

5. OBJECTS AND 2D GRAPHICS

5.1 Object Properties

COMMANDS

PLOT
SUBPLOT
XLABEL
YLABEL
TITLE
TEXT

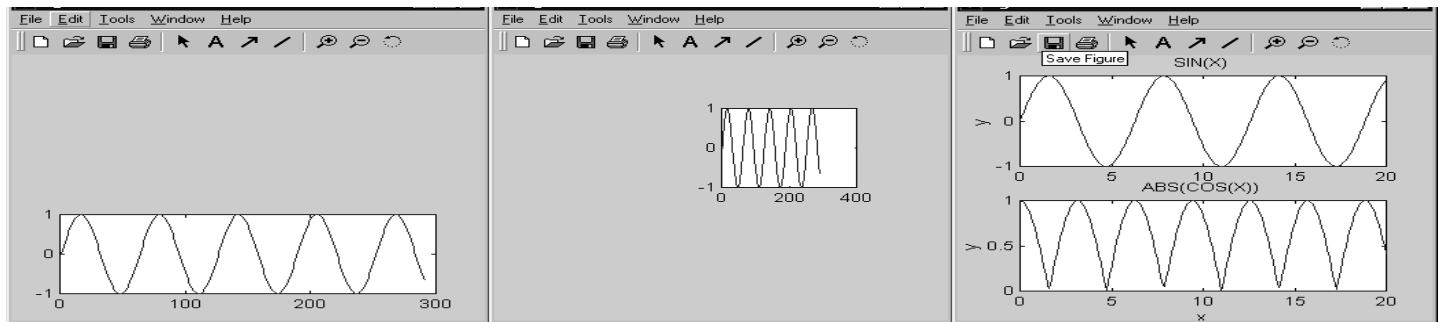
AXIS, GRID
SET, GET
DELETE
HOLD ON
HOLD OFF
GINPUT

```
<name> = <command> ( <property_name>, <property_value> )
```

```
%% Example 5.1: Definition of figure properties, axes properties,  
%% and their modification  
%%  
figure; set(gcf,'Units','Normal','Position',[0.5,0.57,0.3,0.35]);  
h1=axes('Position',[0.1 0.1 0.8 0.3]);  
plot(sin(0:0.1:29))  
get(h1)  
%%  
%% Definition of a property  
set(h1,'Units','Normal','Position',[0.5 0.5 0.3 0.3]);
```

5.2 Two-dimensional Graphics

```
%% Example 5.2: Plot functions  $f_1(x)=\sin(x)$  and  
%%  $f_2(x)=\text{abs}(\cos(x))$  for  $x=a:h:b$  choosing  $a=0$ ,  
%%  $b=20$  and  $h=0.1$  in two separate windows  
%%  
a=0; b=20; h=0.1;  
x=a:h:b;  
figure; set(gcf,'Units','Normal','Position',[0.53,0.54,0.3,0.35]);  
subplot(2,1,1); plot(x,sin(x));  
ylabel('y'); title('SIN(X)');  
subplot(2,1,2); plot(x,abs(cos(x)));  
xlabel('x'); ylabel('y'); title('ABS(COS(X))');
```



EXAMPLES 5

- 5.1 Plot function $f(x) = \sin(x)^2$ and its the first and second derivative for $x \in \langle a, b \rangle$ for $a = 0$, $b = 20$ in three separate figures
- 5.2 Plot $f(x) = \cos(x)$ and its derivative in one figure window axes using different colors for each function
- 5.3 Use GINPUT command for estimation of the smallest positive root of equation:
 $\sin(x) - 0.1x = 0$

6. 3D GRAPHICS

6.1 Fundamentals of 3D Graphics

Notes to the use of basic commands:

1. Definition of x-axis and y-axis values are defined by corresponding values of matrices \mathbf{X}, \mathbf{Y}
 \implies function MESHGRID
2. Selection of 3D plotting \implies function MESH, MESH, ...
3. Selection of the viewpoint \implies function VIEW
4. The choice of the number of contour lines and their description \implies function CONTOUR

```
%%% Example 6.1: Plot function
%%% f(x,y)=-x exp(-x^2-y^2) for x=-2:0.2:2 and y=-2:0.2:2
%%% together with corresponding contour lines
%%%
[X,Y]=meshgrid(-2:0.2:2);
Z=-X.*exp(-X.^2-Y.^2);
meshc(X,Y,Z);
title('f(x,y)=-x*exp(-x^2-y^2)'); xlabel('x'); ylabel('y');
colormap([0 0 1])
```

COMMANDS

MESHGRID
MESH
MESH
MESH
MESH
GRID ON
GRID OFF
LINE
VIEW
VIEW
HOLD ON
HOLD OFF
CONTOUR
COLORMAP
COLORBAR

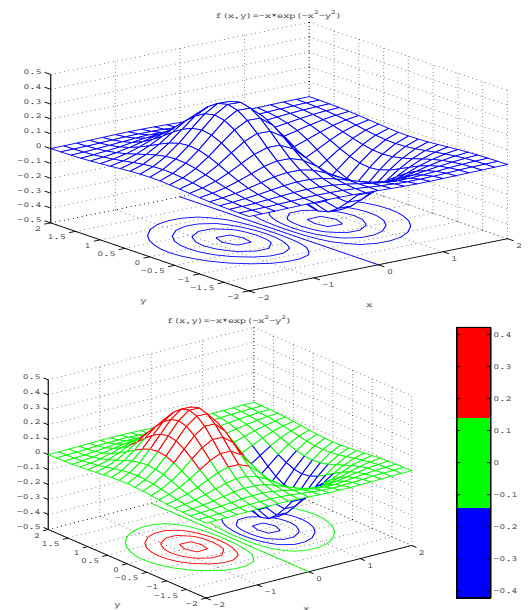
6.2 Colors

Notes to the use of basic commands:

1. Palette of m colors is defined by values of matrix $\mathbf{M}_{m,3}$
2. Each of m colors is defined by the combination of 3 basic colors (Red-Green-Blue) and their intensity in the range of $\langle 0, 1 \rangle$
3. Application of the color map \implies function COLORMAP
4. Plot of the color map \implies function COLORBAR

```
%%% Example 6.2: Store the present colormap into matrix M1,
%%% define a new colormap M2 consisting of three basic colors
%%% and apply it to the given 3D surface
%%%
```

```
M1=colormap
M2=[0 0 1; 0 1 0; 1 0 0]
colormap(M2)
colorbar
```



EXAMPLES 6

- 6.1 Plot function $f(x, y) = -x \exp(-x^2 - y^2)$ using four selected colors and use a separate window to plot its contour plot for $x \in \langle -2, 2 \rangle$ and $y \in \langle -2.5, 2.5 \rangle$
- 6.2 Plot function $f(x, y) = -x^2 y^2$ for $x \in \langle -2, 2 \rangle$ and $y \in \langle -2, 2 \rangle$
- 6.3 Visualize contour plot of function $f(x, y) = -x^2 y^2$ for $x \in \langle -2, 2 \rangle$ and $y \in \langle -2, 2 \rangle$ with line description

7. DATA FILES MANIPULATION

7.1 Data Saving

```
save <file_name> [(list_of_variables)] [-ascii]
```

Notes to data saving:

1. In case that the list_of_variables is not defined the whole workspace is saved
2. Parameter `-ascii` allows data store as a plain text (without its name)

%% Example 7.1: Saving of variables

```
A=[1 2 3; 4 5 6; 7 8 1]; b=[6 15 16]'; save dat1 A b;
```

7.2 Data Retrieving

```
load <file_name>
```

Notes to the data retrieving:

1. In case of the binary file (with MAT extension) all variables are retrieved together with their names
2. In case of the plain text file all its values are retrieved under the file_name

%% Example 7.2: Data retrieving

```
load dat1
```

7.3 Data Import from EXCEL

Steps:

