

АК - Лабораторная работа 3

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1 Условие

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y) \quad (1)$$

$$\begin{cases} u(0, y) = f_1(y) = y^2 \\ u(a, y) = f_2(y) = \sin(y) \\ u(x, 0) = f_3(x) = x^3 \\ u(x, b) = f_4(x) = x^4 \end{cases}$$

2 Запуск

```
bash run.sh {num_of_procces} {rows} {cols}
```

3 Решение Wolfram

```
in: solution2 = NDSolveValue[{D[u[t, x], t, t] + D[u[t, x], x, x] == t*x, u[t, 0] == t^3, u[0, x] == x^2, u[t, 1] == t^2, u[1, x] == Sin[x]}, u, {t, 0, 1}, {x, 0, 1}];  
plot2 = Plot3D[solution2[t, x], {t, 0, 1}, {x, 0, 1}];  
Show[plot2]
```

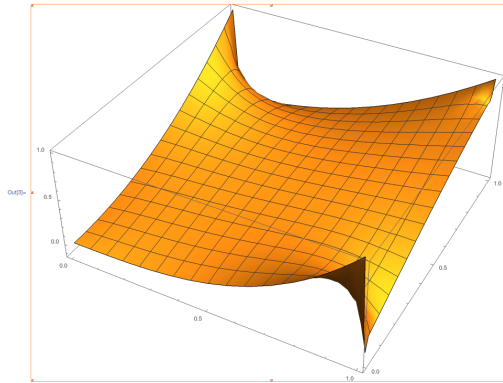


Рис. 1: График решения ДУ Пуассона (1)

4 Результаты

```
(bsu)MacBook-Pro-Ivan:lab3py Drapegnik$ bash run.sh 1 3 3
$ master: Calculate differential equation with 1 processes
$ master: with 1D topology: 1x1
$ master:
$   coord: [0, 0]
$   region: {t: 0, r: 3, b: 3, l: 0}
$   point: (0.00, 1.00)
$ master: initialization: 0.001s
$ master: calculation: 0.000s
$ master: collecting results: 0.000s
$ master: TOTAL: 0.001s
$ master: results:
      1.000000      0.250000      0.841471
      0.250000      0.260481      0.479426
      0.000000      0.125000      0.000000
$ master: iterations: 2
(bsu)MacBook-Pro-Ivan:lab3py Drapegnik$
```

(a) 1 процесс: 3x3

```
(bsu)MacBook-Pro-Ivan:lab3py Drapegnik$ bash run.sh 3 3 3
$ master: Calculate differential equation with 3 processes
$ master: with 1D topology: 3x1
$ proc1:
$   coord: [1, 0]
$   region: {t: 1, r: 3, b: 2, l: 0}
$   point: (0.00, 0.50)
$ proc2:
$   coord: [2, 0]
$   region: {t: 2, r: 3, b: 3, l: 0}
$   point: (0.00, 0.00)
$ master:
$   coord: [0, 0]
$   region: {t: 0, r: 3, b: 1, l: 0}
$   point: (0.00, 1.00)
$ master: initialization: 0.009s
$ master: calculation: 0.002s
$ master: collecting results: 0.000s
$ master: TOTAL: 0.011s
$ master: results:
      1.000000      0.250000      0.841471
      0.250000      0.260481      0.479426
      0.000000      0.125000      0.000000
$ master: iterations: 2
(bsu)MacBook-Pro-Ivan:lab3py Drapegnik$
```

(b) 3 процесса: 3x3

Рис. 2: Примеры работы

num proc	rows	cols	topo	time	iterations
1	40	40	1D(1x1)	14.126s	1598
2	40	40	2D(1x2)	7.112s	1635
4	40	40	2D(1x4)	8.605s	1670
10	40	40	2D(2x5)	12.180s	1725