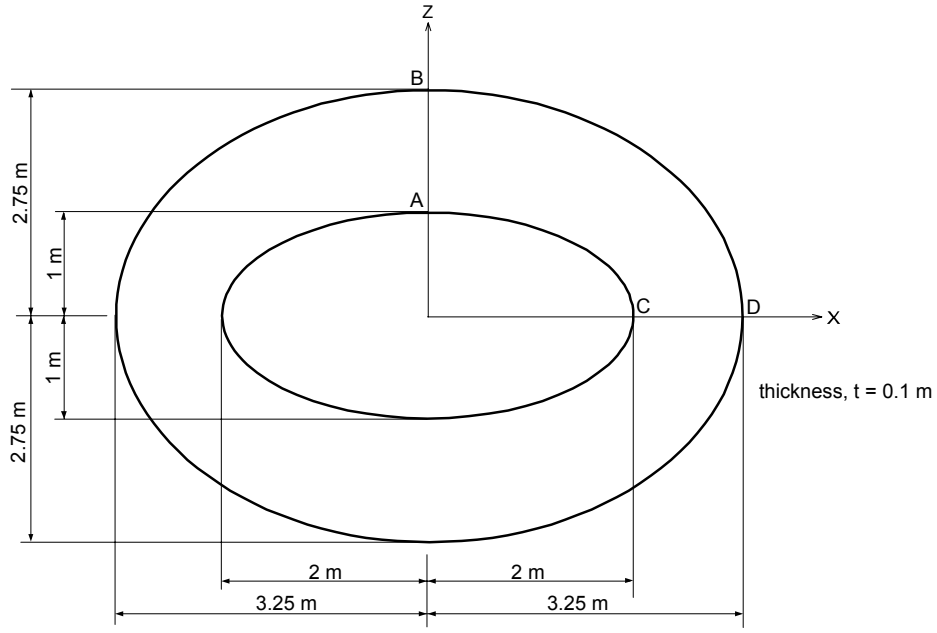
Static-31

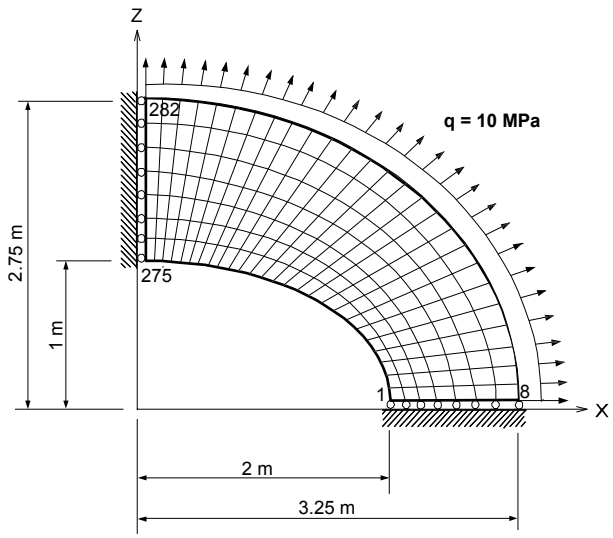
Title

Elliptic membrane under uniformly distributed load

Description

An elliptical membrane of thickness, t and geometrical properties is subjected to a uniformly distributed outward pressure.
Determine the edge stress at the target point C.