1. Opening of the MATLAB environment and EXCEL `<file_name>.xls`
2. Data transport from EXCEL to MATLAB: `chan=ddeinit('excel','<file_name>.xls');`
`D1=ddereq(chan,'r1)c(c1) :r(r2)c(c2)');`
where `r1,r2,c1,c2` stand for initial and final number of rows and columns

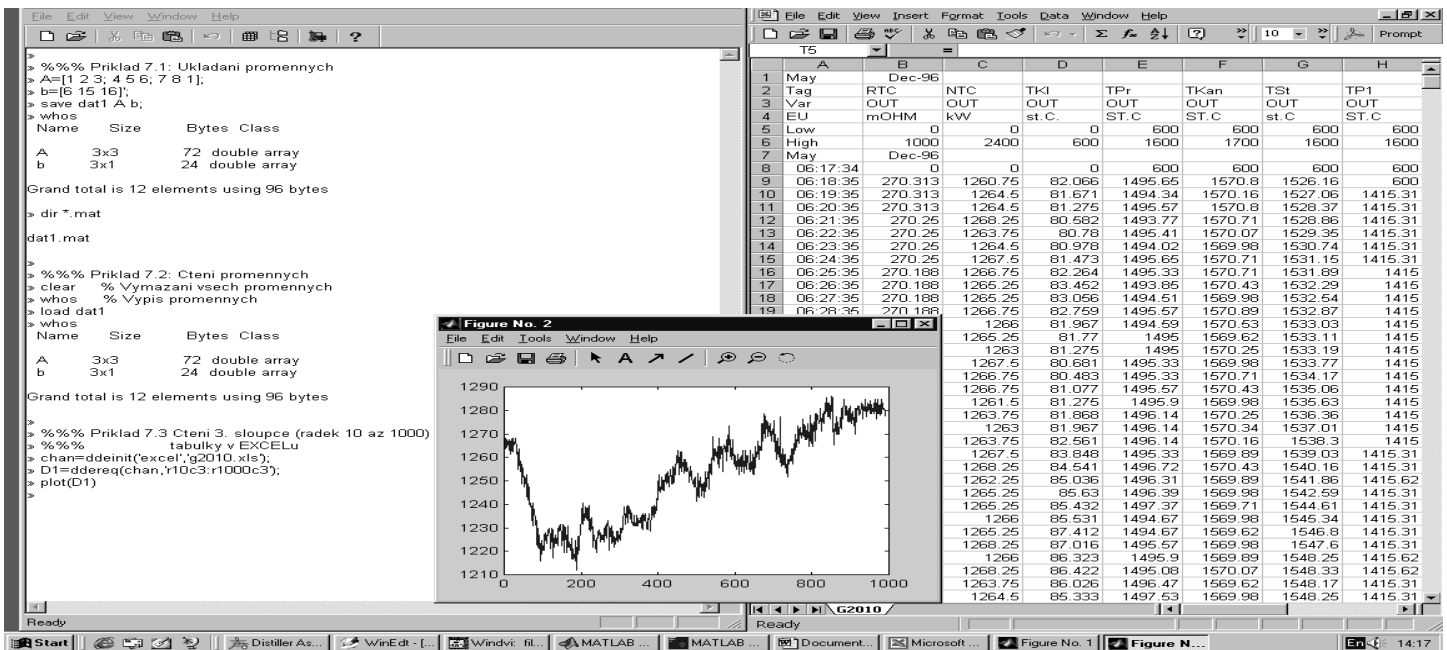
%% Example 7.3: Reading of the EXCEL table

```
chan=ddeinit('excel','g2010.xls');  
D1=ddereq(chan,'r10c3:r1000c3'); plot(D1)
```

COMMANDS

SAVE
LOAD
WHOS
DIR

DDEINT
DDEREQ



EXAMPLES 7

7.1 Using table G2010.XLS import into the MATLAB environment the power consumption (the 3rd column) and channel temperature in the glass furnace (the 6th column), plot these variables and evaluate their mean values

7.2 Using table G2010.XLS import into the MATLAB environment the matrix of measured values from the second up to the seventh column, save them into the *.MAT file and plot these variables in chosen limits

