2.11 Z-section cantilever

REFERENCE	NAFEMS [2-3]
KEYWORDS	shell elements, solid elements, layered solid elements
MODEL FILENAME	Linearstatic11.nfxa

Figure 2.11.1 shows a Z-section cantilever clamped on one end. Torque moment of 1.2 *MN m* is applied on the other end by uniformly distributed edge shears, S = 0.6 *MN* at each flange. The cantilever model is discretized using shell, solid and layered solid elements. Axial stress, σ_x^A is evaluated at point A and compared with the reference solution. The solution from the standard NAFEMS benchmarks is taken as the reference.

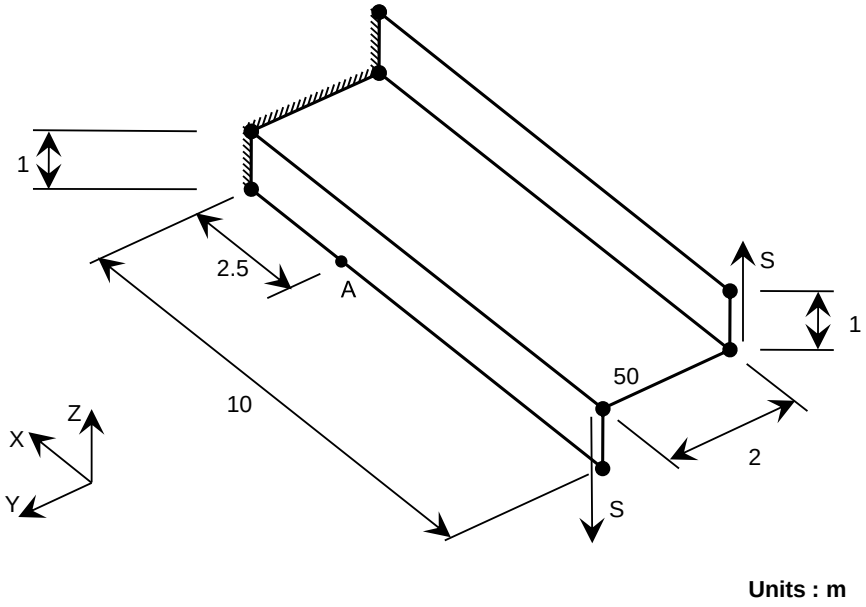

Figure 2.11.1 Z-section cantilever model (all units in meters)

Material data	Young's modulus	*E = 210 GPa*
	Poisson's ratio	*ν = 0.3*
Section property	Thickness	*t = 0.1 m*

Table 2.11.1 Stress σ_X^A at point A obtained using shell elements

		σ_X^A [*MPa*]
Reference		*-108*
Element type	Number of elements	
TRIA-3	48	*-30.80* *-76.58**
QUAD-4	24	*-110.23* *-115.43**
TRIA-6	48	*-107.76*
QUAD-8	24	*-110.09*

* obtained using shell element formulations with 6-dof per node.

Table 2.11.2 Stress σ_X^A at point A obtained using solid elements

		σ_X^A [*MPa*]
Reference		*-108*
Element type	Number of elements	
PENTA-6	80	*-3.047**
HEXA-8	40	*-107.357**
PENTA-15	80	*-104.509**
HEXA-20	40	*-107.094**

* obtained by averaging stresses at top and bottom nodes

Table 2.11.3 Stress σ_X^A at point A obtained using shell elements tied to layered solid elements by contact condition

		σ_X^A [*MPa*]
Reference		*-108*
Element type	Number of elements	
QUAD-4 (PENTAL-6)	16 (16)	*-110.11*
QUAD-4 (HEXAL-8)	16 (8)	*-112.96*