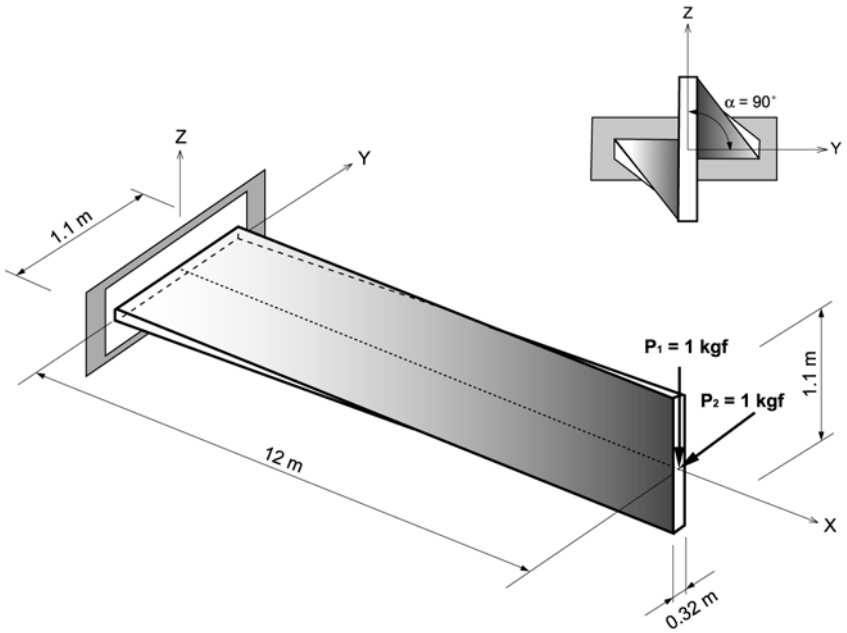
Static-33

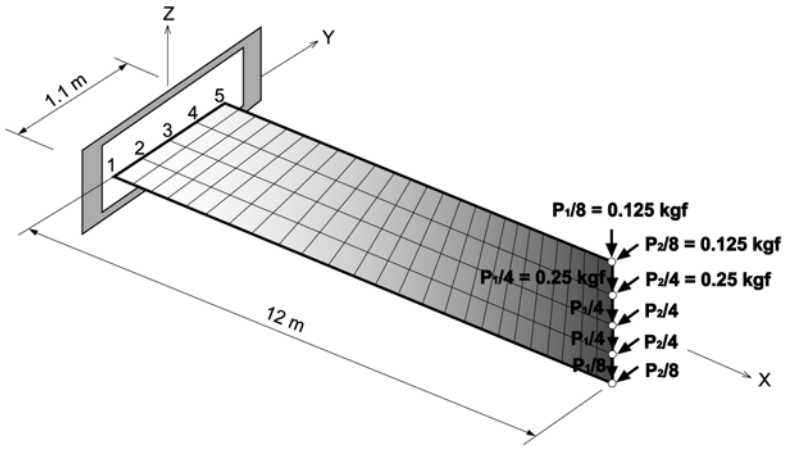
Title

Twisted beam under tip shear loads

Description

A twisted cantilever beam of rectangular cross-section is subjected to the action of unit static shear loads applied at the tip. Load P_1 is applied in the in-plane and load P_2 is applied in the out-of-plane directions. The undeformed cantilever configuration has a 90° twist. Determine the tip displacements in the load directions.