8. GRAPHICAL USER INTERPHASE

8.1 Steps of GUI Construction

1. Opening of the environment \Rightarrow File / New / GUI
2. Either opening of a new environment or existing figure
3. Opening of the PROPERTY INSPECTOR for each object and property
4. Opening EDITOR and modification of commands

%%% Example 8.1: Plot of a selected function

%%% Example 8.2: Plot of a harmonic function with its frequency

%%% modified by a slider

8.2 Menu Creation

1. Opening of the environment \Rightarrow Tools / MenuEditor
2. Creation of the menu structure
3. Modification of related functions in the EDITOR environment

8.3 Hidden Functions Use

1. Modification of callback functions for specific object in the EDITOR environment

Note: Object handles are available for all functions

OBJECTS

PUSH BUT

SLIDER

RADIO BUT

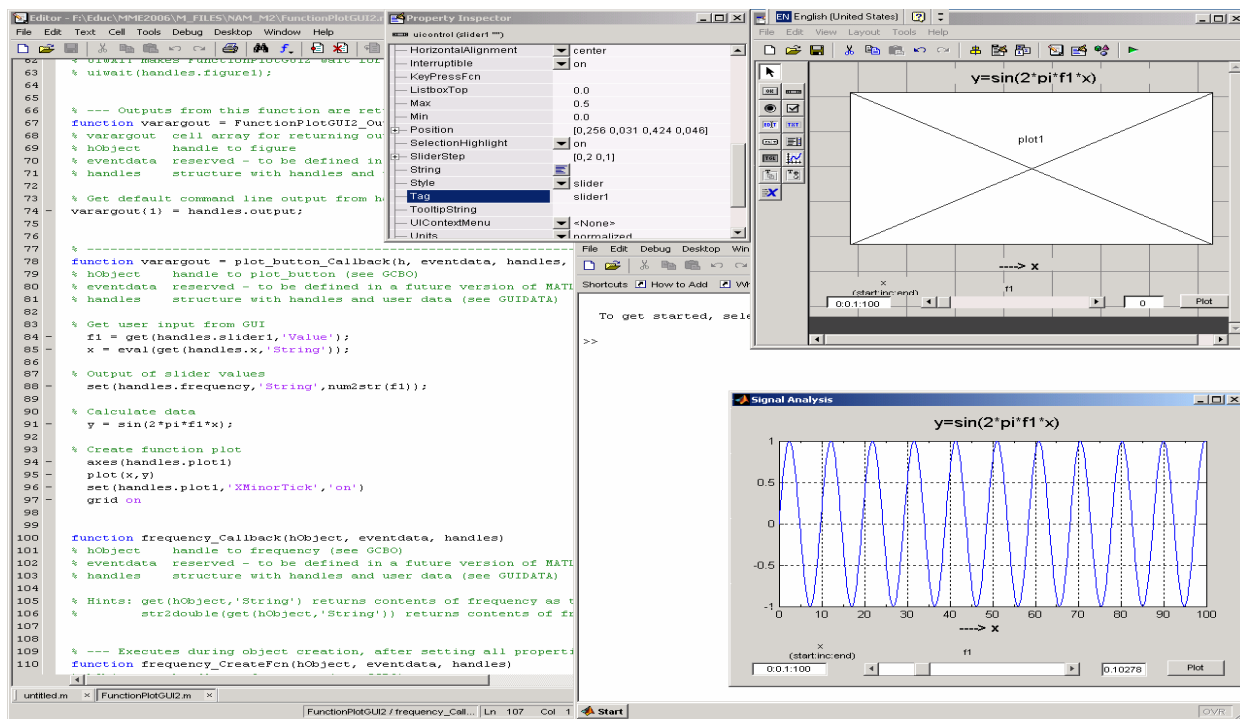
CHECK BOX

EDIT TEXT

STATIC TEXT

MENU

AXES



EXAMPLES 8

8.1 Modification of slider limit values

8.2 Modification of plotted function