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152 «

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2

2[']
2017 .

2017

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»
152 « -
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» [] / . . . -
: , 2017. - 45 .

. . .

: . . , . . . , . . .

	4
1	MATLAB.....	5
2	MATLAB.....	24
3	MATLAB	
	32
	44

MATLAB

MATLAB

MATLAB.

1.1

1.

MATLAB [1–3].

2.

1.2

1.2.1

MATLAB

: Eureka, Gauss, TK Solver!, Derive, Mathcad, Mathematica, Maple

: « MATLAB?» MATLAB –

MATLAB – MATrix LABoratory ().

MATLAB – :

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MATLAB

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. MATLAB

MATLAB

1) MATLAB –

2) MATLAB.

MATLAB.

MATLAB,

m-

MATLAB;

3) MATLAB

(GUI) MATLAB

4)

5)

Fortran,

MATLAB.

MATLAB (): MATLAB

m-

Simulink, MATLAB

Simulink

Blocksets –

Simulink,

C

MATLAB

(*session*).

MATLAB.

save (). load (*.mat*),

diary().

MATLAB

1)

«

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()

<Enter>.

2)

MATLAB.

MATLAB.

MATLAB.

:

MATLAB

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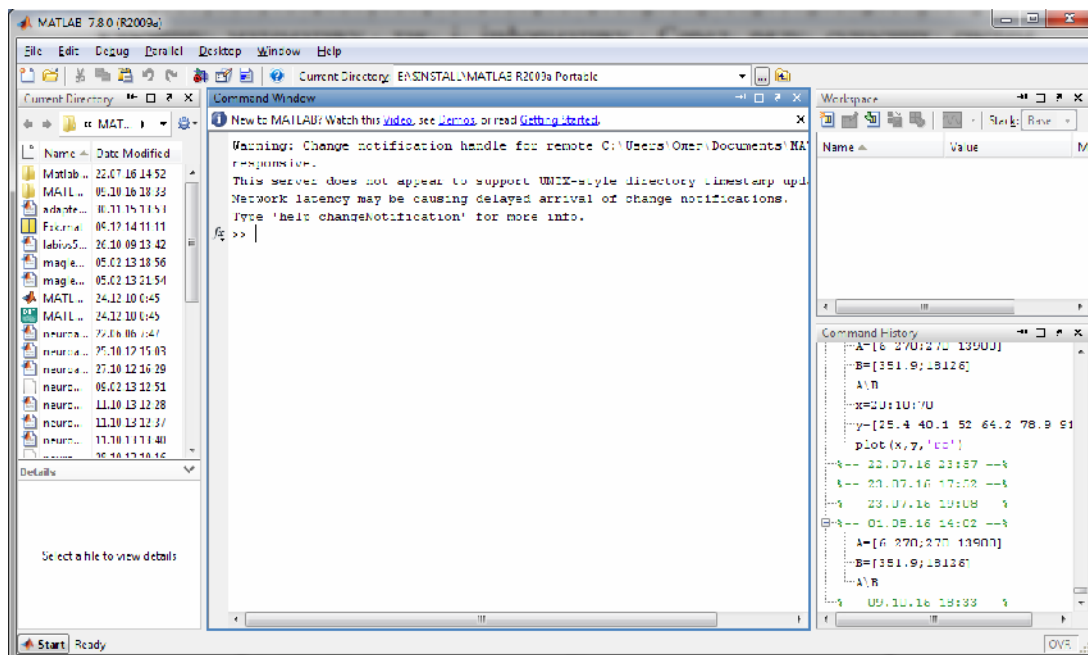
;

;

(*i, j, π , e, ans, Inf, NaN, realmin, realmax*).

MATLAB

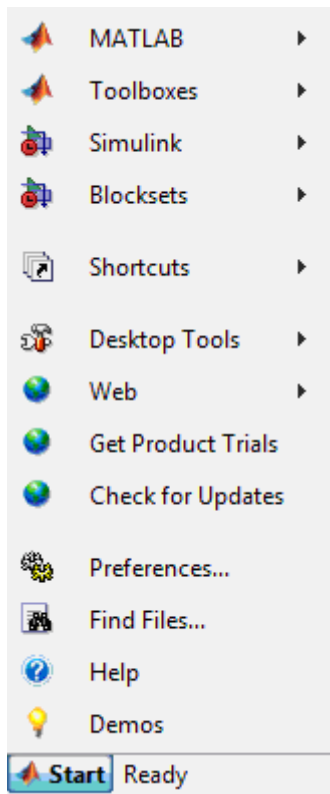
(.1.1).



1.1 –

MATLAB

- ;
 - ;
 - *Workspace* *Current Directory* ;
 - ;
 - *Command Window* (),
 - ;
 - *Command History* –
 - ;
 - *Start.*
 Start ,
 . 1.2,
 .



1.2 – , *Start*
Command Window :
 • ;
 • ,
 • ;
 • .
 • ,
 • ,
 • (

«Undock...»
),
 «Dock...»
 MATLAB.

: MATLAB Help Demos -

MATLAB

:

- help;

- Help;

- Help Desk.

Help.

MATLAB

Help

: Full Product Family Help, Help

MATLAB, Using the Desktop, Using the Command Windows, Demos, About MATLAB.

About MATLAB

Demos

MATLAB Demo Window,

MATLAB,

demo

Help

MATLAB.

html-

1.2.2

MATLAB

MATLAB

Fortran, ++.

MATLAB

(

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MATLAB

Fortran, Basic C.

MATLAB,

MATLAB.
Basic
MATLAB -

1) = ;

2) :

(answer -),

ans

MATLAB,

MATLAB

($m \times n$)).

:

1) >> x=5.213

x =

5.2130

2) >> x=[1 2 3 4 5] ((1x5))

x =

3) >> A=[0.1 -2 0 3; -1 0 2 4; 7.5 -4.25 8 256] (3x4)

A =

0.1000	-2.0000	0	3.0000
-1.0000	0	2.0000	4.0000
7.5000	-4.2500	8.0000	256.0000

<:;>

1) >> x=1:7

x =

1 2 3 4 5 6 7

2) >> x=0:0.1:0.5

x =

0 0.1000 0.2000 0.3000 0.4000 0.5000

<:;>

()

MATLAB

>> A=[1 2 3;4 5 6]

A =

1 2 3
4 5 6

>> B=[0 -1 5;4 2 -11]

B =

0 -1 5
4 2 -11

>> A+B

ans =

1 1 8
8 7 -5

>> A-B

ans =

1 3 -2
0 3 17

A B

```
,  
,  
>> A*B  
??? Error using ==> mtimes  
Inner matrix dimensions must agree.
```

```
,  
,  
,  
,  
,  
>> A.*B
```

```
ans =
```

```
    0    -2    15  
   16    10   -66
```

```
>> B./A
```

```
ans =
```

```
    0   -0.5000    1.6667  
   1.0000    0.4000   -1.8333
```

```
>> A=[1 2 3;4 5 6]
```

```
A =
```

```
    1    2    3  
    4    5    6
```

```
>> A'
```

```
ans =
```

```
    1    4  
    2    5  
    3    6
```

det,

```
-  
inv  
>> G_15=[1 3 5;-4 7 9;12 -6 3]
```

```
G_15 =
```

```

    1     3     5
   -4     7     9
   12    -6     3

```

```
>> det(G_15)
```

```
ans =
```

```
135
```

```
>> inv(G_15)
```

```
ans =
```

```

    0.5556   -0.2889   -0.0593
    0.8889   -0.4222   -0.2148
   -0.4444    0.3111    0.1407

