

Linear Transformation

Use the matrix to find four types of the linear transformation of x-axis symmetric transformation, y-axis symmetric transformation, similar transformation and revolution around the origin.

Calculation

1. Symmetric transformation to x-axis (Case 1)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

2. Symmetric transformation to y-axis (Case 2)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

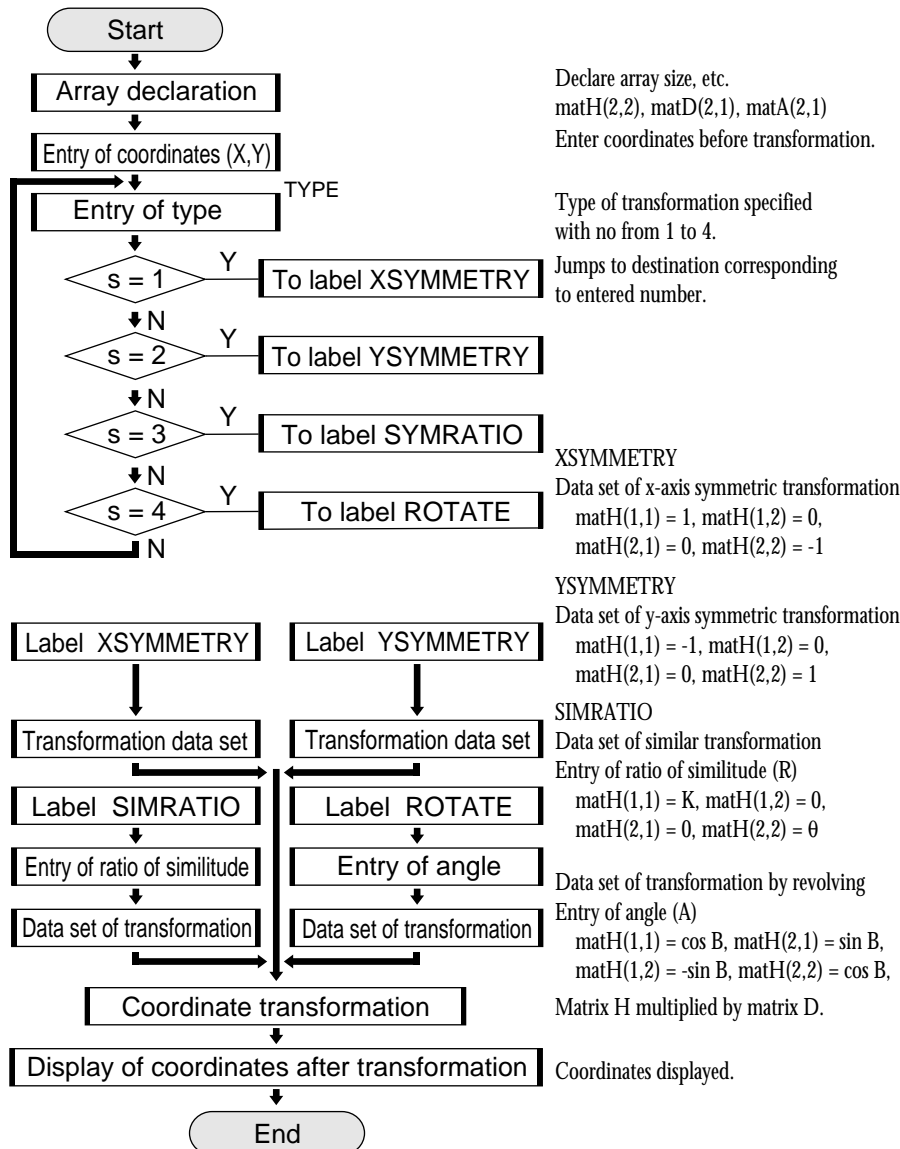
3. Similar transformation with ratio of similitude K around origin (Case 3)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} K & 0 \\ 0 & K \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

4. Transformation revolving around only angle B at the origin (Case 4)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} \cos B & -\sin B \\ \sin B & \cos B \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

FLOWCHART



PROGRAMME LIST

```

Title : LINE TRN
{2, 2}=>dim(mat H)
{2, 1}=>dim(mat D)
{2, 1}=>dim(mat A)
Print "Input POINT
Input X
Input Y
X => mat D(1, 1)
Y => mat D(2, 1)
Label TYPE
Print "SELECT 1, 2, 3, 4
Input S
ClrT
If S=1 Goto XSYMMETRY
If S=2 Goto YSYMMETRY
If S=3 Goto SIMRATIO
If S=4 Goto ROTATE
GotoTYPE
Label XSYMMETRY
1 =>mat H(1, 1)
0 =>mat H(2, 1)
0 =>mat H(1, 2)
-1 =>mat H(2, 2)
Goto TRANS
Label YSYMMETRY
-1 =>mat H(1, 1)
0 =>mat H(2, 1)
0 =>mat H(1, 2)
1 =>mat H(2, 2)
Goto TRANS
Label SIMRATIO
Print "Input SIMILITUDE RATIO
Input R
R =>K
K =>mat H(1, 1)
0 =>mat H(2, 1)
0 =>mat H(1, 2)
0 =>mat H(2, 2)
Goto TRANS
Label ROTATE
Print "Input ANGLE
Input A
A =>B
cos B =>mat H(1, 1)
sin B =>mat H(2, 1)
-sin B =>mat H(1, 2)
cos B =>mat H(2, 2)
Label TRANS
mat H*mat D =>mat A
Print "mat A(1, 1)
Print mat A(1, 1)
Print "mat A(2, 1)
Print mat A(2, 1)
End
    
```

PARAMETERS

Name of parameter	Content	Name of parameter	Content
B	angle	Y	y-coordinate
K	ratio of similitude	A	input of angle
S	selecting type (S=1: case 1, S=2: case 2, S=3: case 3, S=4: case 4)	R	input of ratio of similitude
		mat A	coordinate after transformation
		mat H	transformation data
X	x-coordinate	mat D	x,y-coordinate

Exercise

1. Transform symmetrically the point (3, 5) to the x-axis.
2. Rotate the point (2, 6) at 45° around the origin.

Set up condition: angle unit in Deg Mode and decimal point in Float Pt Mode.

2ndF **SETUP** **B** **1** **C** **1** **CL**

Step

Key Operation

Display

1 Specify the programme mode.
Select the title LINE TRN.

PRGM **A**

```
LINE TRN
Input POINT
X=?
```

2 Enter the values of the point.

3 **ENTER** **5** **ENTER**

```
Input POINT
X=
Y=
SELECT 1,2,3,4
S=?
```

3 Select symmetric transformation
to x-axis (case 1).

1 **ENTER**

```
mat A(1,1)
mat A(2,1)
```

4 Select transformation revolving
around only angle B at the
origin (case 4).

ENTER **2** **ENTER** **6** **ENTER**
4

```
Input POINT
X=
Y=
SELECT 1,2,3,4
4
```

5 Enter the angle value.

ENTER **4** **5** **ENTER**

```
Input ANGLE
A=
45
mat A(1,1)
mat A(2,1)
```