Научное программирование

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Лабораторная работа 7

Цель работы

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Ознакомиться с параметрическими графиками, полярными координатами, графиками неявных функций, комплексными числами и специальными функциями в Octave.

Задание.

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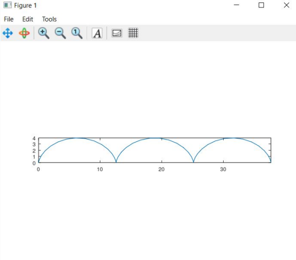
Записать и построить графики: 1. Параметрической функции 2. Полярных координат 3. Неявных функций 4. Комплексных чисел 5. Специальных функций

Выполнение работы

Параметрическая функция

```
>> t = linspace (0, 6*pi, 50)
t =

 Columns 1 through 9:

         0    0.3847    0.7694    1.1541    1.5387    1.9234    2.3081    2.6928    3.0775

 Columns 10 through 18:

    3.4622    3.8468    4.2315    4.6162    5.0009    5.3856    5.7703    6.1550    6.5396

 Columns 19 through 27:

    6.9243    7.3090    7.6937    8.0784    8.4631    8.8478    9.2324    9.6171   10.0018

 Columns 28 through 36:

   10.3865   10.7712   11.1559   11.5405   11.9252   12.3099   12.6946   13.0793   13.4640

 Columns 37 through 45:

   13.8487   14.2333   14.6180   15.0027   15.3874   15.7721   16.1568   16.5414   16.9261

 Columns 46 through 50:

   17.3108   17.6955   18.0802   18.4649   18.8496

>> r = 2
r = 2
>> x = r*(t-sin(t))
x =

 Columns 1 through 9:

         0    0.0188    0.1474    0.4793    1.0785    1.9699    3.1357    4.5178    6.0268

 Columns 10 through 18:

    7.5545    8.9902   10.2363   11.2232   11.9191   12.3348   12.5220   12.5657   12.5720

 Columns 19 through 27:
```

```
>> y = r * ( 1 - cos(t))
y =

 Columns 1 through 10:

        0   0.1462   0.5633   1.1904   1.9359   2.6907   3.3446   3.8019   3.9959   3.8981

 Columns 11 through 20:

   3.5229   2.9251   2.1920   1.4309   0.7530   0.2574   0.0164   0.0654   0.3972   0.9632

 Columns 21 through 30:

   1.6808   2.4450   3.1442   3.6762   3.9631   3.9631   3.6762   3.1442   2.4450   1.6808

 Columns 31 through 40:

   0.9632   0.3972   0.0654   0.0164   0.2574   0.7530   1.4309   2.1920   2.9251   3.5229

 Columns 41 through 50:

   3.8981   3.9959   3.8019   3.3446   2.6907   1.9359   1.1904   0.5633   0.1462        0

>> plot(x,y)
>> axis('equal')
>> axis([0 12*pi 0 4])
```



Полярные координаты - улитка Паскаля

```
>> treta = linspace (0, 2*pi, 100)
treta =

 Columns 1 through 21:

         0    0.0635    0.1269    0.1904    0.2539    0.3173    0.3808

 Columns 22 through 42:

    1.3328    1.3963    1.4597    1.5232    1.5867    1.6501    1.7136

 Columns 43 through 63:

    2.6656    2.7291    2.7925    2.8560    2.9195    2.9829    3.0464

 Columns 64 through 84:

    3.9984    4.0619    4.1253    4.1888    4.2523    4.3157    4.3792

 Columns 85 through 100:

    5.3312    5.3947    5.4581    5.5216    5.5851    5.6485    5.7120

>> r = 1-2*sin(treta)
r =

 Columns 1 through 17:

    1.000000    0.873152    0.746815    0.621498    0.497704    0.37593

 Columns 18 through 34:

  -0.762907   -0.819264   -0.868296   -0.909804   -0.943623   -0.96961
```

```
>> y = r.*sin(treta)
y =

 Columns 1 through 21:

         0    0.0554    0.0945    0.1176    0.1250

 Columns 22 through 42:

  -0.9170   -0.9549   -0.9816   -0.9966   -0.9996

 Columns 43 through 63:

    0.0383    0.0794    0.1081    0.1230    0.1232

 Columns 64 through 84:

  -1.8981   -2.0622   -2.2189   -2.3660   -2.5016

 Columns 85 through 100:

  -2.1416   -1.9810   -1.8138   -1.6425   -1.4691

>> x = r.*cos(treta)
x =

 Columns 1 through 17:

    1.000000    0.871394    0.740807    0.610266

 Columns 18 through 34:

  -0.360299   -0.340335   -0.309883   -0.270139

 Columns 35 through 51:

    0.368434    0.358232    0.334961    0.298399
```