```

MATLAB

$$e^{-2.5}(\ln 11.3)^{0.3} - \sqrt{\frac{\sin 2.45\pi + \cos 3.78\pi}{\operatorname{tg} 3.3}}$$

<Enter>:

```
>> exp(-2.5)*log(11.3)^0.3-
sqrt((sin(2.45*pi)+cos(3.78*pi))/tan(3.3))
```

```
ans =
```

```
-3.2105
```

MATLAB

MATLAB

i j,

```
>> (2.1 + 3.2i)*2 + (4.2 + 1.7i)^2
```

```
ans =
```

```
18.9500 + 20.6800i
```

1.2.3

MATLAB

$$y(x) = e^{-x} \sin 10x$$

```

-
-
-
:
>> x=0:0.01:1;
>> y=exp(-x).*sin(10*x);
>> plot(x,y)

```

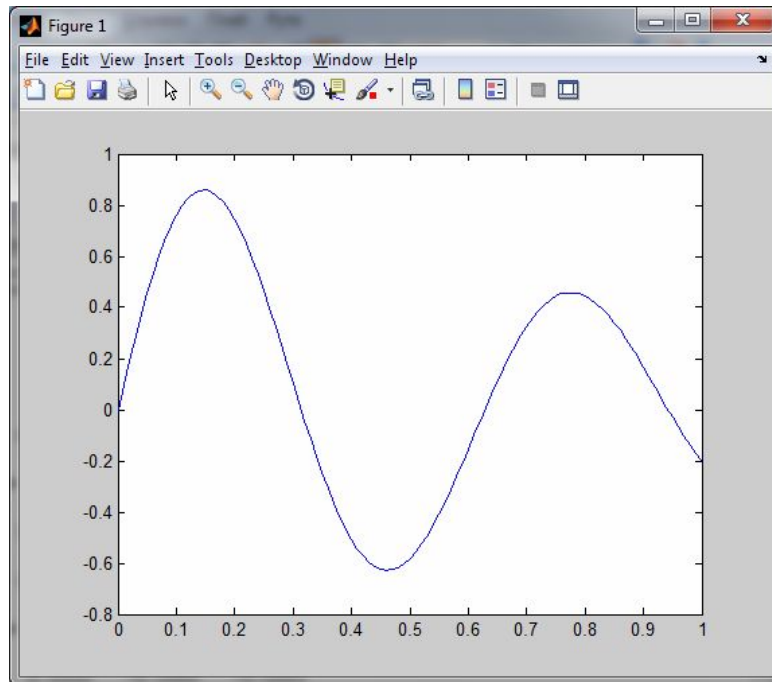
MATLAB

```

,
x y. x -
plot ' , y-
(x(i), y(i)) ,

```

(.1.3).



1.3 -

```

plot(x,y,s);
x-
y-
s-
;

```

plot:
.1.1.

1.1 - s plot

-	•	.	Y
--	+	+	m
:	*	*	b
-	○	○	r
	x	x	g
	■	s	b
	◆	D	w
	▼	V	k
	▲	A	
	◀	<	
	▶	>	
	◓	P	
	◔	H	

```

plot(x1,y1,s1,x2,y2,s2,...)

```

plot:

: $y = \sin x$ $y = e^{-x}$

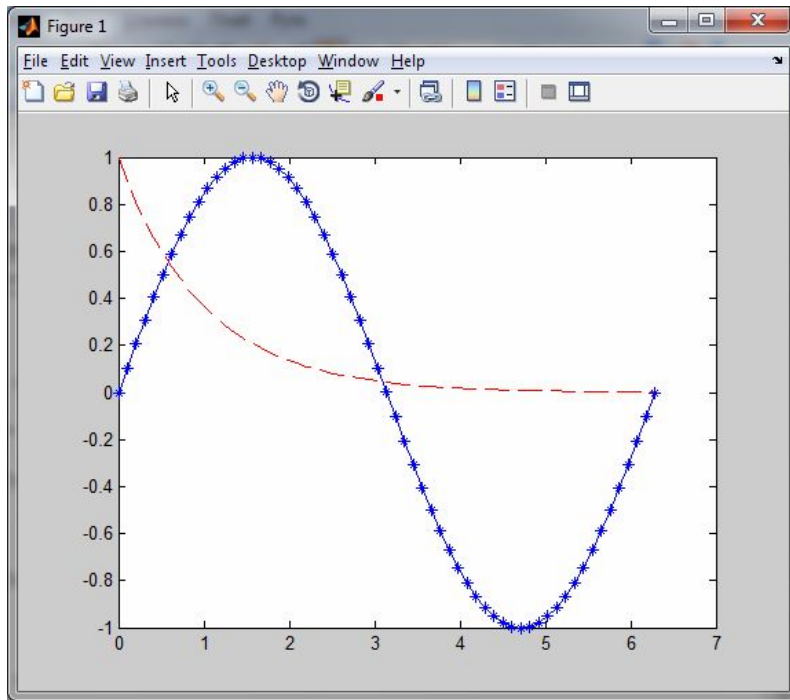
```

x=0:pi/30:2*pi;
y1=sin(x); y2=exp(-x);
plot(x,y1,'b-*',x,y2,'r--');

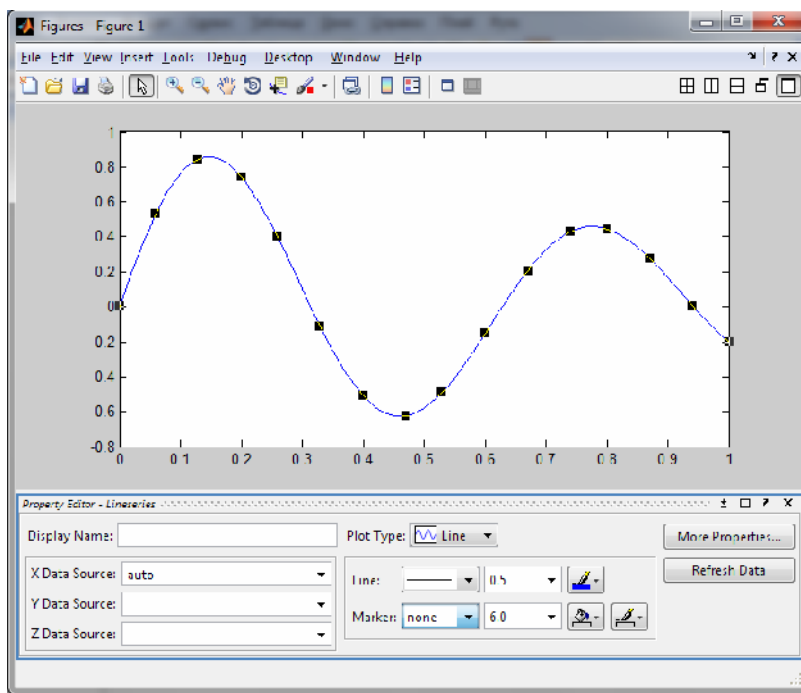
```

. 1.4.

(. 1.5).



1.4 –



1.5 –

1.3

1. MATLAB.
- 2.
- 3.

1.4

1. ' Intel Pentium G3240 3,2 GHz.
2. MATLAB 7.8.0 (R2009a).

