Linear Analysis Result: frame1

unit: [N], [mm]

Member Information:

EID	i	j	E [MPa]	I [mm^4]	A [mm^2]	L [mm]	θ
1	2	1	2.00e+05	4.84e+07	1.14e+04	6000.0	0.5π
2	1	3	2.00e+05	9.86e+08	1.60e+04	1500.0	0
3	4	3	2.00e+05	4.84e+07	1.14e+04	6000.0	0.5π

EID	c	s	cs	c^2	s^2	AE/L	12EI/L^3	6EI/L^2	4EI/L	2EI/L
1	0.0	1.0	0.0	0.0	1.0	3.80e+05	537.78	1.61e+06	6.45e+09	3.23e+09
2	1.0	0.0	0.0	1.0	0.0	2.13e+06	7.01e+05	5.26e+08	5.26e+11	2.63e+11
3	0.0	1.0	0.0	0.0	1.0	3.80e+05	537.78	1.61e+06	6.45e+09	3.23e+09

Member Local Stiffness:

$$[K1] = \begin{bmatrix} 5.38e+02 & 2.32e-11 & -1.61e+06 & -5.38e+02 & -2.32e-11 & -1.61e+06 \\ 2.32e-11 & 3.80e+05 & 9.88e-11 & -2.32e-11 & -3.80e+05 & 9.88e-11 \\ -1.61e+06 & 9.88e-11 & 6.45e+09 & 1.61e+06 & -9.88e-11 & 3.23e+09 \\ -5.38e+02 & -2.32e-11 & 1.61e+06 & 5.38e+02 & 2.32e-11 & 1.61e+06 \\ -2.32e-11 & -3.80e+05 & -9.88e-11 & 2.32e-11 & 3.80e+05 & -9.88e-11 \\ -1.61e+06 & 9.88e-11 & 3.23e+09 & 1.61e+06 & -9.88e-11 & 6.45e+09 \end{bmatrix}$$

$$[K2] = \begin{bmatrix} 2.13e+06 & 0.00e+00 & 0.00e+00 & -2.13e+06 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 7.01e+05 & 5.26e+08 & 0.00e+00 & -7.01e+05 & 5.26e+08 \\ 0.00e+00 & 5.26e+08 & 5.26e+11 & 0.00e+00 & -5.26e+08 & 2.63e+11 \\ -2.13e+06 & 0.00e+00 & 0.00e+00 & 2.13e+06 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & -7.01e+05 & -5.26e+08 & 0.00e+00 & 7.01e+05 & -5.26e+08 \\ 0.00e+00 & 5.26e+08 & 2.63e+11 & 0.00e+00 & -5.26e+08 & 5.26e+11 \end{bmatrix}$$

$$\begin{bmatrix} 5.38e+02 & 2.32e-11 & -1.61e+06 & -5.38e+02 & -2.32e-11 & -1.61e+06 \\ 2.32e-11 & 3.80e+05 & 9.88e-11 & -2.32e-11 & -3.80e+05 & 9.88e-11 \\ -1.61e+06 & 9.88e-11 & 6.45e+09 & 1.61e+06 & -9.88e-11 & 3.23e+09 \end{bmatrix}$$

$$[K3] = \begin{vmatrix} -5.38e+02 & -2.32e-11 & 1.61e+06 & 5.38e+02 & 2.32e-11 & 1.61e+06 \\ -2.32e-11 & -3.80e+05 & -9.88e-11 & 2.32e-11 & 3.80e+05 & -9.88e-11 \\ -1.61e+06 & 9.88e-11 & 3.23e+09 & 1.61e+06 & -9.88e-11 & 6.45e+09 \end{vmatrix}$$

Structure Global Stiffness:

$$[K] = \begin{vmatrix} 2.13e+06 & 2.32e-11 & 1.61e+06 & -5.38e+02 & -2.32e-11 & 1.61e+06 & -2.13e+06 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 2.32e-11 & 1.08e+06 & 5.26e+08 & -2.32e-11 & -3.80e+05 & -9.88e-11 & 0.00e+00 & -7.01e+05 & 5.26e+08 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 1.61e+06 & 5.26e+08 & 5.32e+11 & -1.61e+06 & 9.88e-11 & 3.23e+09 & 0.00e+00 & -5.26e+08 & 2.63e+11 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ -5.38e+02 & -2.32e-11 & -1.61e+06 & 5.38e+02 & 2.32e-11 & -1.61e+06 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ -2.32e-11 & -3.80e+05 & 9.88e-11 & 2.32e-11 & 3.80e+05 & 9.88e-11 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 1.61e+06 & -9.88e-11 & 3.23e+09 & -1.61e+06 & 9.88e-11 & 6.45e+09 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ -2.13e+06 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 2.13e+06 & 2.32e-11 & 1.61e+06 & -5.38e+02 & -2.32e-11 & 1.61e+06 \\ 0.00e+00 & -7.01e+05 & -5.26e+08 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 2.32e-11 & 1.08e+06 & -5.26e+08 & -2.32e-11 & -3.80e+05 & -9.88e-11 \\ 0.00e+00 & 5.26e+08 & 2.63e+11 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 1.61e+06 & -5.26e+08 & 5.32e+11 & -1.61e+06 & 9.88e-11 & 3.23e+09 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & -5.38e+02 & -2.32e-11 & -1.61e+06 & 5.38e+02 & 2.32e-11 & -1.61e+06 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & -2.32e-11 & -3.80e+05 & 9.88e-11 & 2.32e-11 & 3.80e+05 & 9.88e-11 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 1.61e+06 & -9.88e-11 & 3.23e+09 & -1.61e+06 & 9.88e-11 & 6.45e+09 \end{vmatrix}$$

