Buckling-2

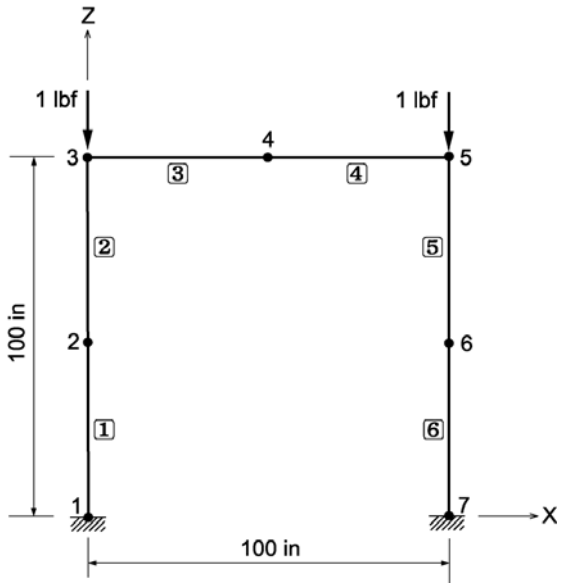
Title

3-Member Frame

Description

A plane frame structure is subjected to two vertical point forces.
The buckling load is determined for each case in which different number of elements per member has been considered.

Case 1: 2 Elements per member
Case 2: 4 Elements per member
Case 3: 8 Elements per member



Structural geometry and analysis model

MODEL

Analysis Type

2-D buckling analysis

Unit System

in, lbf

Dimension

Length 100 in Height 100 in

Element

Beam elements

Material

Modulus of elasticity $E = 1.0 \times 10^6$ psi

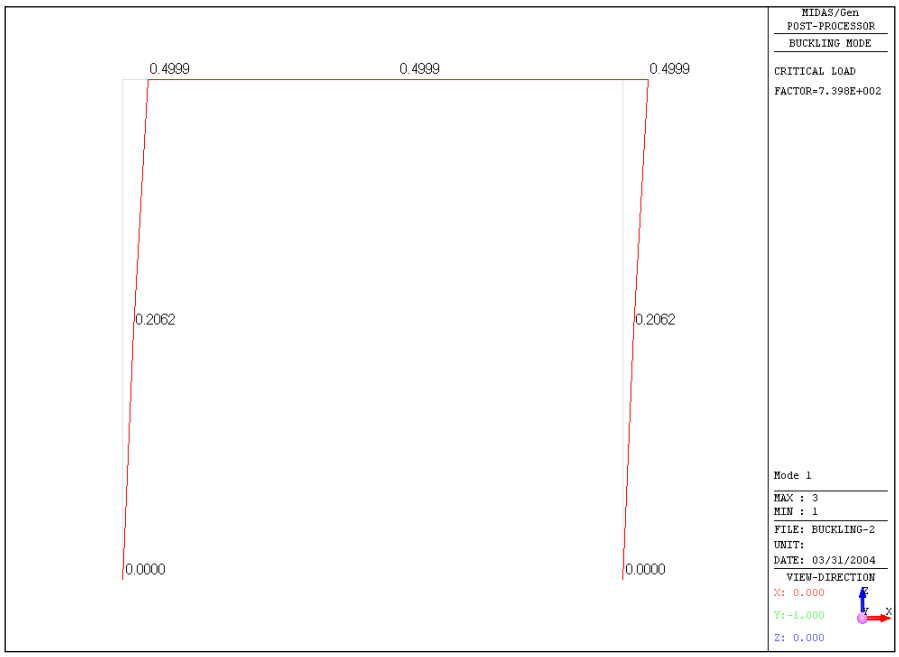
Section

Area $A = 1.0$ in^2
Moment of inertia $I_{yy} = 1.0$ in^4

Boundary Condition

Node 1, 7: Constrain all DOFs

Results



Buckling 1st Mode Shape (Elements per member: 2)

Buckling load factor

Node	Mode	UX	UY
BUCKLING ANALYSIS			
	Mode	Eigenvalue	Tolerance
	1	739,8	5,8092e-014
	2	2577,1	3,5889e-007

Elements per member: 2

Node	Mode	UX	UY
BUCKLING ANALYSIS			
	Mode	Eigenvalue	Tolerance
	1	737,6	1,4407e-012
	2	2524,7	9,9644e-007

Elements per member: 4

Node	Mode	UX	UY
BUCKLING ANALYSIS			
	Mode	Eigenvalue	Tolerance
	1	737,5	1,6957e-015
	2	2518,6	4,0617e-007

Elements per member: 8

Comparison of Results

Case	Buckling Load Factor		
	Theoretical	MIDAS	Ratio
Case 1		739.8	1.003
Case 2	737.9	737.6	0.999
Case 3		737.5	0.999

Reference

S. P. Timoshenko and J. M. Gere, "*Theory of Elastic Stability*", McGraw-Hill, N.Y., 1961.