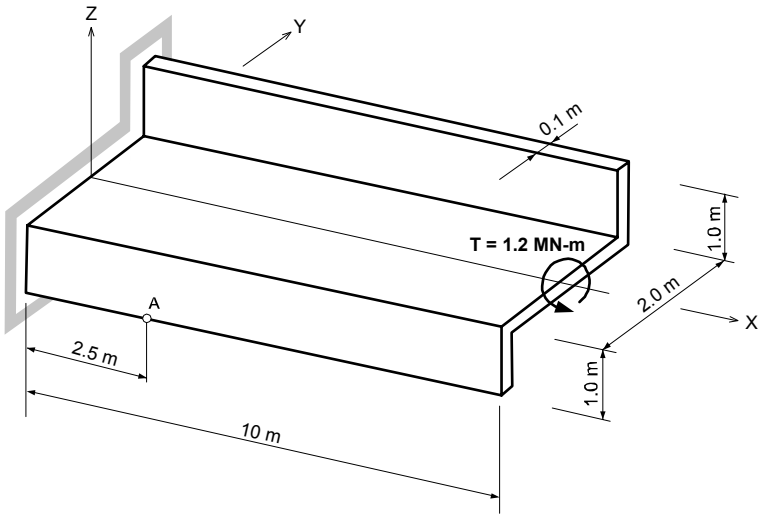
Static-36

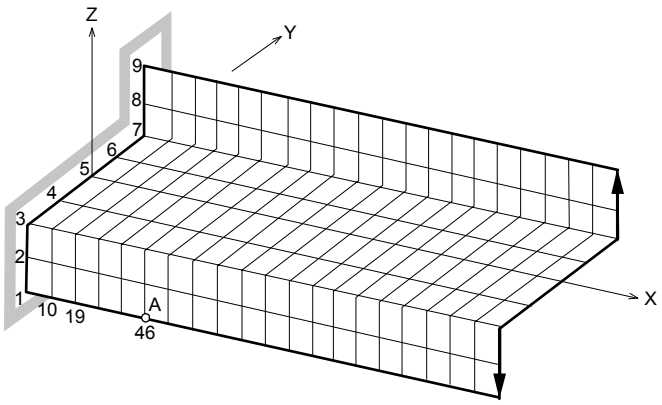
Title

Cantilever bar of z-cross section torsion

Description

A cantilever bar of Z-section is twisted by torque moment applied at the end.
Determine the axial stress at the target point A.





Structural geometry and analysis model

MODEL

Analysis Type

3-D static analysis

Unit System

m, N

Dimension

Length 10 m

Element

Plate element

Material

Modulus of elasticity $E = 210 \times 10^9$ Pa
Poisson's ratio $\nu = 0.3$

Sectional Property

Thickness 0.1 m

Boundary Condition

Node 1~9: Constrain all DOFs

Load Case

A torque moment, T = 1.2 MN-m is applied at the end.

Results

	Elem	Load	Node	Part	Sig-xx (kN/m²)	Sig-yy (kN/m²)	Sig-xy (kN/m²)	Sig-Max (kN/m²)	Sig-Min (kN/m²)	Angle ([deg])	Sig-EFF (kN/m²)
	33	Torque	Cent	Top	-81366	-2382	-13206	-233	-83515	-81	83399
				Bot	-70883	2196	20015	7319	-76006	76	79917
	33	Torque	38	Top	-42717	-3734	-12636	3	-46454	-74	46456
				Bot	-33920	5162	19445	13189	-41946	68	49866
	33	Torque	47	Top	-42870	-5590	-13751	-1066	-47394	-72	46869
				Bot	-33766	3789	20561	12856	-42834	66	50504
▶	33	Torque	46	Top	-120037	-892	-13771	678	-121608	-83	121949
				Bot	-107824	-909	20580	2916	-111649	79	113135
	33	Torque	37	Top	-119839	687	-12655	2001	-121154	-84	122167
				Bot	-108022	741	19465	4120	-111401	80	113517

*The axial stress (σ_x) at the target point **A***

Comparison of Results

Unit: MPa

Result	Theoretical	MIDAS/Civil
Max stress (σ_x)	-108.000	-107.824

Reference

NAFEMS. (1990). "*The Standard NAFEMS Benchmarks*", Rev. No. 3, Publication TSNB, National Engineering Laboratory, E. Kilbride, Glasgow, UK.