Structural geometry and analysis model

MODEL

Analysis Type

2-D static analysis (X-Z plan)

Unit System

m, N

Dimension

Major radius 6.5 m Minor radius 5.5m

Element

Plane stress element, Plate element

Material

Modulus of elasticity $E = 2.1\times10^5$ MPa
Poisson's ratio $\nu = 0.3$

Sectional Property

Thickness 0.10 m

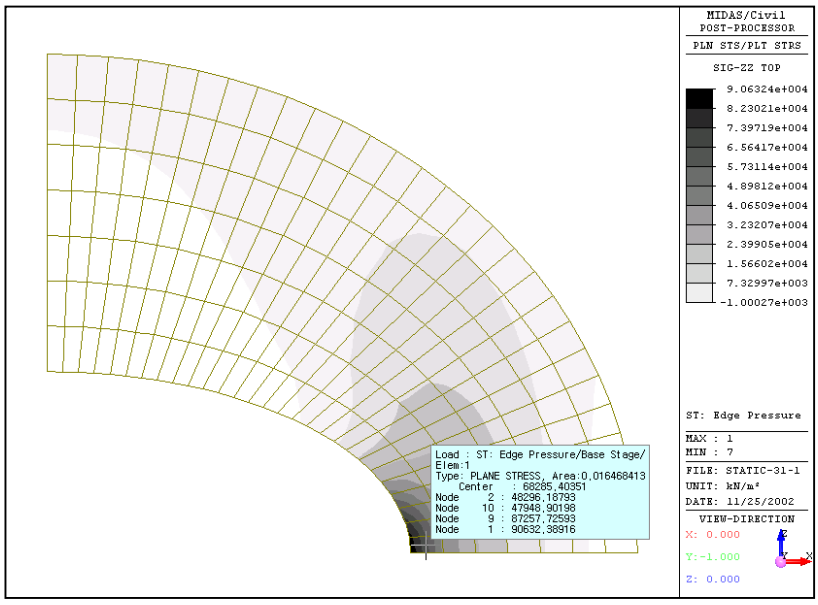
Boundary Condition

Node 1~8: Constrain D_Z and R_Y
Node 275~282: Constrain D_X and R_Y

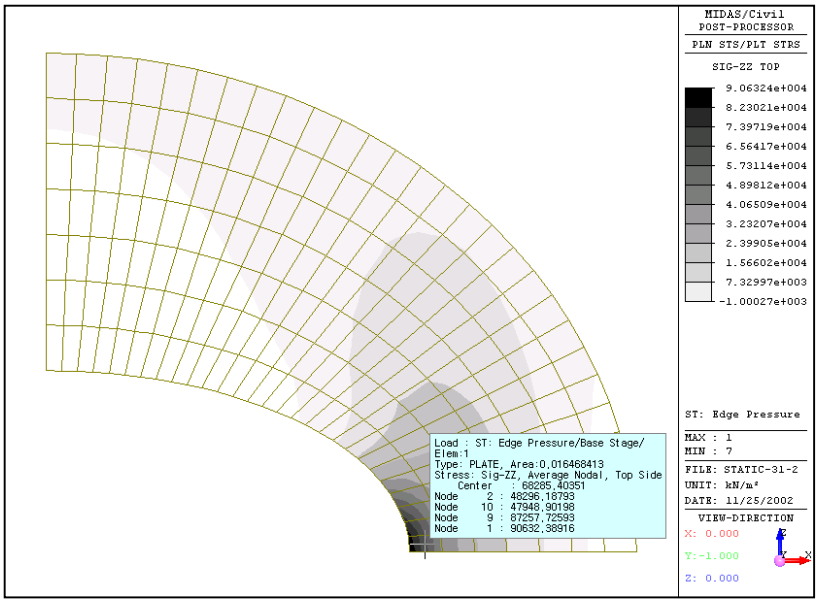
Load Case

Uniformly distributed outward pressure, q = 10 MPa

Results



The edge stress (σ_Z) at the target point C (Plane stress element)



The edge stress (σ_Z) at the target point C (Plate element)

Comparison of Results

Unit: MPa

Result	Element type	Theoretical	MIDAS/Civil
Stress (σ_Z)	Plane stress	92.700	90.632
	Plate		90.632

Reference

NAFEMS. (1989). "*The Standard NAFEMS Benchmarks*", Rev. No TSNB, National Engineering Laboratory, E. Kilbride, Glasgow, UK.