1.5

1. MATLAB 7.8.0 (R2009a).

```
:  
- , , - ;  
-  
help elfun;  
- clc;  
-  
- , . 1.2;  
- ;  
- ,  
save;  
- Workspace  
clear;  
-  
load.
```

1.2 –

1	$\frac{\operatorname{tg}0,48\pi - \sqrt{3} \sin^2 1,84}{2,33^3}$
2	$\frac{\sin 1,5^2}{3e^{-\cos^2 0,2}}$
3	$\ln^5 2,7 \cos^2 \frac{1}{4\pi + \sqrt{2}}$
4	$\sin^2(\lg 43) + \frac{1}{\sqrt{1,7^2 + 2,46^2}}.$
5	$\arcsin 0,3 + \operatorname{tg}^2 \frac{1}{e^{-0,67}}$
6	$\sin 4,13^3 - 5 \cdot 6,34 + 20 \lg 3\pi$
7	$2,6^3 + 3 \cdot 2,6^2 - \operatorname{arctg} 2,6$
8	$\cos(0,75^2 + 1) \sqrt{\sin^5 1.089}$

9	$\frac{3,18^3}{2} + 6 \ln 1,3 + \operatorname{tg} \sqrt{0,47}$
10	$\frac{\sin 0,3}{0,3} + 8 \sin \frac{1}{8} \cdot \frac{\sin 2,5}{2,5} + 4,89 \cos^2 \frac{1}{38,12}$
11	$\cos^2(1,1 + \pi) + \frac{e^{2,5}}{\sqrt{1,5^2 + 2,12^2}}$
12	$\frac{\operatorname{tg} 0,7^2}{2e^{-\sin^2 1,4}} + 1$
13	$1,1 \sqrt{(-2 \sin 0,5)^2 + (1,4 \cos 0,8)^2}$
14	$\sin \left(0,25^{1,5} + 0,47^{\frac{1}{3}} \right) - \frac{3}{\sqrt{\cos^2 \pi}}$
15	$\frac{16 - \sqrt{8} \sin^2 0,46}{\ln 2} + \frac{\cos^2 \sqrt{\pi + 1}}{1,5^2}$
16	$1 + \frac{1}{\sin 0,7^2} - \frac{1}{\cos 0,7^3} + \frac{1}{\sin 0,7^4}$
17	$\cos(\pi^3 - 0,2) + \frac{4\sqrt{2}}{20 \lg 3\pi}$
18	$\sqrt{\left(\frac{3 \sin 1,5}{4} \right)^2 + (1,8 \cos 2,7)^2}$
19	$\arcsin \sqrt{1,75} + \sin^2 \frac{1}{e^{-2,1}}$
20	$1,8^5 + 4 \cdot \pi^{-2,5} - \sqrt{e^{-0,4} + 1}$

2. (. 1.3) :
- 1) ;
- 2) , ;
- 3) ;
- 4) $A + 2, A \cdot 3, A \cdot B, A^T \cdot B, B^T \cdot A \cdot B, A^{-1} \cdot A, B^T \cdot B, B \cdot B^T$;
- 5) , $A \cdot x = B$;
- 6) 2- 1- .

1	$A = \begin{pmatrix} 0 & 1 & 2.5 & -3 \\ 7 & 4 & -2 & 8 \\ 3 & 1.2 & 0.7 & -5.1 \\ -2.5 & 1 & 1 & 0 \end{pmatrix}$	$B = \begin{pmatrix} -0.2 \\ 4 \\ -3.7 \\ 5.5 \end{pmatrix}$
2	$A = \begin{pmatrix} -1.8 & 2.9 & 4.1 & 1 \\ 2.6 & 5 & 7.8 & 1 \\ 3 & -1.3 & 12 & 1 \\ -0.7 & 9.2 & 0 & 1 \end{pmatrix}$	$B = \begin{pmatrix} -13.6 \\ 0.5 \\ -1 \\ 4 \end{pmatrix}$
3	$A = \begin{pmatrix} 0 & 4.8 & -2 & 2 \\ -7 & -1 & 6.3 & 7 \\ 13.2 & 3 & -1 & -4 \\ -1.1 & 0 & 15 & 0.5 \end{pmatrix}$	$B = \begin{pmatrix} 2.7 \\ -3 \\ 0.8 \\ 13 \end{pmatrix}$
4	$A = \begin{pmatrix} -7.5 & 2.3 & 2.4 & 1 \\ 1.6 & 0 & 0 & -5 \\ 12 & -4 & 25 & 4 \\ -9.6 & 3.8 & 7.3 & 11 \end{pmatrix}$	$B = \begin{pmatrix} 7 \\ -3 \\ 4 \\ 2 \end{pmatrix}$
5	$A = \begin{pmatrix} 4.4 & 8.7 & 11 & 5 \\ 5.8 & -2 & -16 & 2 \\ -1 & 3 & 9.2 & -3 \\ 0 & -5.1 & 0 & 20 \end{pmatrix}$	$B = \begin{pmatrix} -2 \\ 14 \\ 0.9 \\ 0.1 \end{pmatrix}$
6	$A = \begin{pmatrix} -4 & 2 & 0 & 3 \\ 3.5 & 0 & -1 & 16 \\ -6.1 & 2.5 & 7 & -1.5 \\ 11.7 & -1 & 4.8 & 0 \end{pmatrix}$	$B = \begin{pmatrix} -3 \\ 2.7 \\ 4 \\ -2 \end{pmatrix}$
7	$A = \begin{pmatrix} -3.5 & 27 & 5 & -8 \\ 1 & -2 & 14.7 & 4 \\ -1 & -6 & 0 & 0.25 \\ 2 & -5 & 7 & -9.3 \end{pmatrix}$	$B = \begin{pmatrix} 0 \\ -7 \\ 2.9 \\ 0.7 \end{pmatrix}$

8	$A = \begin{pmatrix} 2 & -7.5 & 9.9 & -1 \\ 0.7 & 18 & -1.6 & 0.6 \\ -1 & -4 & 0 & 3 \\ 2 & 12.5 & -6.5 & 1 \end{pmatrix}$	$B = \begin{pmatrix} 13.2 \\ -10 \\ 0 \\ -6.4 \end{pmatrix}$
9	$A = \begin{pmatrix} -3 & 12 & 3.7 & 1 \\ 0.5 & -1 & 5 & 0 \\ -3.2 & 8 & 9 & -4 \\ 6 & 0 & 11 & 7 \end{pmatrix}$	$B = \begin{pmatrix} 25 \\ 8 \\ -1.4 \\ 17 \end{pmatrix}$
10	$A = \begin{pmatrix} 2 & -3 & 2.5 & -3 \\ 1 & 0 & -2 & 6 \\ 3 & 4 & 0.7 & 7 \\ -0.5 & 3 & 1 & 0 \end{pmatrix}$	$B = \begin{pmatrix} 1 \\ -2 \\ -3 \\ 9 \end{pmatrix}$
11	$A = \begin{pmatrix} 2 & 1 & 1.5 & 0 \\ -3 & 2 & -1 & -2 \\ 6 & -1.4 & 0.7 & 7 \\ 0.2 & 5 & 1 & 5 \end{pmatrix}$	$B = \begin{pmatrix} -0.6 \\ 2 \\ 10 \\ 3.1 \end{pmatrix}$
12	$A = \begin{pmatrix} -1.6 & 4 & 2.7 & 5 \\ 0 & 1 & -11 & 3 \\ 5 & -2 & 10 & 0 \\ -7 & 9 & 0 & -1 \end{pmatrix}$	$B = \begin{pmatrix} 8 \\ -0.5 \\ 4 \\ 2 \end{pmatrix}$
13	$A = \begin{pmatrix} 0 & 2.8 & -2 & 0 \\ -5 & -3 & 3.1 & 1 \\ 3.6 & 0 & -1 & 0 \\ -1.5 & 1 & -4 & 0.5 \end{pmatrix}$	$B = \begin{pmatrix} 1 \\ -3 \\ 2 \\ 1.8 \end{pmatrix}$
14	$A = \begin{pmatrix} 2.5 & -8 & 2.5 & 1 \\ 3 & -1 & 0 & -5 \\ 1.2 & 0 & 11 & 2 \\ -3 & 4 & 3.7 & 0 \end{pmatrix}$	$B = \begin{pmatrix} -7 \\ 0 \\ -4 \\ 16 \end{pmatrix}$

