

Linear Analysis Result: frame_truss

unit: [N], [mm]

Member Information:

EID	i	j	E [MPa]	I [mm^4]	A [mm^2]	L [mm]	θ
1	2	3	1.00e+05	None	50.0	3605.55	0.19π
2	5	3	1.00e+05	None	50.0	3605.55	0.81π
3	1	3	1.00e+05	1.00e+07	25.0	5000.0	0.3π
4	4	3	1.00e+05	1.00e+07	25.0	5000.0	0.7π

EID	c	s	cs	c^2	s^2	AE/L	$12EI/L^3$	$6EI/L^2$	4EI/L	2EI/L
1	0.83	0.55	0.46	0.69	0.31	1386.75	None	None	None	None
2	-0.83	0.55	-0.46	0.69	0.31	1386.75	None	None	None	None
3	0.6	0.8	0.48	0.36	0.64	500.0	96.0	2.40e+05	8.00e+08	4.00e+08
4	-0.6	0.8	-0.48	0.36	0.64	500.0	96.0	2.40e+05	8.00e+08	4.00e+08

Member Local Stiffness:

$$[K1] = \begin{bmatrix} 9.60e+02 & 6.40e+02 & -9.60e+02 & -6.40e+02 \\ 6.40e+02 & 4.27e+02 & -6.40e+02 & -4.27e+02 \\ -9.60e+02 & -6.40e+02 & 9.60e+02 & 6.40e+02 \\ -6.40e+02 & -4.27e+02 & 6.40e+02 & 4.27e+02 \end{bmatrix}$$

$$[K2] = \begin{bmatrix} 9.60e+02 & -6.40e+02 & -9.60e+02 & 6.40e+02 \\ -6.40e+02 & 4.27e+02 & 6.40e+02 & -4.27e+02 \\ -9.60e+02 & 6.40e+02 & 9.60e+02 & -6.40e+02 \\ 6.40e+02 & -4.27e+02 & -6.40e+02 & 4.27e+02 \end{bmatrix}$$

$$[K3] = \begin{bmatrix} 2.41e+02 & 1.94e+02 & -1.92e+05 & -2.41e+02 & -1.94e+02 & -1.92e+05 \\ 1.94e+02 & 3.55e+02 & 1.44e+05 & -1.94e+02 & -3.55e+02 & 1.44e+05 \\ -1.92e+05 & 1.44e+05 & 8.00e+08 & 1.92e+05 & -1.44e+05 & 4.00e+08 \\ -2.41e+02 & -1.94e+02 & 1.92e+05 & 2.41e+02 & 1.94e+02 & 1.92e+05 \\ -1.94e+02 & -3.55e+02 & -1.44e+05 & 1.94e+02 & 3.55e+02 & -1.44e+05 \end{bmatrix}$$

$$[K4] = \begin{bmatrix} -1.92e+05 & 1.44e+05 & 4.00e+08 & 1.92e+05 & -1.44e+05 & 8.00e+08 \\ 2.41e+02 & -1.94e+02 & -1.92e+05 & -2.41e+02 & 1.94e+02 & -1.92e+05 \\ -1.94e+02 & 3.55e+02 & -1.44e+05 & 1.94e+02 & -3.55e+02 & -1.44e+05 \\ -1.92e+05 & -1.44e+05 & 8.00e+08 & 1.92e+05 & 1.44e+05 & 4.00e+08 \\ -2.41e+02 & 1.94e+02 & 1.92e+05 & 2.41e+02 & -1.94e+02 & 1.92e+05 \\ 1.94e+02 & -3.55e+02 & 1.44e+05 & -1.94e+02 & 3.55e+02 & 1.44e+05 \\ -1.92e+05 & -1.44e+05 & 4.00e+08 & 1.92e+05 & 1.44e+05 & 8.00e+08 \end{bmatrix}$$

