Лабораторна робота №3

Студента групи ФІ-84 Жупаника Олексія

Варіант 1(Метод Зейделя)

Завдання:

№ вар.	Матриця системи A	Вектор правої частини b
1	3,81 0,25 1,28 0,75 2,25 1,32 4,58 0,49 5,31 6,28 0,98 1,04 9,39 2,45 3,35 2,28	4,21 6,47 2,38 10,48

```
Iteration -  100
x:
[0.8102867715745137, -0.48551915222187647, 1.1540264463720806, 0.037581845117978574]
r:
[0.23684164365550942, 0.09265677147797646, 0.08480898356830835, 7.105427357601002e-15]
Iteration -  200
x:
[0.671135265000393, -0.4646374081513449, 1.154231923526304, 0.6059784121185867]
r:
[0.14761431356026833, 0.05774941225423902, 0.05285818701456435, 0.0]
Iteration -  300
x:
[0.5844074674442552, -0.45162261789175484, 1.1543599895564367, 0.9602381941941376]
r:
[0.09200234060006096, 0.03599299395514777, 0.032944480842843404, 7.105427357601002e-15]
Iteration -  400
x:
[0.5303533572580189, -0.44351099824308027, 1.1544398082016571, 1.1810347304196633]
r:
[0.05734153058563152, 0.02243305279284158, 0.020533031481107855, 0.0]
Iteration -  500
x:
[0.4966635033661956, -0.4384553367984956, 1.1544895561021602, 1.3186487438523127]
r:
[0.03573877695345118, 0.013981661493161823, 0.012797451075797994, 0.0]
Iteration -  600
x:
[0.47566590944888065, -0.43530433690583714, 1.1545205620607006, 1.4044182808965804]
r:
[0.022274609084973918, 0.008714233408838368, 0.007976160470420268, 0.0]
```

```
Iteration -  700
x:
[0.4625789144226584, -0.4333404395142961, 1.1545398868855732, 1.457875144055273]
r:
[0.013882909606394378, 0.005431247490918167, 0.004971234933663027, 0.0]
Iteration -  800
x:
[0.45442229231201126, -0.4321164175860548, 1.1545519313078052, 1.491192756779384]
r:
[0.008652685144966199, 0.003385088271514291 6, 0.0030983800861719146, 0.0]
Iteration -  900
x:
[0.4493385825587335, -0.4313535316596975, 1.154559438134276, 1.5119583470523965]
r:
[0.005392886818441411, 0.002109795700746986, 0.0019311014841463248, 0.0]
Iteration -  1000
x:
[0.4461701012309266, -0.43087805411864566, 1.1545641168513265, 1.5249007431045136]
r:
[0.003361179535517067, 0.0013149547491337898, 0.0012035814968811565, 0.0]
Iteration -  1100
x:
[0.4441953083312741, -0.4305817072019782, 1.1545670329162345, 1.532967242220006]
r:
[0.0020948943025018707, 0.0008195608663186249, 0.0007501461893753003, 0.0]
Iteration -  1200
x:
[0.4429644956506711, -0.43039700553379023, 1.1545688503876599, 1.5379947817666437]
```

```
r:
[0.0013056672790980883, 0.0005108008576399925, 0.0004675373515823 3667, 0.0]
Iteration -  1300
x:
[0.4421973773087944, -0.43028188806735934, 1.154569983147899, 1.5411282543587905]
r:
[0.0008137723424397336, 0.0003183625852329 8966, 0.0002913981010692 6234, 0.0]
Iteration -  1400
x:
[0.4417192618654634, -0.4302101397653133, 1.1545706891539143, 1.5430812276560975]
r:
[0.0005071930926874302, 0.0001984231901062 1168, 0.0001816172612194 5776, 7.105427357601002e-15]
Iteration -  1491
x:
[0.44144270054559454, -0.43016863764403923, 1.1545710975363628, 1.5442109064403864]
r:
[0.0003298552485944 1284, 0.0001290453904871 9244, 0.0001181155810456 8576, 7.105427357601002e-15]
```

Код програми:

```
import numpy as np
from numpy.core.fromnumeric import transpose
def sub(b, ax):
    r = []
    for i in range(len(b)):
        r.append((abs(b[i] - ax[i])))
    return r

def multiply(a, x):
    ax = []
    for i in range(len(a)):
        sum = 0
        for j in range(len(a)):
            sum += a[i][j] * x[j]
        ax.append(sum)
    return ax

def check(xNew,xOld,e):
    for i in range(len(xNew)):
        if abs(xNew[i] - xOld[i]) > e:
            return False
    return True
```

```python
def main():
    a = [
        [3.81, 0.25, 1.28, 0.75],
        [2.25, 1.32, 4.58, 0.49],
        [5.31, 6.28, 0.98, 1.04],
        [9.39, 2.45, 3.35, 2.28]
        ]
    b = [4.21, 6.47, 2.38, 10.48]
    A_new = np.array(a)
    B_new = np.array(b)
    A_new, B_new = transpose(A_new)@A_new, transpose(A_new)@B_new
    a = A_new.tolist()
    b = B_new.tolist()
    e = 0.00001
    c = []
    d = []
    for i in range(len(a)):
        line = []
        for j in range(len(a[i])):
            if i == j:
                line.append(0)
            else:
                line.append(-a[i][j]/a[i][i])
        c.append(line)
        d.append(b[i]/a[i][i])
    xOld = [0,0,0,0]
    xNew = [0,0,0,0]
    k = 1
```

```
    while True:

        k += 1
        for i in range(len(xOld)):
            for j in range(len(xOld)):
                if i > j:
                    xNew[i] += c[i][j]*xNew[j]
                else:
                    xNew[i] += c[i][j]*xOld[j]
            xNew[i] += d[i]
        ax = multiply(a,xNew)
        if (k%100)==0:
            print("Iteration - ",k)
            print('x:')
            print(xNew)
            r = sub(b, ax)
            print('r:')
            print(r)
        if(check(xNew,xOld,e)):
            print("Iteration - ",k)
            print('x:')
            print(xNew)
            r = sub(b, ax)
            print('r:')
            print(r)
            break
        xOld = xNew.copy()
        xNew = [0,0,0,0]


if __name__ == '__main__':
    main()
```