. 1.3

15	$A = \begin{pmatrix} 0 & 1.7 & 4 & 5 \\ -2 & 14 & 0 & -10 \\ 3.6 & 3 & -1.2 & -7 \\ 2 & -9 & 5 & 4 \end{pmatrix}$	$B = \begin{pmatrix} 8.8 \\ -7 \\ 1.1 \\ 0.5 \end{pmatrix}$
16	$A = \begin{pmatrix} 1 & -2.4 & 6 & -2 \\ 1 & 0 & 5 & 0 \\ 1 & 7 & -0.4 & 16 \\ 1 & 4.4 & 1.8 & 3 \end{pmatrix}$	$B = \begin{pmatrix} 7 \\ -4 \\ 1 \\ 0.7 \end{pmatrix}$
17	$A = \begin{pmatrix} 1.5 & -1 & -9 & 2 \\ -3 & -2 & 13 & 0 \\ 3 & 0 & -1 & 0 \\ 2 & -5 & 7 & -1.1 \end{pmatrix}$	$B = \begin{pmatrix} 5 \\ 1.6 \\ -7 \\ 4 \end{pmatrix}$
18	$A = \begin{pmatrix} 2 & -1 & 4 & 2 \\ 0.6 & 0 & -1.8 & -4 \\ -5 & -6 & 0 & 3 \\ -3 & 7.5 & 5.4 & 1 \end{pmatrix}$	$B = \begin{pmatrix} 3.2 \\ 1.6 \\ 0 \\ -8 \end{pmatrix}$
19	$A = \begin{pmatrix} -2 & 11 & 2.4 & 0 \\ -0.5 & -2 & 4 & -1 \\ -4.2 & 7 & 6 & -5 \\ 0 & 0 & 9 & 6 \end{pmatrix}$	$B = \begin{pmatrix} 12 \\ -3 \\ 1.6 \\ 10 \end{pmatrix}$
20	$A = \begin{pmatrix} 2 & 5 & 2.5 & 6 \\ 1 & -3 & 0 & -4 \\ 3 & 9.2 & -3 & 0 \\ -0.5 & 1 & 1 & -2.2 \end{pmatrix}$	$B = \begin{pmatrix} -1 \\ 0.5 \\ 8 \\ -2 \end{pmatrix}$

3.
(. 1.4)

plot

1	$y(x) = x + \sin x - e^{0.5x} + 2$	$x \in [-6, 4]$	$dx = 0.15$
2	$y(x) = \frac{\sin x}{x^2 + 1}$	$x \in [-6, 6]$	$dx = 0.2$
3	$y(x) = \frac{\sin x + \cos x}{1 + x^2}$	$x \in [-6, 6]$	$dx = 0.1$
4	$y(x) = \frac{2x + \sqrt{1 + 3x}}{9 + x^2}$	$x \in [0, 10]$	$dx = 0.25$
5	$y(x) = \frac{\sin 2x}{x} + 0.1x $	$x \in [-6, 6]$	$dx = 0.11$
6	$y(x) = 0.35x^2 \sin x$	$x \in [-10, 10]$	$dx = 0.25$
7	$y(x) = x^3 + x^2 - 6x - 4$	$x \in [-3, 3]$	$dx = 0.08$
8	$y(x) = (x - 2)^2 + 7 \sin x$	$x \in [-3, 3]$	$dx = 0.12$
9	$y(x) = \sin(x - 3) + e^{-0.5x}$	$x \in [-2, 5]$	$dx = 0.2$
10	$y(x) = \sin x + e^{0.3x} - \frac{x}{2}$	$x \in [-6, 8]$	$dx = 0.25$
11	$y(x) = 2 \cos x + \sin x - 5$	$x \in [-3, 5]$	$dx = 0.2$
12	$y(x) = \frac{\sin^2 x + \cos 3x}{7 + x^2}$	$x \in [-6, 6]$	$dx = 0.1$
13	$y(x) = -8x^3 + 11x^2 - 2x + 1$	$x \in [-3, 3]$	$dx = 0.08$
14	$y(x) = 2x^2 - e^{0.5x} + 5$	$x \in [-6, 4]$	$dx = 0.15$
15	$y(x) = \frac{\sqrt{1 + 8x}}{2 + 3x + x^2}$	$x \in [0, 10]$	$dx = 0.2$
16	$y(x) = 5x^2 + e^{-0.1x} - 1$	$x \in [0, 12]$	$dx = 0.15$
17	$y(x) = -x^3 + 5 \sin x^2$	$x \in [-3, 3]$	$dx = 0.08$
18	$y(x) = \frac{\cos 2x}{x^2 + 1}$	$x \in [-6, 6]$	$dx = 0.12$
19	$y(x) = x^2 - 5x + 9$	$x \in [2, 15]$	$dx = 0.1$
20	$y(x) = \frac{\sqrt{4 + x^2}}{\sin x}$	$x \in [0, 8]$	$dx = 0.15$

1.6

1. MATLAB?
 2. MATLAB?
 3. MATLAB?
 4. , ?
 5. MATLAB?
 6. MATLAB?
 7. , -
 8. ? MATLAB?
 9. 2D
- plot?
10. plot?

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MATLAB,

MATLAB.

2.1

1.

MATLAB

[1–3].

2.

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2.2

2.2.1

MATLAB

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MATLAB

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MATLAB

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MATLAB

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Basic (

Fortran

Pascal).

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Mathcad

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Mathcad,

MATLAB

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(Simulink)

2.2.2

MATLAB

MATLAB

```
if < >
    < >
end
if < >
    < >
else
    < >
end
if < >
    < >
elseif < >
    < >
else
    < >
end
```

-1, -0).

```
for V=A:H:B
    < >
end
for V=A:B
    < >
end
```

(V - / , A, B - ; H -

```
for i=1:n
    for j=1:m
        a(i,j)=x(i)^j;
    end
end
```

```
k=1;
for i=[0 5 7]
    x(k)=2^i;
    k=k+1;
end
x=[1 32 128].
```

```

while < >
    < >
end

```

```

    , , ( , -
    . , ) break:

```

```

while a<1
    n=n+1
    if n>250
        break
end ...

```

```

:
switch < >
    case < 1>
        < >
    case < 2>
        < >
    .....
    otherwise %
        < >
end

```

```

switch k
case 0
    t=1
case (1,2,5)
    t=2
otherwise
    t=0
end

```

return.

```

    , -
    .

```

```

< >= input (' ')

```

```
» x=input(' ');
```

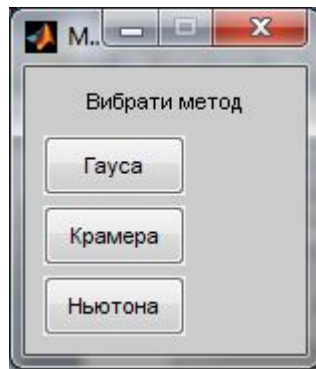
3

```
pause (n), keyboard (return).
```

```
< >=menu(' ', '1', '2',...)
```

```
k=menu(' ', '1', '2', '3') (2.1)
```

1, 2 3.