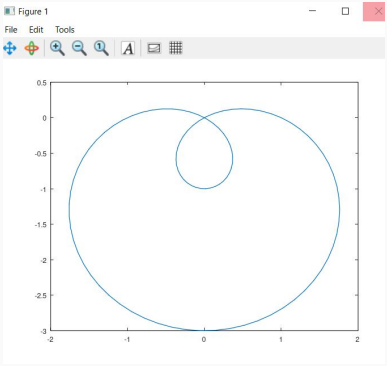
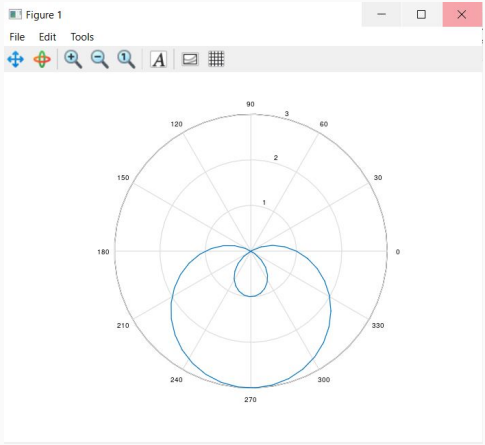


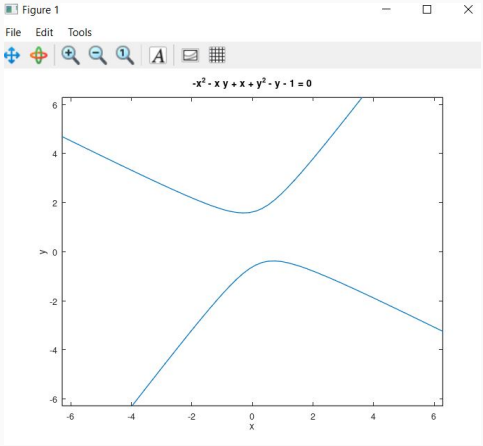
График в полярных координатах

```
>> plot(x, y)
>> treta = linspace(0, 2*pi, 50)
treta =

 Columns 1 through 21:

         0    0.1282    0.2565    0.3847    0.5129    0.6411

 Columns 22 through 42:

    2.6928    2.8210    2.9493    3.0775    3.2057    3.3339

 Columns 43 through 50:

    5.3856    5.5138    5.6420    5.7703    5.8985    6.0267

>> r = 1 - 2*sin(treta)
r =

 Columns 1 through 17:

    1.000000    0.744246    0.492691    0.249466    0.018565

 Columns 18 through 34:

   -0.640345   -0.480556   -0.296457   -0.091070    0.132233

 Columns 35 through 50:

    2.876937    2.949856    2.990758    2.998972    2.974364

>> polar(treta, r)
```



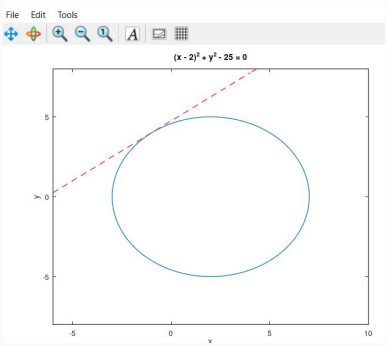
Неявных функций - $f = -x^2 - x * y + x + y^2 - y - 1$

```
>> f = @(x,y) -x.^2-x.*y + x + y.^2 - y - 1
f =

@(x, y) -x .^ 2 - x .* y + x + y .^ 2 - y - 1

>> ezplot(f)
```



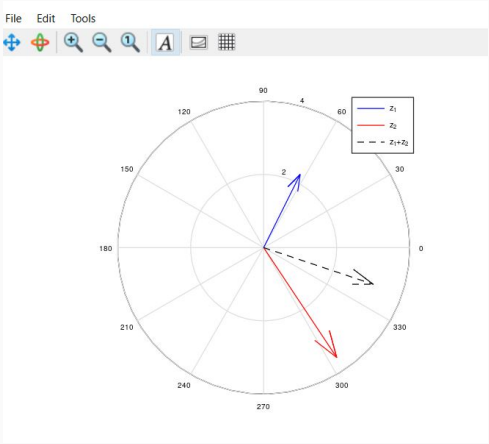
Неявных функций - круг с касательной

```
>> f = @ (x,y) (x-2).^2+y.^2-25
f =

@(x, y) (x - 2) .^ 2 + y .^ 2 - 25

>> ezplot(f)
>> ezplot(f, [-6 10 -8 8])
>> x = [-6:10]
x =

   -6   -5   -4   -3   -2   -1    0    1    2    3    4    5    6    7

>> y = 3/4*x +19/4
y =

    0.2500    1.0000    1.7500    2.5000    3.2500    4.0000    4.7500

>> hold on
>> plot(x, y, 'r--')
```