Structural geometry and analysis model

MODEL

Analysis Type

3-D static analysis

Unit System

m, kgf

Dimension

Length 12 m

Element

Plate element

Material

Modulus of elasticity $E = 2.9\times10^7$ kgf/m^2

Poisson's ratio $\nu = 0.22$

Sectional Property

Rectangular cross-section: b = 1.1 m, t = 0.32 m

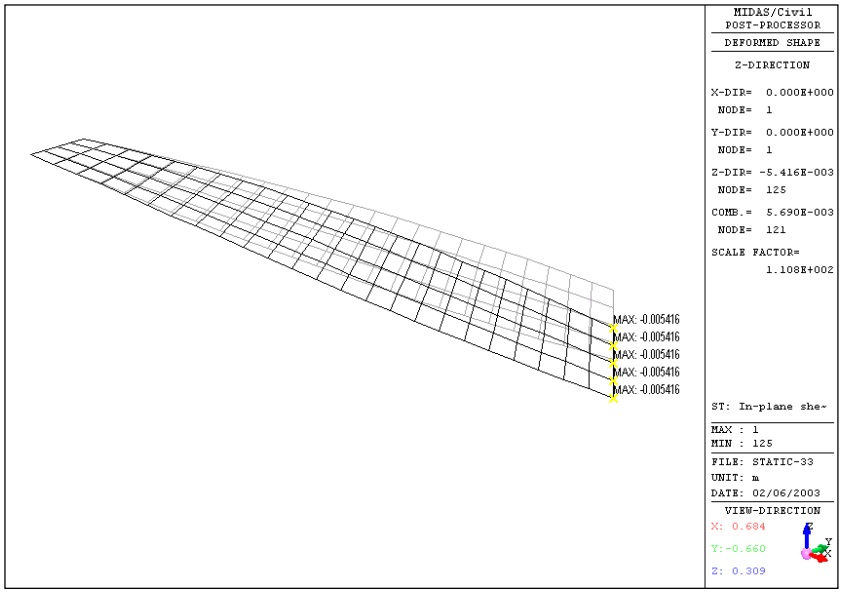
Boundary Condition

Node 1,2,4,5: Constrain D_X, D_Z and R_Y
Node 3: Constrain D_X, D_Y, D_Z and R_Y

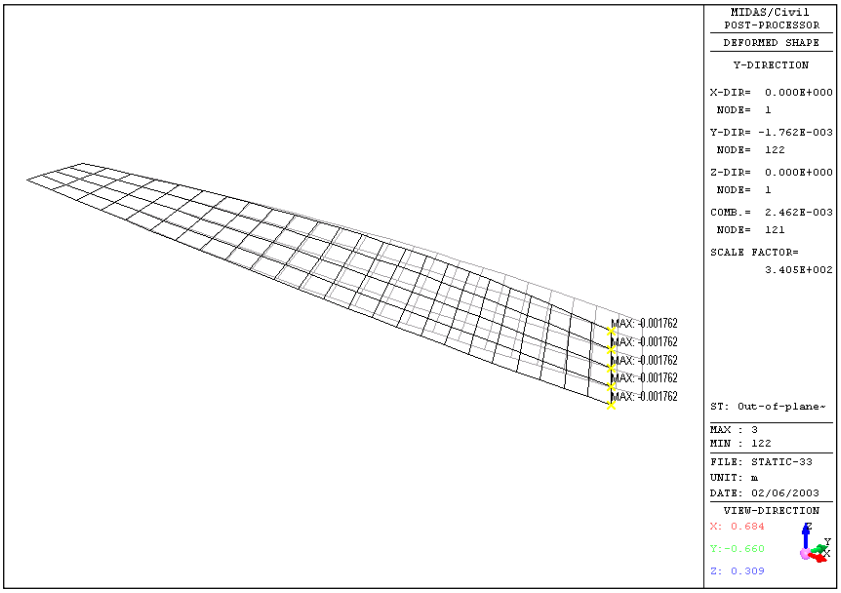
Load Case

Case 1: Unit static shear loads P_1 = 1.0 kgf (Vertical)
Case 2: Unit static shear loads P_2 = 1.0 kgf (Horizontal)

Results



Tip displacements in the load directions (Case 1)



Tip displacements in the load directions (Case 2)

Comparison of Results

Unit: in

Results	Theoretical	MIDAS/Civil
In-Plane (δ_Z)	-0.005424	-0.005416
Out-of-Plane (δ_Y)	-0.001754	-0.001780

Reference

MacNeal, R. H., and Harder, R. L. (1985). "*A Proposed Standard Set of Problems to Test Finite Element Accuracy*", Finite Element in Analysis and Design, **1**, Elsevier Science Publishers, North-Holland, 3-20.