2.1 –

```
( disp, fprintf),
```

2.2.3

MATLAB

m-

MATLAB

m-

script-

m- , . m-
 . m-
 m- :
function [**<** **>**]=
 < ' > (< >)
 ,
 fact.m:
 function [f, g]=fact(n) %
 %
 f=prod(1:n);
 g=1/f;
 script- , MATLAB -
 , :
 >> ' _ .m
 , ,
 File / New,
 (. 2.2).

```

1 - clc;
2 - N=100; % Час моделювання
3 - TH=[0.3;1.2;-0.5]; % Вектор "істинних" параметрів
4 - fi=[0;0;0]; % Початкове значення вектора стану (y(n-1),x(n-1),x(n-2))
5 - th=[0.1;0.1;0.1]; % Початкове значення вектора параметрів моделі
6 - P=eye(3)*1000;
7 - X=[ones(1,10) zeros(1,20)];X=[X X X ones(1,10)];
8 - disp('Початкова похибка:');
9 - disp(norm(TH-th));
10 - for n=1:N
11 -     x(n)=sin(0.12*n+0.7); % Вхідний сигнал
12 -     y(n)=TH*fi; % Розрахунок виходу об'єкта
13 -     ym(n)=th*fi; % Розрахунок виходу моделі
14 -     %%% Настроювання моделі (РМНК) %%%
15 -     z=1+fi'*P*fi;
16 -     th=th+P*(y(n)-ym(n))*fi/z;
17 -     P=P-P*fi*fi'*P/z;
18 -     %%%%%%%%%%%%%%%%%%%%%%%%%
19 -     THM(:,n)=th;
20 -     % Підготовка наступної ітерації
21 -     fi(1)=y(n); fi(3)=fi(2); fi(2)=x(n);
22 - end
23 - %%% Вивід результатів %%%
24 - n=1:N;
  
```

2.2 –

1	$y(x) = \begin{cases} 2x^2 + 3x - 3.9, & x < -2, \\ \sin x, & -2 \leq x \leq 5, \\ e^{0.5x} - 14, & x > 5. \end{cases}$	$x \in [-7, 10]$	$dx = 0.2$
2	$y(x) = \begin{cases} 0, & x = 0, \\ \frac{0.78}{x^2}, & x < 0, \\ 0.78x^2, & x > 0. \end{cases}$	$x \in [-3, 2]$	$dx = 0.1$
3	$y(x) = \begin{cases} \frac{\sin x + \cos x}{1 + x^2}, & \sin x > 0, \\ \frac{1}{1 + x^2}, & \sin x < 0, \\ 1 + x^2, & \sin x = 0. \end{cases}$	$x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	$dx = \frac{\pi}{10}$
4	$y(x) = \begin{cases} \frac{6.9 + x}{x^2 + \sqrt{1 + 3x}} + 0.7, & x \leq 4, \\ \frac{2.1x + x^2}{x^2 + \sqrt{1 + 3x}}, & x > 4. \end{cases}$	$x \in [2, 10]$	$dx = 0.25$
5	$y(x) = \begin{cases} \frac{2x - 5}{ x - 8 }, & x < 5, \\ x^2 - 7, & 5 \leq x \leq 10, \\ \ln x, & x > 10. \end{cases}$	$x \in [1, 13]$	$dx = 0.25$
6	$y(x) = \begin{cases} \frac{\sin(x + 0.75)}{4x^2 + 5x}, & x > 5, \\ x^4 + 2x^2 \sin x, & x \leq 5 \end{cases}$	$x \in [-10, 10]$	$dx = 0.4$
7	$y(x) = \begin{cases} 25.44, & x \leq 0.5, \\ \frac{x^3 - \pi \lg x \sin x}{x + \sin x^{-0.3} }, & x > 0.5 \end{cases}$	$x \in [0, 1]$	$dx = 0.08$
8	$y(x) = \begin{cases} (x + 4)^3 + x \ln(x + 1), & x \leq 1, \\ e^{-x} + 0.5e^{-2x+5}, & x > 1 \end{cases}$	$x \in [0, 2]$	$dx = 0.1$

. 2.1

9	$y(x) = \begin{cases} 0.75, & x < -1, \\ \frac{\sin x}{x}, & -1 \leq x \leq 1, \\ 3^{-2x} + 0.75, & x > 1. \end{cases}$	$x \in [-3, 3] \quad dx = 0.2$
10	$y(x) = \begin{cases} \frac{1}{x+5}, & x < -12, \\ 0.2 \operatorname{tg} x - 4, & -12 \leq x \leq -5, \\ 1.5^{2x+1}, & x > -5. \end{cases}$	$x \in [-15, 0] \quad dx = 0.5$

2. MATLAB - , -
- 1) ; -
- 2) ;
- 3) ;
- 4) .

2.6

1. if?
2. for?
3. while?
4. ?
5. switch?
6. MATLAB, ? , -
7. ?
8. - ? - ?
9. m- ?
10. m- ?

MATLAB

MATLAB

3.1

1. MATLAB GUI (Graphics User's Interface) [1–3].
- 2.

3.2

MATLAB
2-D 3-D

(Handle Graphics),

(),

. MATLAB

pushbutton, radiobutton slider;

– ' *Axes*

Figure


```

- ' Uimenu , -
- ' Image - Figure; , -
- ' Line ; MATLAB, -
- ' Surface - ; x-y; -
- ' Text - ; , -
- ' Light , -
Axes. , -
, handle, , -
, root . figure - -
, , -
MATLAB. , -
MATLAB , -
: , -
gcf - , figure; -
gca- , axes; -
gco- , . -
, figure axes. , -
MATLAB, , -
( , ) , -
, delete, -
, , -
axes , -
delete(gca) , -
, text , text, figure , figure -
. . ( plot surface) -
, , -
MATLAB , -
set, , : -
h=uicontrol('style','pushbutton','Back',[0 .8 .8],...
'string',' ')
set(h,'unit','normal','position',[.5 .5 .2 .1],...
'string','BUTTON')

```

```

, , set(h).
BackgroundColor
Callback
CData
Enable: [ {on} | off | inactive ]
FontAngle: [ {normal} | italic | oblique ]
FontName
FontSize
FontUnits: [ inches | centimeters | normalized | {points} |
pixels ]
FontWeight: [ light | {normal} | demi | bold ]
ForegroundColor
HorizontalAlignment: [ left | {center} | right ]
...