Nodal Displacement & Nodal Load:

$$\{r\} = \begin{vmatrix} u1 \\ v1 \\ \theta 1 \\ 0 \\ 0 \\ 0 \\ u3 \\ v3 \\ \theta 3 \\ 0 \\ 0 \\ 0 \end{vmatrix} \qquad \{R\} = \begin{vmatrix} 0 \\ 0 \\ 0 \\ Fx,2 \\ Fy,2 \\ M2 \\ 0 \\ 0 \\ 0 \\ Fx,4 \\ Fy,4 \\ M4 \end{vmatrix}$$

Member Local P:

		-1.07e+03			0.00e+00
		6.58e-14			0.00e+00
		2.05e+06			0.00e+00
{P1} =		-2.39e+04	{P2} =		0.00e+00
		1.47e-12			0.00e+00
		-1.44e+07			0.00e+00

		-1.07e+03
		6.58e-14
		2.05e+06
{P3} =		-2.39e+04
		1.47e-12
		-1.44e+07

Structure Global P:

		-2.39e+04
		1.47e-12
		-1.44e+07
		-1.07e+03
		6.58e-14
		2.05e+06
{P} =		-2.39e+04
		1.47e-12
		-1.44e+07
		-1.07e+03
		6.58e-14
		2.05e+06

Nodal Displacement {rf}:

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

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

$$[Kff] = \begin{vmatrix} 2.13e+06 & 2.32e-11 & 1.61e+06 & -2.13e+06 & 0.00e+00 & 0.00e+00 \\ 2.32e-11 & 1.08e+06 & 5.26e+08 & 0.00e+00 & -7.01e+05 & 5.26e+08 \\ 1.61e+06 & 5.26e+08 & 5.32e+11 & 0.00e+00 & -5.26e+08 & 2.63e+11 \\ -2.13e+06 & 0.00e+00 & 0.00e+00 & 2.13e+06 & 2.32e-11 & 1.61e+06 \\ 0.00e+00 & -7.01e+05 & -5.26e+08 & 2.32e-11 & 1.08e+06 & -5.26e+08 \\ 0.00e+00 & 5.26e+08 & 2.63e+11 & 1.61e+06 & -5.26e+08 & 5.32e+11 \end{vmatrix}$$

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

$$\{Pf\} = \begin{vmatrix} -2.39e+04 \\ 1.47e-12 \\ -1.44e+07 \\ -2.39e+04 \\ 1.47e-12 \\ -1.44e+07 \end{vmatrix}$$

$$\Rightarrow \{rf\} = \begin{vmatrix} u1 \\ v1 \\ \theta 1 \\ u3 \\ v3 \\ \theta 3 \end{vmatrix} = \begin{vmatrix} 4.55e+01 \\ 2.00e-01 \\ -3.38e-04 \\ 4.55e+01 \\ -2.00e-01 \\ -3.38e-04 \end{vmatrix}$$

Reaction Force {Rs}:

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

$$[Ksf] = \begin{vmatrix} -5.38e+02 & -2.32e-11 & -1.61e+06 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ -2.32e-11 & -3.80e+05 & 9.88e-11 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 1.61e+06 & -9.88e-11 & 3.23e+09 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & -5.38e+02 & -2.32e-11 & -1.61e+06 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & -2.32e-11 & -3.80e+05 & 9.88e-11 \\ 0.00e+00 & 0.00e+00 & 0.00e+00 & 1.61e+06 & -9.88e-11 & 3.23e+09 \end{vmatrix}$$

$$\{Ps\} = \begin{vmatrix} -1.07e+03 \\ 6.58e-14 \\ 2.05e+06 \\ -1.07e+03 \\ 6.58e-14 \\ 2.05e+06 \end{vmatrix}$$

$$\Longrightarrow \{Rs\} = \begin{vmatrix} Fx,2 \\ Fy,2 \\ M2 \\ Fx,4 \\ Fy,4 \\ M4 \end{vmatrix} = \begin{vmatrix} -2.50e+04 \\ -7.58e+04 \\ 7.44e+07 \\ -2.50e+04 \\ 7.58e+04 \\ 7.44e+07 \end{vmatrix}$$

Member Force:

Frame: member1

$$\{F'1\} = ([K1]\{r1\} + \{P1\}) \times [LD] = \begin{vmatrix} -7.58e+04 \\ 2.50e+04 \\ 7.44e+07 \\ 7.58e+04 \\ 1.21e-08 \\ 5.69e+07 \end{vmatrix}$$

Frame: member2

-1.04e-07
-7.58e+04
-5.69e+07
1.04e-07
7.58e+04
-5.69e+07

{F'2} = ([K2]{r2} + {P2}) x [LD] =

Frame: member3

7.58e+04
2.50e+04
7.44e+07
-7.58e+04
1.24e-08
5.69e+07

{F'3} = ([K3]{r3} + {P3}) x [LD] =