

# Метод вращения

## 1.1.7(в) Решение матричного уравнения

Дано: A, F - матрицы

$$A \cdot X = F$$

Найти: X-?

Алгоритм:

```
In[109]:= rotation2[A_, F_] := Module[{a = A, b = F, c, s, m, mp, x, ans = {}, n = Length@a},
  m = Table[Table[Append[a[[j]], b[[j, i]]], {j, 1, Length@a}], {i, 1, Length@b}];
  Do[
    Do[
      
$$c = \frac{m[[k]][i, i]}{\sqrt{m[[k]][i, i]^2 + m[[k]][j, i]^2}} // N;$$

      
$$s = \frac{m[[k]][j, i]}{\sqrt{m[[k]][i, i]^2 + m[[k]][j, i]^2}} // N;$$

      mp = c * m[[k]][i] + s * m[[k]][j] // N;
      m[[k]][j] = -s * m[[k]][i] + c * m[[k]][j] // N;
      m[[k]][[i]] = mp, {j, i, n}], {i, 1, n}],
    {k, 1, Length@m}];

  Do[x = Table[
    
$$x_i = \left( m[[k]][i, n+1] - \sum_{j=i}^n \text{If}[i == j, 0, m[[k]][i, j]] * x_j \right) / m[[k]][i, i], \{i, n, 1, -1\}];
    x = Reverse[x];
    AppendTo[ans, x], {k, 1, Length@m}];
  Transpose[ans]$$

```

Результат работы:

### 1) Пример

```
In[111]:= A = {{3., -2., 1.}, {-2., 1., 3.}, {2., 0., -2.}};
F = {{1., 1., 2.}, {1., 3., 1.}, {2., 1., 3.}};
```

```
In[117]:= MatrixForm /@ {A, F}
```

```
Out[117]= {
  
$$\begin{pmatrix} 3. & -2. & 1. \\ -2. & 1. & 3. \\ 2. & 0. & -2. \end{pmatrix}, \begin{pmatrix} 1. & 1. & 2. \\ 1. & 3. & 1. \\ 2. & 1. & 3. \end{pmatrix}
}$$

```

Ответ:

```
In[120]:= rotation2[A, F] // MatrixForm
```

```
Out[120]/MatrixForm=

$$\begin{pmatrix} 1.66667 & 1.75 & 2.41667 \\ 2.33333 & 2.75 & 3.08333 \\ 0.666667 & 1.25 & 0.916667 \end{pmatrix}$$

```

Проверка:

$$X = A^{-1} \cdot F$$

```
In[129]:= x = Inverse[A].F // MatrixForm
```

```
Out[129]/MatrixForm=
```

$$\begin{pmatrix} 1.66667 & 1.75 & 2.41667 \\ 2.33333 & 2.75 & 3.08333 \\ 0.666667 & 1.25 & 0.916667 \end{pmatrix}$$

2) Пример:

```
In[132]:= A2 = {{3.45, -21.78, 1.5, 6.089}, {4.556, -5.12, -7.5, 2.44},
               {0.8, 1.78, -1.5, 3.333}, {8.123, -6.61, 0.5, 7.}};
F2 = {{1.88, 7.456, -2.101, 3.}, {12., 3.9, 1.32, 0.67},
       {2.9, 1.34, 3.0, -4.}, {0.9, 7.34, 3.4, -7.4}};
```

```
In[135]:= MatrixForm /@ {A2, F2}
```

$$\text{Out[135]} = \left\{ \begin{pmatrix} 3.45 & -21.78 & 1.5 & 6.089 \\ 4.556 & -5.12 & -7.5 & 2.44 \\ 0.8 & 1.78 & -1.5 & 3.333 \\ 8.123 & -6.61 & 0.5 & 7. \end{pmatrix}, \begin{pmatrix} 1.88 & 7.456 & -2.101 & 3. \\ 12. & 3.9 & 1.32 & 0.67 \\ 2.9 & 1.34 & 3. & -4. \\ 0.9 & 7.34 & 3.4 & -7.4 \end{pmatrix} \right\}$$

Ответ:

```
In[136]:= rotation2[A2, F2] // MatrixForm
```

```
Out[136]/MatrixForm=
```

$$\begin{pmatrix} -0.162132 & 0.441616 & 0.0776532 & -0.464635 \\ -0.132243 & -0.167379 & 0.290944 & -0.50661 \\ -1.51069 & -0.0141466 & -0.106879 & -0.341938 \\ 0.299747 & 0.379065 & 0.677972 & -0.971927 \end{pmatrix}$$

Проверка:

```
In[140]:= x = Inverse[A2].F2 // MatrixForm
```

```
Out[140]/MatrixForm=
```

$$\begin{pmatrix} -0.162132 & 0.441616 & 0.0776532 & -0.464635 \\ -0.132243 & -0.167379 & 0.290944 & -0.50661 \\ -1.51069 & -0.0141466 & -0.106879 & -0.341938 \\ 0.299747 & 0.379065 & 0.677972 & -0.971927 \end{pmatrix}$$