```

```

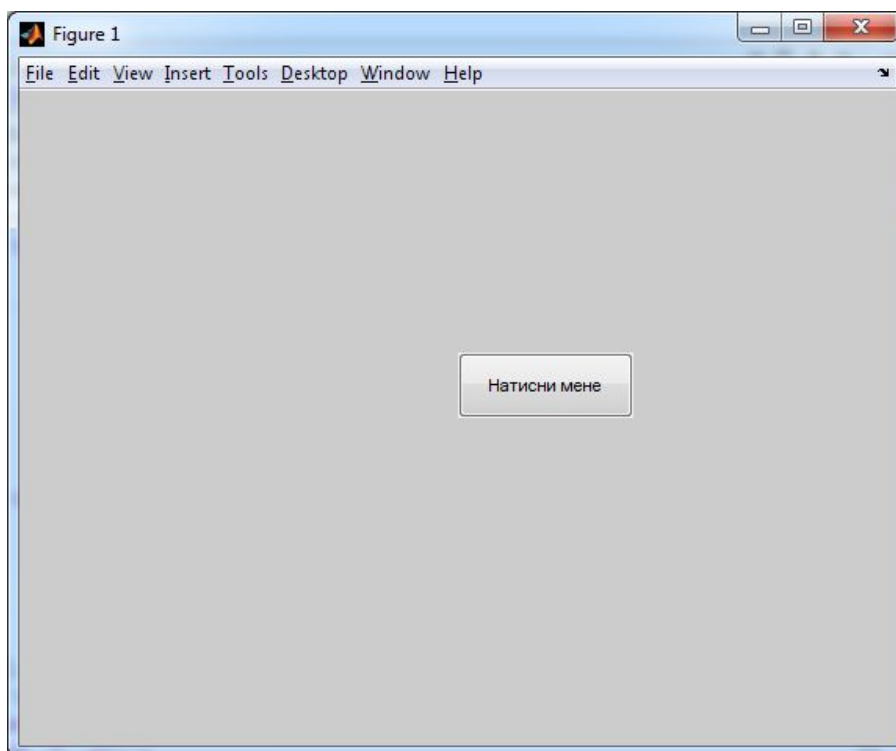
, , get(h).
BackgroundColor = [0.831373 0.815686 0.784314]
Callback =
CData = []
Enable = on
Extent = [0 0 49 17]
FontAngle = normal
FontName = MS Sans Serif
FontSize = [8]
FontUnits = points
FontWeight = normal
ForegroundColor = [0 0 0]
HorizontalAlignment = center
ListboxTop = [0]
Max = [1]
Min = [0]
Position = [20 20 60 20]
String =
Style = pushbutton
SliderStep = [0.01 0.1]
TooltipString =
Units = pixels
Value = [0]
...

```

```

h=uicontrol('style','pushbutton','units','normal',...
'position',[.5 .5 .2 .1],'string',' ');
s='set(h,'position',[.8*rand .9*rand .2 .1]);
set(h,'callback',s);

```



3.1 –

3.3

GUI,

MATLAB,

:

–

–

;

–

–

–

;

;

(

);

3.4

1.

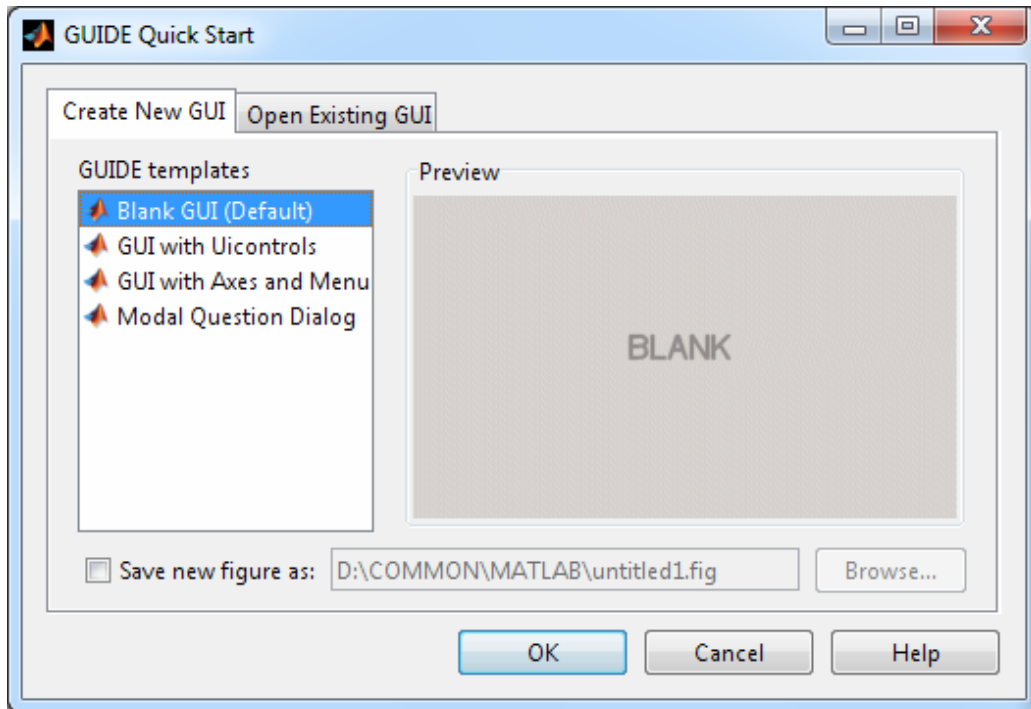
2.

Intel Pentium G3240 3,2 GHz.

MATLAB 7.8.0 (R2009a).

3.5

guide, MATLAB – guide.
MATLAB,
(3.2),



3.2 – guide

Blank GUI (Default)

3.3).

axes, 3.4.

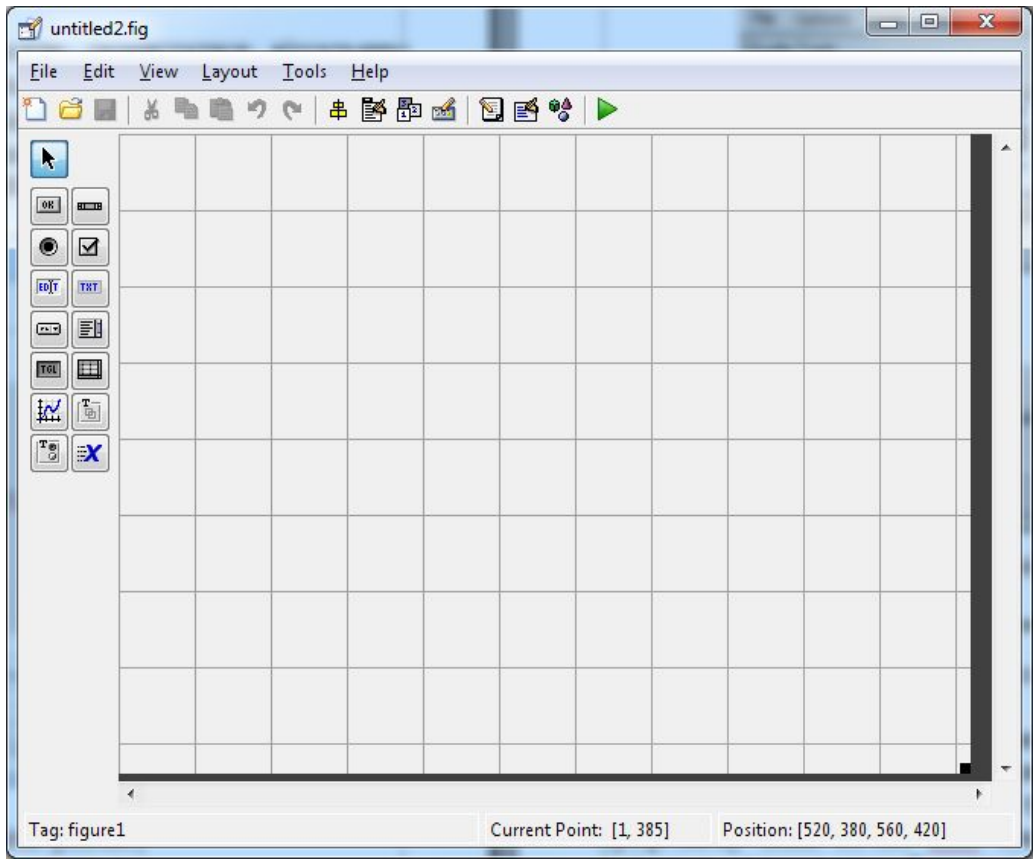
Property Inspector (3.5).

().

