Лабораторная работа №4

Дифференциальные уравнения (Системы дифференциальных уравнений)

Инструментарий

Python 3.7

Система уравнений

$$\begin{cases} \dfrac{dx}{dy} = -2x + 5z \\[2mm] \dfrac{dy}{dt} = \sin(t-1)\,x - y - 3z \\[2mm] \dfrac{dz}{dt} = -x + 2z \end{cases}$$

x(0) = 2; y(0) = 1; z(0) = 1

Код программы

```python
def system():
    def dx_dy(x, z):
        return -2*x + 5*z
    def dy_dt(t, x, y, z):
        return math.sin(t-1)*x - y - 3*z
    def dz_dt(x, z):
        return -x + 2*z
    h = 0.001
    end = 0.3
    ti = 0
    xi = 2
    yi = 1
    zi = 1
    print(f'x0={xi}, y0={yi}, z0={zi}, t0={ti}')
    while ti < end:
        yi += h * dy_dt(ti, xi, yi, zi)
        tmp = xi  # Текущий x
        xi += h * dx_dy(xi, zi)
        zi += h * dz_dt(tmp, yi)   # Текущий x
        print(f'x={xi}, y={yi}, z={zi}, t={ti}')
        ti += h
```

Результаты

```
x=2.0366572778768064, y=-0.25413487891369596, z=0.585434583429262, t=0.2820000000000002
x=2.035511136238199, y=-0.25697538882799387, z=0.5828839753737293, t=0.2830000000000002
x=2.0343545338425915, y=-0.2598031182512728, z=0.5803288580009885, t=0.2840000000000002
x=2.033187469064911, y=-0.26261805997114845, z=0.5777692673472037, t=0.2850000000000002
x=2.0320099404635172, y=-0.26542020691699164, z=0.5752052394643048, t=0.2860000000000002
x=2.030821946779912, y=-0.2682095521599974, z=0.5726368104195213, t=0.2870000000000002
x=2.0296234869384495, y=-0.2709860889132523, z=0.5700640162949149, t=0.2880000000000002
x=2.028414560046047, y=-0.27374981053179887, z=0.5674868931869128, t=0.2890000000000002
x=2.0271951653918894, y=-0.276500710512697 6, z=0.5649054772058414, t=0.2900000000000002
x=2.0259653024471347, y=-0.27923878249508693, z=0.5623198044754594, t=0.2910000000000002
x=2.0247249708646176, y=-0.2819640202602404, z=0.5597299111324917, t=0.2920000000000002
x=2.0234741704785506, y=-0.28467641773162156, z=0.5571358333261639, t=0.2930000000000002
x=2.0222129013042243, y=-0.2873759689749363, z=0.5545376072177355, t=0.2940000000000002
x=2.0209411635377044, y=-0.29006266819818305, z=0.5519352689800349, t=0.2950000000000002
x=2.0196589575555293, y=-0.29273650975170035, z=0.5493288547969938, t=0.2960000000000002
x=2.018366283914403, y=-0.295397488128212, z=0.5467184008631818, t=0.2970000000000002
x=2.01706314335089, y=-0.2980455979628699, z=0.5441039433833417, t=0.2980000000000002
x=2.015749536781105, y=-0.30068083403329443, z=0.5414855185719242, t=0.2990000000000002
```