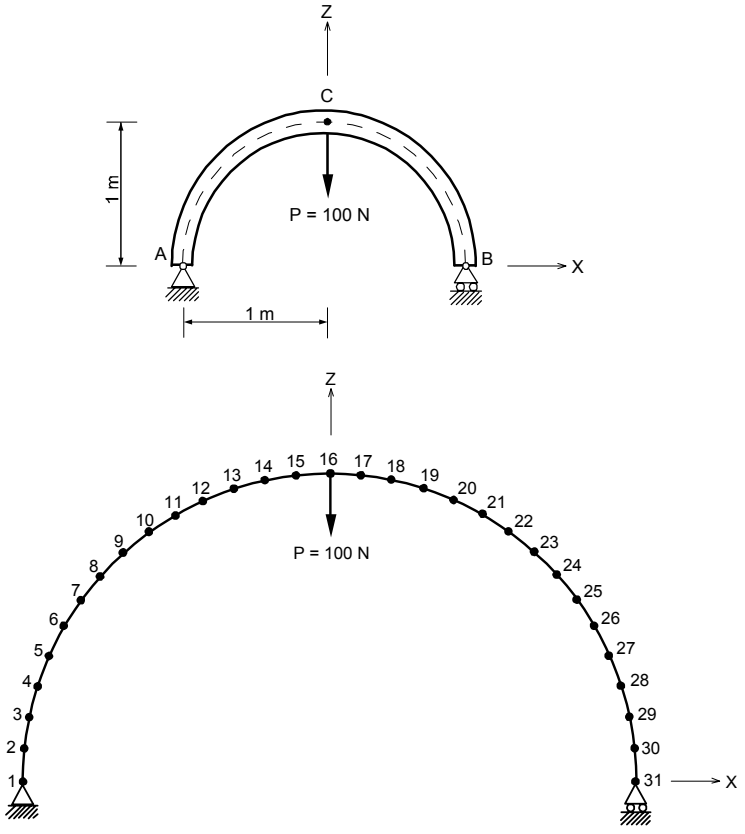
Static-42

Title

A bi-articulated slim arch

Description

Determine the vertical displacement at the point C , horizontal displacement at the point B and the rotation at the points A & B.



Structural geometry and analysis model

MODEL

Analysis Type

2-D static analysis

Unit System

m, N

Dimension

Radius 1 m

Element

Beam element

Material

Modulus of elasticity $E = 2.0\times10^{11}$ Pa
Poisson's ratio $\nu = 0.3$

Sectional Property

Area 1.131×10^{-4} m^2
Moment of inertia $I_x = 4.637\times10^{-9}$ m^4

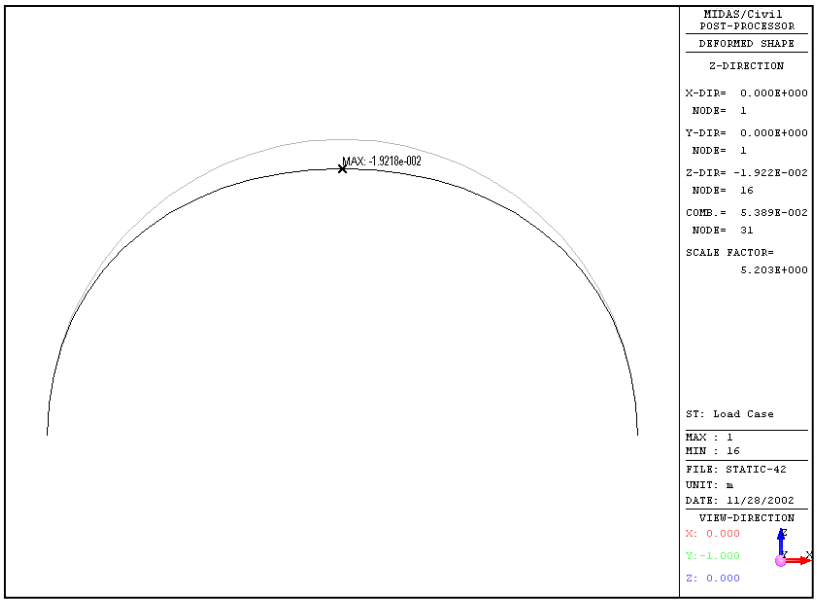
Boundary Condition

Node 1: Constrain D_X and D_Z
Node 31: Constrain D_Z

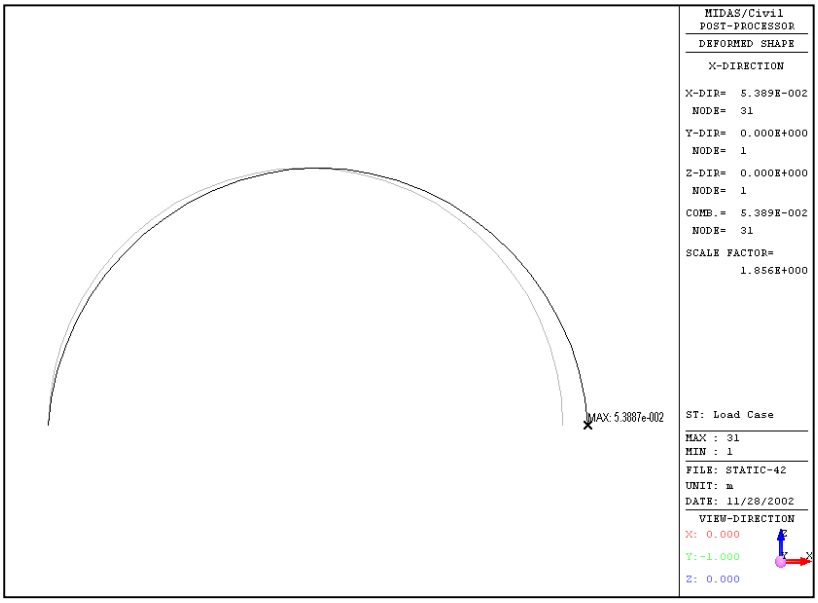
Load Case

A concentrated load, P = 100 N is applied to the node 16 in the -Z direction.

Results



Z-displacement (δ_Z) at the point C



X-displacement (δ_X) at the point B

	Node	Load	DX (m)	DY (m)	DZ (m)	RX ([rad])	RY ([rad])	RZ ([rad])
▶	1	Load Case	0,0000e+000	0,0000e+000	0,0000e+000	0,0000e+000	3,0809e-002	0,0000e+000
	31	Load Case	5,3887e-002	0,0000e+000	0,0000e+000	0,0000e+000	-3,0809e-002	0,0000e+000

Y-rotation (θ) at the point A and B

Comparison of Results

Unit: m, rad

Results	point	Theoretical	MIDAS/Civil
Displacement (δ_Z)	C	-1.9206×10^{-2}	-1.9218×10^{-2}
Displacement (δ_X)	B	5.3912×10^{-2}	5.3887×10^{-2}
Rotation (θ)	A	3.0774×10^{-2}	3.0809×10^{-2}
Rotation (θ)	B	-3.0774×10^{-2}	-3.0809×10^{-2}

Reference

P. Dellus, "*Résistance des matériaux*", Paris, Technique et Vulgarisation, 1958