Structure Global Stiffness:

$$[K] = \begin{bmatrix} 2.41e+02 & 1.94e+02 & -1.92e+05 & 0.00e+00 & 0.00e+00 & -2.41e+02 & -1.94e+02 & -1.92e+05 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 1.94e+02 & 3.55e+02 & 1.44e+05 & 0.00e+00 & 0.00e+00 & -1.94e+02 & -3.55e+02 & 1.44e+05 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ -1.92e+05 & 1.44e+05 & 8.00e+08 & 0.00e+00 & 0.00e+00 & 1.92e+05 & -1.44e+05 & 4.00e+08 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 9.60e+02 & 6.40e+02 & -9.60e+02 & -6.40e+02 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 6.40e+02 & 4.27e+02 & -6.40e+02 & -4.27e+02 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ -2.41e+02 & -1.94e+02 & 1.92e+05 & -9.60e+02 & -6.40e+02 & 2.40e+03 & 0.00e+00 & 3.84e+05 & -2.41e+02 & 1.94e+02 & 1.92e+05 & -9.60e+02 & 6.40e+02 & -4.27e+02 \\ -1.94e+02 & -3.55e+02 & -1.44e+05 & -6.40e+02 & -4.27e+02 & 2.84e-14 & 1.56e+03 & -5.82e-11 & 1.94e+02 & -3.55e+02 & 1.44e+05 & 6.40e+02 & -4.27e+02 & 2.84e-14 \\ -1.92e+05 & 1.44e+05 & 4.00e+08 & 0.00e+00 & 0.00e+00 & 3.84e+05 & -5.82e-11 & 1.60e+09 & -1.92e+05 & -1.44e+05 & 4.00e+08 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & -2.41e+02 & 1.94e+02 & -1.92e+05 & 2.41e+02 & -1.94e+02 & -1.92e+05 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 1.94e+02 & -3.55e+02 & -1.44e+05 & -1.94e+02 & 3.55e+02 & -1.44e+05 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 1.92e+05 & 1.44e+05 & 4.00e+08 & -1.92e+05 & -1.44e+05 & 8.00e+08 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & -9.60e+02 & 6.40e+02 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 9.60e+02 & -6.40e+02 & 4.27e+02 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 6.40e+02 & -4.27e+02 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & -6.40e+02 & 4.27e+02 & -2.84e-14 \end{bmatrix}$$

Nodal Displacement & Nodal Load:

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ u3 \end{bmatrix} = \begin{bmatrix} F_{x,1} \\ F_{y,1} \\ M1 \\ F_{x,2} \\ F_{y,2} \\ 0 \end{bmatrix}$$

$$\{r\} = \begin{bmatrix} v3 \\ \theta3 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \quad \{R\} = \begin{bmatrix} 0 \\ 0 \\ F_{x,4} \\ F_{y,4} \\ M4 \\ F_{x,5} \\ F_{y,5} \end{bmatrix}$$

Member Local P:

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

$$\{P3\} = \begin{bmatrix} -1.25e+04 \\ 1.82e-12 \\ 1.25e+07 \\ -1.25e+04 \\ 1.82e-12 \\ -1.25e+07 \end{bmatrix} \quad \{P4\} = \begin{bmatrix} -1.25e+04 \\ 1.82e-12 \\ 1.25e+07 \\ -1.25e+04 \\ 1.82e-12 \\ -1.25e+07 \end{bmatrix}$$

Structure Global P:

$$\{P\} = \begin{bmatrix} -1.25e+04 \\ 1.82e-12 \\ 1.25e+07 \\ 0.00e+00 \\ 0.00e+00 \\ -2.50e+04 \\ 3.64e-12 \\ -2.50e+07 \end{bmatrix}$$

$$\begin{array}{c}
 | \quad -1.25\text{e}+04 \quad | \\
 | \quad 1.82\text{e}-12 \quad | \\
 | \quad 1.25\text{e}+07 \quad | \\
 | \quad 0.00\text{e}+00 \quad | \\
 | \quad 0.00\text{e}+00 \quad |
 \end{array}$$

Nodal Displacement {rf}:

