Linear Analysis Result: truss1

unit: [N], [mm]

Member Information:

EID	i	j	E [MPa]	I [mm^4]	A [mm^2]	L [mm]	θ
1	1	2	2.00e+05	None	10000.0	5000.0	0
2	3	4	2.00e+05	None	10000.0	5000.0	0
3	1	3	2.00e+05	None	10000.0	9999.78	0.33π
4	2	4	2.00e+05	None	10000.0	9999.78	0.33π
5	2	3	2.00e+05	None	10000.0	8660.0	0.5π

EID	c	s	cs	c^2	s^2	AE/L	12EI/L^3	6EI/L^2	4EI/L	2EI/L
1	1.0	0.0	0.0	1.0	0.0	4.00e+05	None	None	None	None
2	1.0	0.0	0.0	1.0	0.0	4.00e+05	None	None	None	None
3	0.5	0.87	0.43	0.25	0.75	2.00e+05	None	None	None	None
4	0.5	0.87	0.43	0.25	0.75	2.00e+05	None	None	None	None
5	0.0	1.0	0.0	0.0	1.0	2.31e+05	None	None	None	None

Member Local Stiffness:

$$[K1] = \begin{bmatrix} 4.00e+05 & 0.00e+00 & -4.00e+05 & -0.00e+00 \\ 0.00e+00 & 0.00e+00 & -0.00e+00 & -0.00e+00 \\ -4.00e+05 & -0.00e+00 & 4.00e+05 & 0.00e+00 \\ -0.00e+00 & -0.00e+00 & 0.00e+00 & 0.00e+00 \end{bmatrix}$$

$$[K2] = \begin{bmatrix} 4.00e+05 & 0.00e+00 & -4.00e+05 & -0.00e+00 \\ 0.00e+00 & 0.00e+00 & -0.00e+00 & -0.00e+00 \\ -4.00e+05 & -0.00e+00 & 4.00e+05 & 0.00e+00 \\ -0.00e+00 & -0.00e+00 & 0.00e+00 & 0.00e+00 \end{bmatrix}$$

$$[K3] = \begin{bmatrix} 5.00e+04 & 8.66e+04 & -5.00e+04 & -8.66e+04 \\ 8.66e+04 & 1.50e+05 & -8.66e+04 & -1.50e+05 \\ -5.00e+04 & -8.66e+04 & 5.00e+04 & 8.66e+04 \end{bmatrix}$$

| -8.66e+04 | -1.50e+05 | 8.66e+04 | 1.50e+05 |

[K4] =

5.00e+04	8.66e+04	-5.00e+04	-8.66e+04
8.66e+04	1.50e+05	-8.66e+04	-1.50e+05
-5.00e+04	-8.66e+04	5.00e+04	8.66e+04
-8.66e+04	-1.50e+05	8.66e+04	1.50e+05

[K5] =

8.66e-28	1.41e-11	-8.66e-28	-1.41e-11
1.41e-11	2.31e+05	-1.41e-11	-2.31e+05
-8.66e-28	-1.41e-11	8.66e-28	1.41e-11
-1.41e-11	-2.31e+05	1.41e-11	2.31e+05

Structure Global Stiffness:

[K] =

4.50e+05	8.66e+04	-4.00e+05	0.00e+00	-5.00e+04	-8.66e+04	0.00e+00	0.00e+00
8.66e+04	1.50e+05	0.00e+00	0.00e+00	-8.66e+04	-1.50e+05	0.00e+00	0.00e+00
-4.00e+05	0.00e+00	4.50e+05	8.66e+04	-8.66e-28	-1.41e-11	-5.00e+04	-8.66e+04
0.00e+00	0.00e+00	8.66e+04	3.81e+05	-1.41e-11	-2.31e+05	-8.66e+04	-1.50e+05
-5.00e+04	-8.66e+04	-8.66e-28	-1.41e-11	4.50e+05	8.66e+04	-4.00e+05	0.00e+00
-8.66e+04	-1.50e+05	-1.41e-11	-2.31e+05	8.66e+04	3.81e+05	0.00e+00	0.00e+00
0.00e+00	0.00e+00	-5.00e+04	-8.66e+04	-4.00e+05	0.00e+00	4.50e+05	8.66e+04
0.00e+00	0.00e+00	-8.66e+04	-1.50e+05	0.00e+00	0.00e+00	8.66e+04	1.50e+05

Nodal Displacement & Nodal Load:

{r} =	{R} =
0	Fx,1
0	Fy,1
u2	0
0	Fy,2
u3	0
v3	0
u4	282840.0
v4	-282840.0

Member Local P:

$$\{P1\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix} \quad \{P2\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}$$

$$\{P3\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix} \quad \{P4\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}$$

$$\{P5\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}$$

Structure Global P:

$$\{P\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}$$

Nodal Displacement {rf}:

$$\{Rf\} = [Kff]\{rf\} + \{Pf\}$$

{rf} = [Kff]^(-1) x ({Rf} - {Pf})

$$[Kff] = \begin{bmatrix} 4.50e+05 & -8.66e-28 & -1.41e-11 & -5.00e+04 & -8.66e+04 \\ -8.66e-28 & 4.50e+05 & 8.66e+04 & -4.00e+05 & 0.00e+00 \\ -1.41e-11 & 8.66e+04 & 3.81e+05 & 0.00e+00 & 0.00e+00 \\ -5.00e+04 & -4.00e+05 & 0.00e+00 & 4.50e+05 & 8.66e+04 \\ -8.66e+04 & 0.00e+00 & 0.00e+00 & 8.66e+04 & 1.50e+05 \end{bmatrix}$$

$$\{Rf\} = \begin{bmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 2.83e+05 \\ -2.83e+05 \end{bmatrix}$$

$$\{Pf\} = \begin{bmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{bmatrix}$$

$$\Longrightarrow \{rf\} = \begin{bmatrix} u2 \\ u3 \\ v3 \\ u4 \\ v4 \end{bmatrix} = \begin{bmatrix} -4.08e-01 \\ 1.47e+01 \\ -3.35e+00 \\ 1.58e+01 \\ -1.13e+01 \end{bmatrix}$$

Reaction Force {Rs}:

{Rs} = [Ksf]{rf} + {Ps}

$$[Ksf] = \begin{bmatrix} -4.00e+05 & -5.00e+04 & -8.66e+04 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & -8.66e+04 & -1.50e+05 & 0.00e+00 & 0.00e+00 \\ 8.66e+04 & -1.41e-11 & -2.31e+05 & -8.66e+04 & -1.50e+05 \end{bmatrix}$$

$$\begin{bmatrix} 0.00e+00 \end{bmatrix}$$

$$\{Ps\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \end{vmatrix}$$

$$\Longrightarrow \{Rs\} = \begin{vmatrix} Fx,1 \\ Fy,1 \\ Fy,2 \end{vmatrix} = \begin{vmatrix} -2.83e+05 \\ -7.73e+05 \\ 1.06e+06 \end{vmatrix}$$

Member Force:

Truss: member1

S1 = (AE/L) x <-c,-s,c,s>{r1} = -1.63e+05

Truss: member2

S2 = (AE/L) x <-c,-s,c,s>{r2} = 4.46e+05

Truss: member3

S3 = (AE/L) x <-c,-s,c,s>{r3} = 8.92e+05

Truss: member4

S4 = (AE/L) x <-c,-s,c,s>{r4} = -3.27e+05

Truss: member5

S5 = (AE/L) x <-c,-s,c,s>{r5} = -7.73e+05