete data plot with stems in 3-D,
`bar3`	plots 3-D bar graph,
`bar3h`	plots 3-D horizontal bar graph,
`pie3`	makes 3-D pie chart,
`comet3`	makes animated 3-D line plot,
`fill3`	draws filled 3-D polygons,
`contour3`	makes 3-D contour plots,
`quiver3`	draws vector fields in 3-D,
`scatter3`	makes scatter plots in 3-D,
`mesh`	draws 3-D mesh surfaces (wire-frame),
`meshc`	draws 3-D mesh surfaces along with contours,
`meshz`	draws 3-D mesh surfaces with reference plane curtains,
`surf`	creates 3-D surface plots,
`surfc`	creates 3-D surface plots along with contours,
`surfl`	creates 3-D surface plots with specified light source,
`trimesh`	mesh plot with triangles,
`trisurf`	surface plot with triangles,
`slice`	draws a volumetric surface with slices,
`waterfall`	creates a *waterfall* plot of 3-D data,

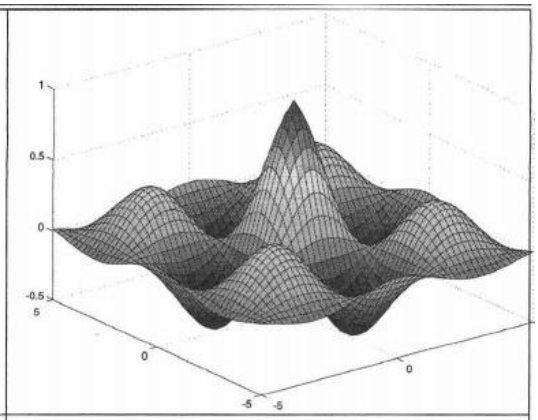
`cylinder`	generates a cylinder,
`ellipsoid`	generates an ellipsoid, and
`sphere`	generates a sphere.

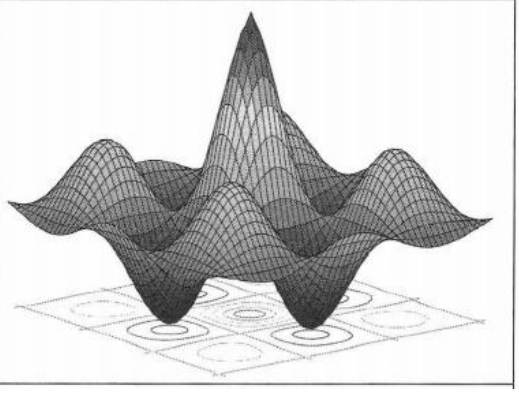
Function	Example Script	Output

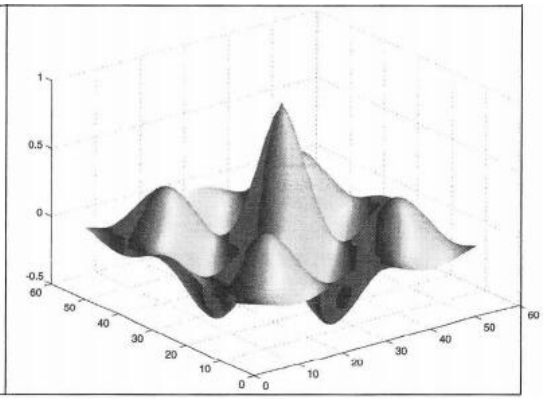
plot3	Plot of a parametric space curve:
	$x(t) = t,\ y(t) = t^2,\ z(t) = t^3.$
	$0 \le t \le 1.$
	`t = linspace(0,1,100);`
	`x = t; y = t.^2; z = t.^3;`
	`plot3(x,y,z), grid`
	`xlabel('x(t) = t')`
	`ylabel('y(t) = t^2')`
	`zlabel('z(t) = t^3')`
		

fill3	Plot of four filled polygons with three vertices each.
	`X = [0 0 0 0; 1 1 -1 1;`
	`1 -1 -1 -1];`
	`Y = [0 0 0 0; 4 4 4 4;`
	`4 4 4 4];`
	`Z = [0 0 0 0; 1 1 -1 -1;`
	`-1 1 1 -1];`
	`fillcolor=rand(3,4);`
	`fill3(X,Y,Z,fillcolor)`
	`view(120,30)`
		

contour3	Plot of 3-D contour lines of
	$z = -\dfrac{5}{1+x^2+y^2},$
	$\lvert x\rvert \le 3, \lvert y\rvert \le 3.$
	`r = linspace(-3,3,50);`
	`[x,y] = meshgrid(r,r);`
	`z = -5./(1 + x.^2 + y.^2);`
	`contour3(x,y,z)`
		

surf	$z = \cos x \cos y \, e^{\frac{-\sqrt{x^2+y^2}}{4}}$
	$\lvert x\rvert \le 5, \quad \lvert y\rvert \le 5$
	`u = -5:.2:5;`
	`[X,Y] = meshgrid(u, u);`
	`Z = cos(X).*cos(Y).*...`
	`exp(-sqrt(X.^2 + Y.^2)/4);`
	`surf(X,Y,Z)`
		

surfc	$z = \cos x \cos y \, e^{\frac{-\sqrt{x^2+y^2}}{4}}$
	$\lvert x\rvert \le 5, \quad \lvert y\rvert \le 5$
	`u = -5:.2:5;`
	`[X,Y] = meshgrid(u, u);`
	`Z = cos(X).*cos(Y).*...`
	`exp(-sqrt(X.^2 + Y.^2)/4);`
	`surfc(Z)`
	`view(-37.5,20)`
	`axis('off')`
		

surfl	$z = \cos x \cos y \, e^{\frac{-\sqrt{x^2+y^2}}{4}}$
	$\lvert x\rvert \le 5, \quad \lvert y\rvert \le 5$
	`u = -5:.2:5;`
	`[X,Y] = meshgrid(u, u);`
	`Z = cos(X).*cos(Y).*...`
	`exp(-sqrt(X.^2 + Y.^2)/4);`
	`surfl(Z)`
	`shading interp`
	`colormap hot`
		

Part B: Practical

1. Plot voltage vs time for various RC time constants

$$\frac{\vartheta}{V} = e^{-t/\tau}$$

2. Plot a sphere, which is defined as [x(t, s), y(t, s), z(t, s)] = [cos(t) cos(s), cos(t) sin(s), sin(t)] (use 'surf'). for t, s = [0, 2] .Make first equal axes, then remove them. Use 'shading interp' to remove black lines