Комплексные числа

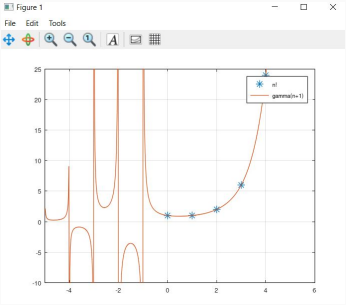
```
z1 =  1 + 2i
>> z2 = 2 - 3*i
z2 =  2 - 3i
>> z1+zz2
error: 'zz2' undefined near line 1, column 4
>> z1+z2
ans =  3 - 1i
>> z1-z2
ans = -1 + 5i
>> z1*z2
ans =  8 + 1i
>> z1/z2
ans = -0.3077 + 0.5385i
>> clf
>> z1 = 1 + 2*i
z1 =  1 + 2i
>> z2 = 2 - 3*i
z2 =  2 - 3i
>> compass(z1, 'b')
>> hold on
>> compass(z2, 'r')
>> compass(z1+z2, 'k--')
>> legend('z_1','z_2','z_1+z_2')
```



Специальные функции $ Г(x+1) и n! $

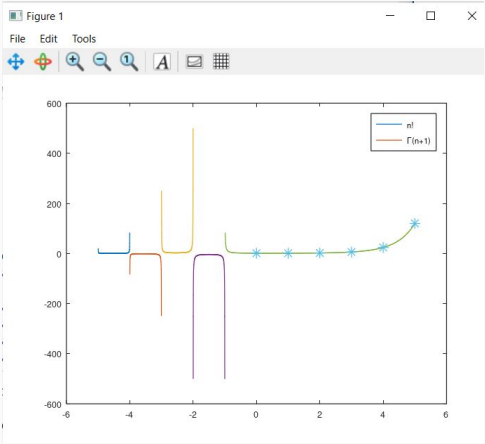
```
>> n = [0:1:5]
n =

   0   1   2   3   4   5

>> x = linspace(-5, 5, 500)
x =

 Columns 1 through 17:

  -5.000000  -4.979960  -4.959920  -4.939880  -4.919840

 Columns 18 through 34:

  -4.659319  -4.639279  -4.619238  -4.599198  -4.579158

 Columns 35 through 51:

  -4.318637  -4.298597  -4.278557  -4.258517  -4.238477

 Columns 52 through 68:

  -3.977956  -3.957916  -3.937876  -3.917836  -3.897796

 Columns 69 through 85:
```

```
>> plot(n, factorial(n), '*', x, gamma(x+1))
>> axis([-5 6 -10 25])
>> grid on
>> legend('n!','gamma(n+1)')
```



Вычисления по частям для избавления от артефактов

```
   4.7234e+00   4.7355e+00   4.7475e+00   4.7595e+00

 Columns 491 through 500:

   4.8918e+00   4.9038e+00   4.9158e+00   4.9279e+00

>> plot(x1, gamma(x1+1))
>> hold on
>> plot(x2, gamma(x2+1))
>> plot(x3, gamma(x3+1))
>> plot(x4, gamma(x4+1))
>> plot(x5, gamma(x5+1))
>> axis([-5 6 - 10 25])
error: axis: LIMITS vector must have 2, 4, 6, or 8 elem
error: called from
    axis>__axis__ at line 371 column 9
    axis at line 179 column 7
>> axis([-5 6 - 10 25])
error: axis: LIMITS vector must have 2, 4, 6, or 8 elem
error: called from
    axis>__axis__ at line 371 column 9
    axis at line 179 column 7
>> plot(n, factorial(n), '*')
>> legend('n!', "\\Gamma(n+1)")
```



Выводы

В процессе выполнения работы, я научилась работать с комплексными числами, строить на графиках специальные функции, строить графики в полярных координатах, а также выислять и строить графики параметрических и неявных функций в Octave.