

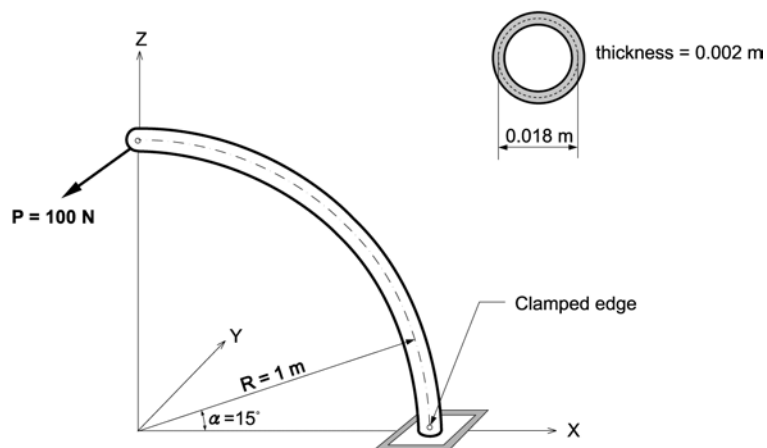
Static-29

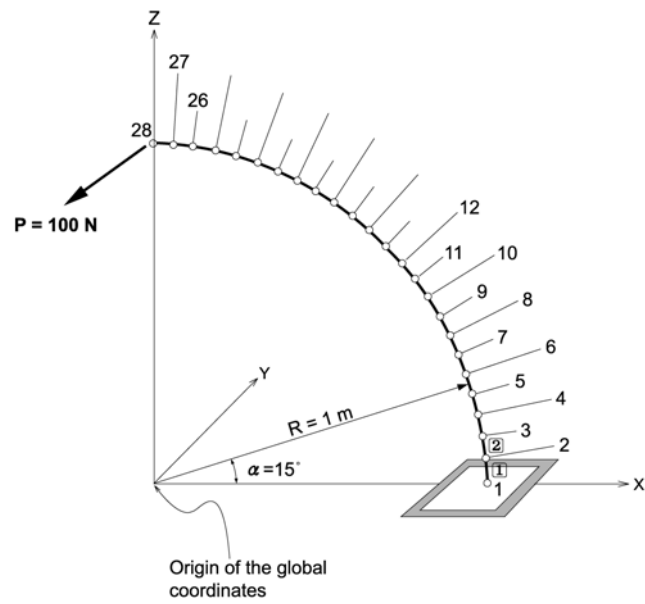
Title

Plane curved bar subjected to an out-of-plane load

Description

A plane curved bar is subjected to an out-of-plane load applied at the free end. Determine the displacement at the free end, and the bending moment and the torsional moment at the section $\alpha=15^\circ$.





Structural geometry and analysis model

MODEL

Analysis Type

3-D static analysis

Unit System

m, N

Dimension

Radius 1.0 m

Element

Beam element

Material

Modulus of elasticity $E = 2.0 \times 10^5$ MPa

Poisson's ratio $\nu = 0.3$

Sectional Property

Circular hollow section: outer diameter 0.02 m, inner diameter 0.016 m

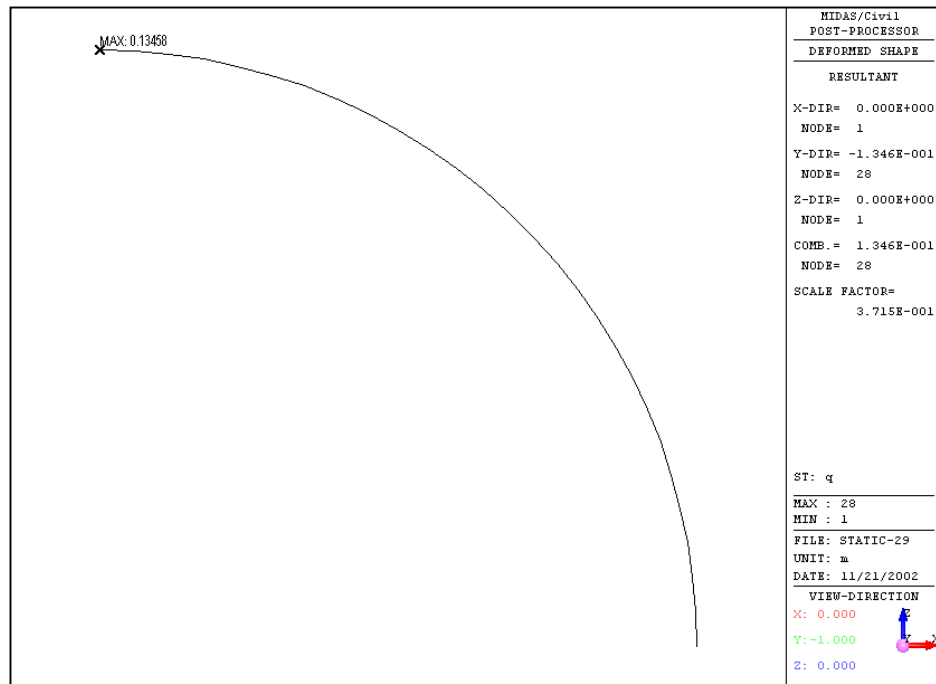
Boundary Condition

Node 1: Constrain all DOFs

Load Case

A concentrated load, -100 N is applied to the free end node 28 in the Y direction

Results



Displacement at free node in the Y direction

	Elem	Load	Part	Axial (N)	Shear-y (N)	Shear-z (N)	Torsion (N·m)	Moment-y (N·m)	Moment-z (N·m)
	1	q	2/4	0,00	100,00	0,00	97,0492	0,0000	99,9577
	2	q	2/4	0,00	100,00	0,00	91,2421	0,0000	99,6195
	3	q	2/4	0,00	100,00	0,00	85,4645	0,0000	98,9442
	4	q	2/4	0,00	100,00	0,00	79,7359	0,0000	97,9341
►	5	q	2/4	0,00	100,00	0,00	74,0758	0,0000	96,5926
	6	q	2/4	0,00	100,00	0,00	68,5032	0,0000	94,9243
	7	q	2/4	0,00	100,00	0,00	63,0371	0,0000	92,9348
	8	q	2/4	0,00	100,00	0,00	57,6959	0,0000	90,6308
	9	q	2/4	0,00	100,00	0,00	52,4977	0,0000	88,0201

Bending moment and torsional moment at the section $\alpha=15^\circ$

Comparison of Results

Results	Unit: m, N-m	
	Theoretical	MIDAS/Civil
Displacement at free node in the Y direction	-0.13462	-0.13458
Bending moment at $\alpha=15^\circ$	96.5925	96.5926
Torsional moment at $\alpha=15^\circ$	74.1180	74.0758

References

“*Guide de Validation des Progiciels de Calcul de Structures*”, SFM, Afnor Technique, France, 1990.

Timoshenko, S. “*Strength of Materials, Part I, Elementary Theory*”, 3rd Edition”, D. Van Nostrand Co., Inc., New York, NY., 1955.

Roark, R.J., and Young, W. C. “*Formulas for Stress and Strain*”, 5th edition”, McGraw-Hill, New York, NY., 1975.