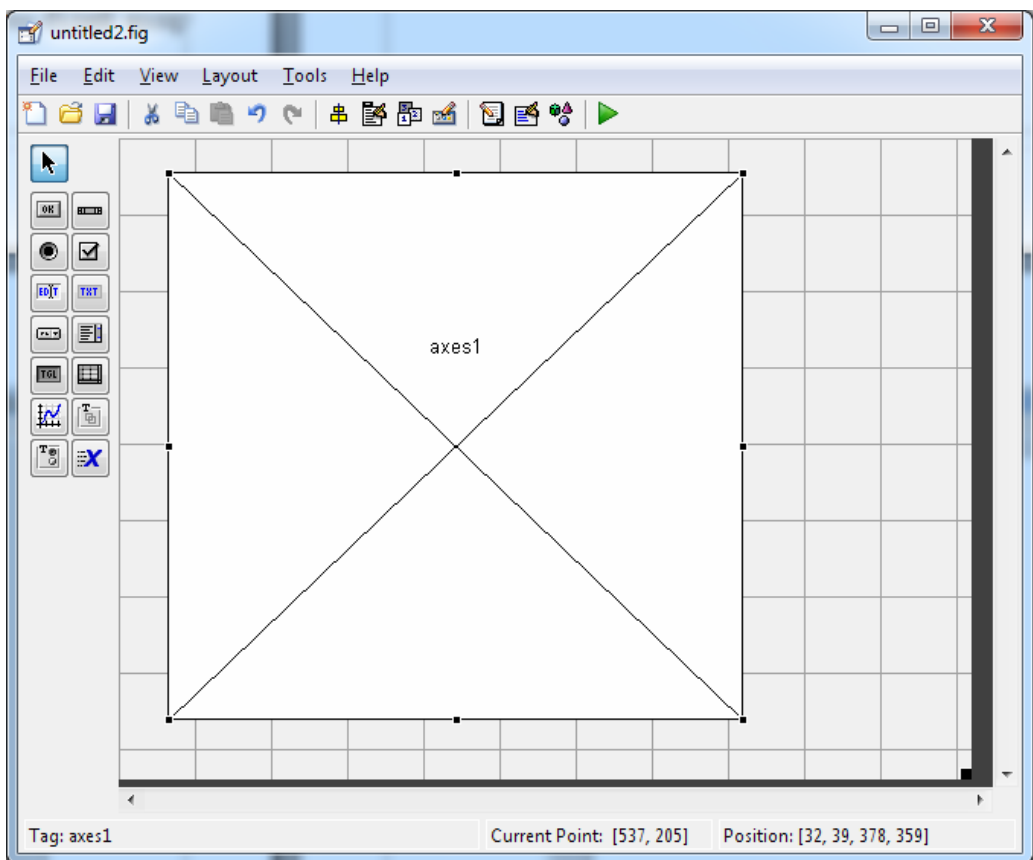
3.6.

