Linear Analysis Result: frame2

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	750.0	0

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	4.27e+06	5.61e+06	2.10e+09	1.05e+12	5.26e+11

Member Local Stiffness:

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

$$[K2] = \begin{bmatrix} 4.27e+06 & 0.00e+00 & 0.00e+00 & -4.27e+06 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & 5.61e+06 & 2.10e+09 & 0.00e+00 & -5.61e+06 & 2.10e+09 \\ 0.00e+00 & 2.10e+09 & 1.05e+12 & 0.00e+00 & -2.10e+09 & 5.26e+11 \\ -4.27e+06 & 0.00e+00 & 0.00e+00 & 4.27e+06 & 0.00e+00 & 0.00e+00 \\ 0.00e+00 & -5.61e+06 & -2.10e+09 & 0.00e+00 & 5.61e+06 & -2.10e+09 \\ 0.00e+00 & 2.10e+09 & 5.26e+11 & 0.00e+00 & -2.10e+09 & 1.05e+12 \end{bmatrix}$$

Structure Global Stiffness:

$$\begin{bmatrix} 4.27e+06 & 2.32e-11 & 1.61e+06 & -5.38e+02 & -2.32e-11 & 1.61e+06 & -4.27e+06 & 0.00e+00 & 0.00e+00 \\ 2.32e-11 & 5.99e+06 & 2.10e+09 & -2.32e-11 & -3.80e+05 & -9.88e-11 & 0.00e+00 & -5.61e+06 & 2.10e+09 \end{bmatrix}$$

$$
[K] = \begin{vmatrix}
1.61e+06 & 2.10e+09 & 1.06e+12 & -1.61e+06 & 9.88e-11 & 3.23e+09 & 0.00e+00 & -2.10e+09 & 5.26e+11 \\
-5.38e+02 & -2.32e-11 & -1.61e+06 & 5.38e+02 & 2.32e-11 & -1.61e+06 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\
-2.32e-11 & -3.80e+05 & 9.88e-11 & 2.32e-11 & 3.80e+05 & 9.88e-11 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\
1.61e+06 & -9.88e-11 & 3.23e+09 & -1.61e+06 & 9.88e-11 & 6.45e+09 & 0.00e+00 & 0.00e+00 & 0.00e+00 \\
-4.27e+06 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 4.27e+06 & 0.00e+00 & 0.00e+00 \\
0.00e+00 & -5.61e+06 & -2.10e+09 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 5.61e+06 & -2.10e+09 \\
0.00e+00 & 2.10e+09 & 5.26e+11 & 0.00e+00 & 0.00e+00 & 0.00e+00 & 0.00e+00 & -2.10e+09 & 1.05e+12
\end{vmatrix}
$$

Nodal Displacement & Nodal Load:

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

Member Local P:

$$
\{P1\} = \begin{vmatrix} -1.07e+03 \\ 6.58e-14 \\ 2.05e+06 \\ -2.39e+04 \\ 1.47e-12 \\ -1.44e+07 \end{vmatrix}
\qquad
\{P2\} = \begin{vmatrix} 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}
$$

Structure Global P:

$$
\{P\} = \begin{vmatrix} -2.39e+04 \\ 1.47e-12 \\ -1.44e+07 \\ -1.07e+03 \\ 6.58e-14 \\ 2.05e+06 \\ 0.00e+00 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}
$$

Nodal Displacement {rf}:

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

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

$$
[Kff] = \begin{vmatrix} 4.27e+06 & 2.32e-11 & 1.61e+06 & -4.27e+06 & 0.00e+00 \\ 2.32e-11 & 5.99e+06 & 2.10e+09 & 0.00e+00 & 2.10e+09 \\ 1.61e+06 & 2.10e+09 & 1.06e+12 & 0.00e+00 & 5.26e+11 \\ -4.27e+06 & 0.00e+00 & 0.00e+00 & 4.27e+06 & 0.00e+00 \\ 0.00e+00 & 2.10e+09 & 5.26e+11 & 0.00e+00 & 1.05e+12 \end{vmatrix}
$$

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

$$
\{Pf\} = \begin{vmatrix} -2.39e+04 \\ 1.47e-12 \\ -1.44e+07 \\ 0.00e+00 \\ 0.00e+00 \end{vmatrix}
$$

$$
\begin{vmatrix} u1 \\ v1 \end{vmatrix} \quad \begin{vmatrix} \\ \end{vmatrix} \quad \begin{vmatrix} 4.55e+01 \\ 2.00e-01 \end{vmatrix}
$$

$$
\text{==> } \{rf\} = \begin{vmatrix} \theta 1 \\ u3 \\ \theta 3 \end{vmatrix} = \begin{vmatrix} -3.38e\text{-}04 \\ 4.55e{+}01 \\ -2.30e\text{-}04 \end{vmatrix}
$$

Reaction Force {Rs}:

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

$$
[Ksf] = \begin{vmatrix} -5.38e{+}02 & -2.32e\text{-}11 & -1.61e{+}06 & 0.00e{+}00 & 0.00e{+}00 \\ -2.32e\text{-}11 & -3.80e{+}05 & 9.88e\text{-}11 & 0.00e{+}00 & 0.00e{+}00 \\ 1.61e{+}06 & -9.88e\text{-}11 & 3.23e{+}09 & 0.00e{+}00 & 0.00e{+}00 \\ 0.00e{+}00 & -5.61e{+}06 & -2.10e{+}09 & 0.00e{+}00 & -2.10e{+}09 \end{vmatrix}
$$

$$
\{Ps\} = \begin{vmatrix} -1.07e{+}03 \\ 6.58e\text{-}14 \\ 2.05e{+}06 \\ 0.00e{+}00 \end{vmatrix}
$$

$$
\text{==> } \{Rs\} = \begin{vmatrix} Fx,2 \\ Fy,2 \\ M2 \\ Fy,3 \end{vmatrix} = \begin{vmatrix} -2.50e{+}04 \\ -7.58e{+}04 \\ 7.44e{+}07 \\ 7.58e{+}04 \end{vmatrix}
$$

Member Force:

Frame: member1

$$
\{F'1\} = ([K1]\{r1\} + \{P1\}) \times [LD] = \begin{vmatrix} -7.58e{+}04 \\ 2.50e{+}04 \\ 7.44e{+}07 \\ 7.58e{+}04 \\ 1.05e\text{-}06 \\ 5.69e{+}07 \end{vmatrix}
$$

Frame: member2

$$
\{F'2\} = (\lbrack K2\rbrack\{r2\} + \{P2\}) \times \lbrack LD\rbrack = \begin{vmatrix} 0.00e+00 \\ -7.58e+04 \\ -5.69e+07 \\ 0.00e+00 \\ 7.58e+04 \\ 1.79e-05 \end{vmatrix}
$$