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

$$\{rf\} = [Kff]^{-1} \times (\{Rf\} - \{Pf\})$$

$$[Kff] = \begin{array}{c}
 | \quad 2.40\text{e}+03 \quad 0.00\text{e}+00 \quad 3.84\text{e}+05 \quad | \\
 | \quad 2.84\text{e}-14 \quad 1.56\text{e}+03 \quad -5.82\text{e}-11 \quad | \\
 | \quad 3.84\text{e}+05 \quad -5.82\text{e}-11 \quad 1.60\text{e}+09 \quad |
 \end{array}$$

$$\{Rf\} = \begin{array}{c}
 | \quad 0.00\text{e}+00 \quad | \\
 | \quad 0.00\text{e}+00 \quad | \\
 | \quad 0.00\text{e}+00 \quad |
 \end{array}$$

$$\{Pf\} = \begin{array}{c}
 | \quad -2.50\text{e}+04 \quad | \\
 | \quad 3.64\text{e}-12 \quad | \\
 | \quad -2.50\text{e}+07 \quad |
 \end{array}$$

$$\Rightarrow \{rf\} = \begin{array}{c}
 | \quad u3 \quad | \quad \quad \quad | \quad 8.22\text{e}+00 \quad | \\
 | \quad v3 \quad | \quad = \quad | \quad -1.97\text{e}-15 \quad | \\
 | \quad \theta3 \quad | \quad \quad \quad | \quad 1.37\text{e}-02 \quad |
 \end{array}$$

Reaction Force {Rs}:

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

$$\begin{array}{c}
 | \quad -2.41\text{e}+02 \quad -1.94\text{e}+02 \quad -1.92\text{e}+05 \quad | \\
 | \quad -1.94\text{e}+02 \quad -3.55\text{e}+02 \quad 1.44\text{e}+05 \quad | \\
 | \quad 1.92\text{e}+05 \quad -1.44\text{e}+05 \quad 4.00\text{e}+08 \quad | \\
 | \quad -9.60\text{e}+02 \quad -6.40\text{e}+02 \quad 0.00\text{e}+00 \quad |
 \end{array}$$

$$[K_{sf}] = \begin{bmatrix} -6.40e+02 & -4.27e+02 & 0.00e+00 \\ -2.41e+02 & 1.94e+02 & -1.92e+05 \\ 1.94e+02 & -3.55e+02 & -1.44e+05 \\ 1.92e+05 & 1.44e+05 & 4.00e+08 \\ -9.60e+02 & 6.40e+02 & 0.00e+00 \\ 6.40e+02 & -4.27e+02 & 0.00e+00 \end{bmatrix}$$

$$\{P_s\} = \begin{bmatrix} -1.25e+04 \\ 1.82e-12 \\ 1.25e+07 \\ 0.00e+00 \\ 0.00e+00 \\ -1.25e+04 \\ 1.82e-12 \\ 1.25e+07 \\ 0.00e+00 \\ 0.00e+00 \end{bmatrix}$$

$$\Rightarrow \{R_s\} = \begin{bmatrix} F_{x,1} & & -1.71e+04 \\ F_{y,1} & & 3.71e+02 \\ M_1 & & 1.95e+07 \\ F_{x,2} & & -7.89e+03 \\ F_{y,2} & & -5.26e+03 \\ F_{x,4} & = & -1.71e+04 \\ F_{y,4} & & -3.71e+02 \\ M_4 & & 1.95e+07 \\ F_{x,5} & & -7.89e+03 \\ F_{y,5} & & 5.26e+03 \end{bmatrix}$$

Member Force:

Truss: member1

$$S_1 = (AE/L) \times \langle -c, -s, c, s \rangle \{r_1\} = 9.49e+03$$

Truss: member2

$$S2 = (AE/L) \times \langle -c, -s, c, s \rangle \{r2\} = -9.49e+03$$

Frame: member3

		-9.97e+03	
		1.39e+04	
		1.95e+07	
{F'3} = ([K3]{r3} + {P3}) x [LD] =		-5.03e+03	
		6.09e+03	
		1.86e-09	

Frame: member4

		9.97e+03	
		1.39e+04	
		1.95e+07	
{F'4} = ([K4]{r4} + {P4}) x [LD] =		5.03e+03	
		6.09e+03	
		1.86e-09	