Property Inspector

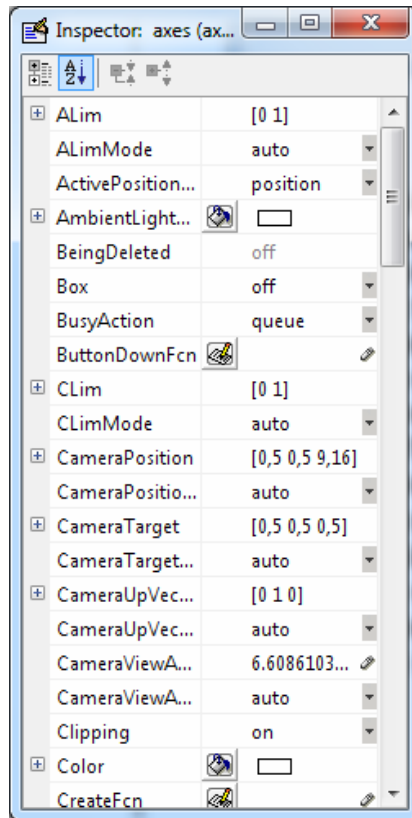
String



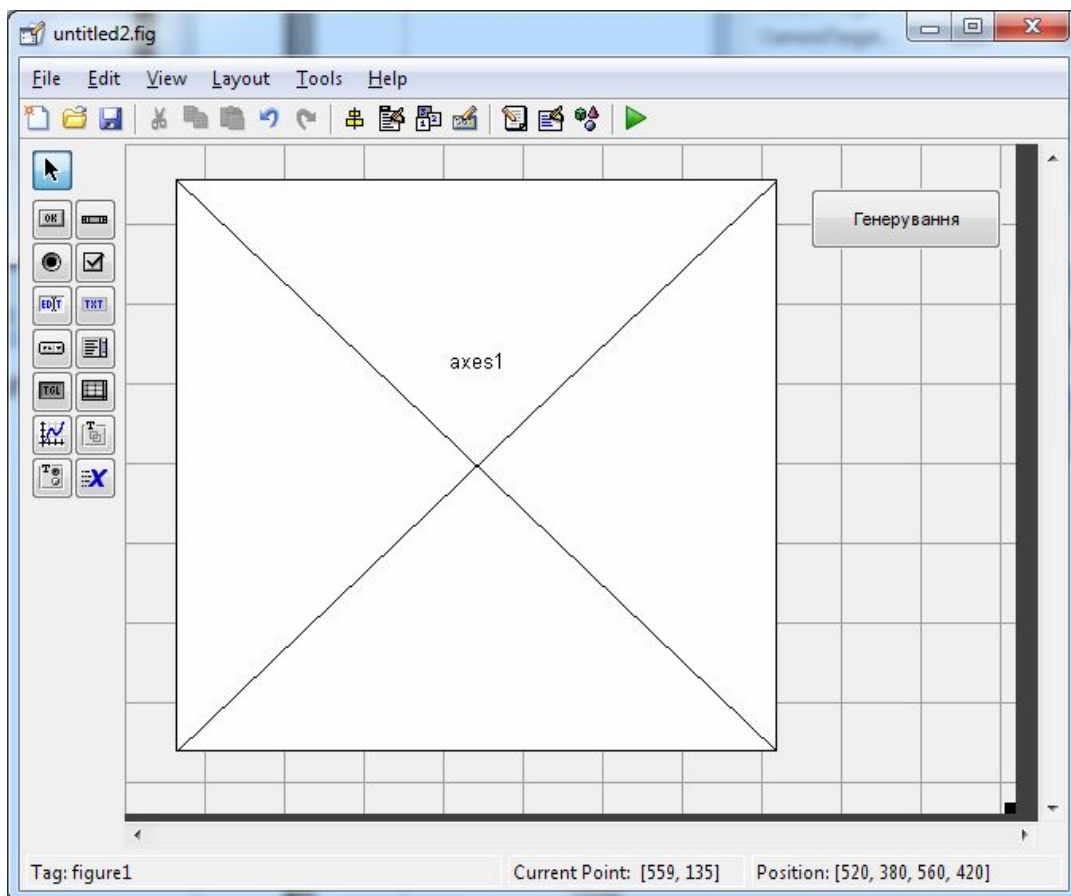
3.3 –



3.4 –



3.5 –

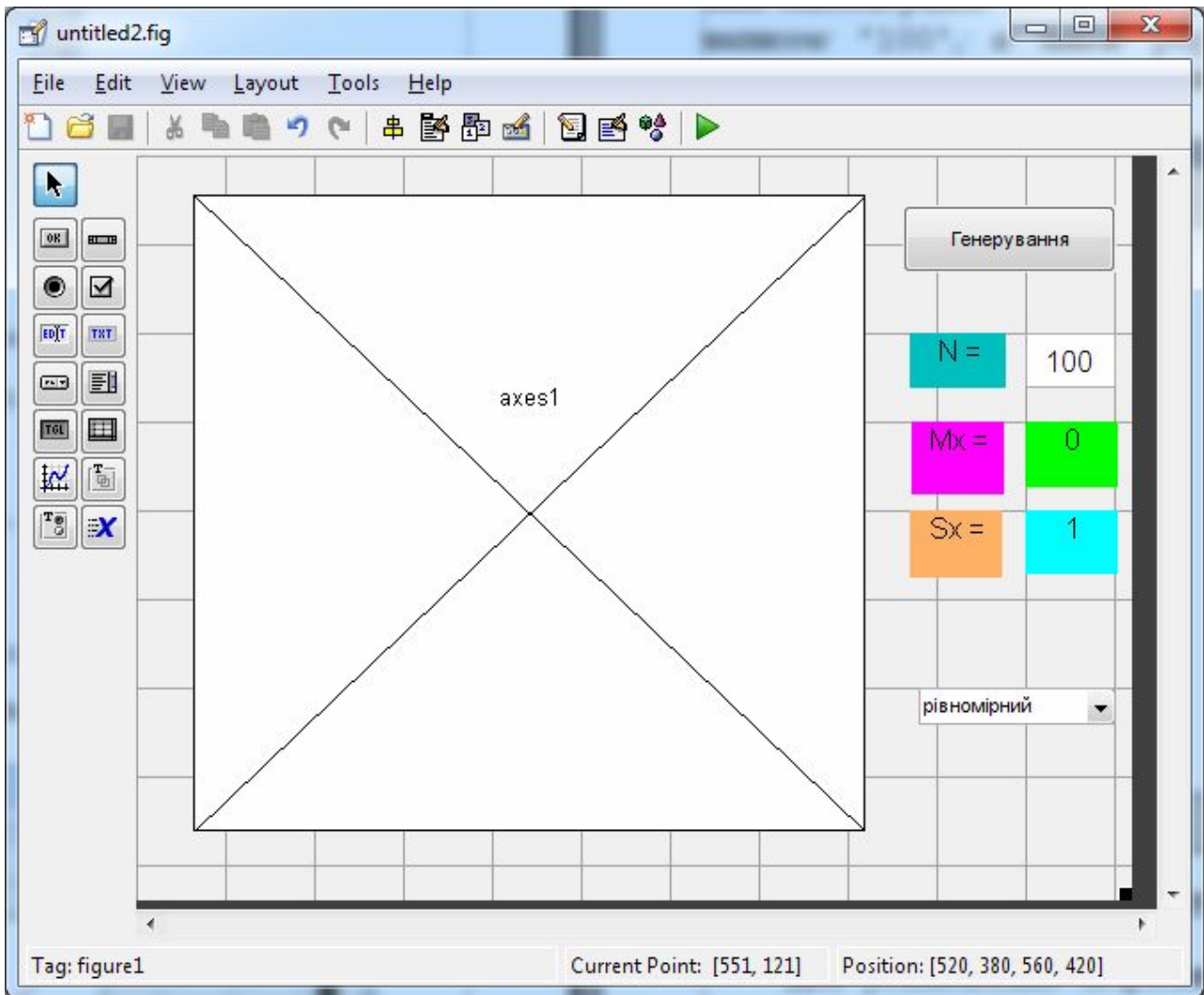


3.6 –

```

        ( ' ),
    -
    ,
    ,
    .
    ,
    Property
Inspector, ( ' Uicontrol).
        Tag
        pushbutton1 btnGeneration
    <Enter>.
    'N=', 'Mx=', 'Sx=', '0', '1',
    '100', popup-
    ( . .3.7).
    edit
    -

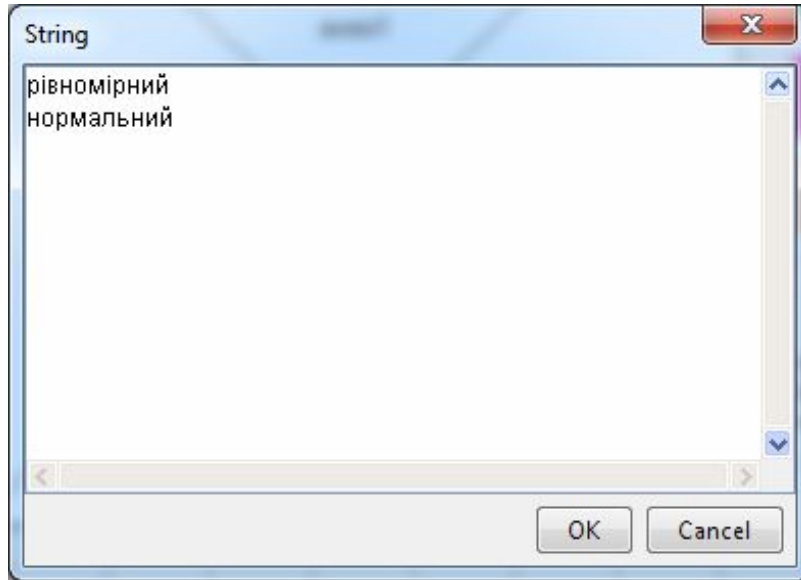
```



3.7 –

. .) Property Inspector.

BackgroundColor, – ForegroundColor, – String,
 – FontName, – FontSize. popup-
 String, .3.8.



3.8 – String popup-

```

edit      '100' – edN;
          '0' – txtMx;
          '1' – txtSx;
popup-    – popupPdf.
          Save Figure,
          *.m.
,         Ok.
:         ,
)         fig (
,         m (
          ,
          ,
          ,
          Callback
Run Figure
          ,
          .3.7.
          ,
          myhist,
  
```



```

N      z      (z=0 - , z=1 - ), -
      ,      ,      -
      mx      -
      sx.

```

```

function [mx,sx]=myhist(N,z)
if z x=randn(1,N);
else
    x=rand(1,N);
end;
mx=mean(x);
sx=std(x);
hist(x,7);

```

Callback

View Callbacks

Callback.

M-

btnGeneration_Callback,

:

```

% --- Executes on button press in btnGeneration.
function btnGeneration_Callback(hObject, eventdata, handles)
% hObject    handle to btnGeneration (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

```

```

'      -      '      (btnGeneration),
Callback      ,      Callback (      ).
      :

```

```

-      hObject      ,
'      Uicontrol      btnGeneration;
-      eventdata      -
MATLAB;
-      handles      ,
      handles      ,      handles.edN
      edit, handles.txtMx
,
handles.txtSx
,
      , handles.popupPdf
popup-

```

Callback -
btnGeneration_Callback

```
N=str2num(get(handles.edN,'string'));  
z=get(handles.popupPdf,'value')-1;  
[mx,sx]=myhist(N,z);  
set(handles.txtMx,'string',num2str(mx));  
set(handles.txtSx,'string',num2str(sx));
```

, Callback- -
edit handles.edN, -
str2num -
N. z , -
popup- -
handles.popupPdf. myhist, -
N , -
mx -
sx. string ' -
handles.txtMx handles.txtSx , -
mx sx. -
num2str -
. -
mx sx . -
N , -
Callback- , -
N , -
edit popup- , -
Callback- . -
Callback- , -
, : -
. -
. -
, . -
, .

3.6

1. , MATLAB.
2. , ?
3. , ?
4. gcf, gca, gco?
5. delete?
6. get set?
7. , ?
8. , ?
9. Callback- , ?
10. ,
guide?

1. . . . MATLAB. [] / . . . -
 . - . : , 2012. - 768 .
2. , . . - MatLab -
 ' : . . . 1. -
 [] / . . . - . : « » ,
 2009. - 507 .
3. , . . MATLAB. [] /
 . . . - . : - , 1997. - 350 .

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152 «

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