

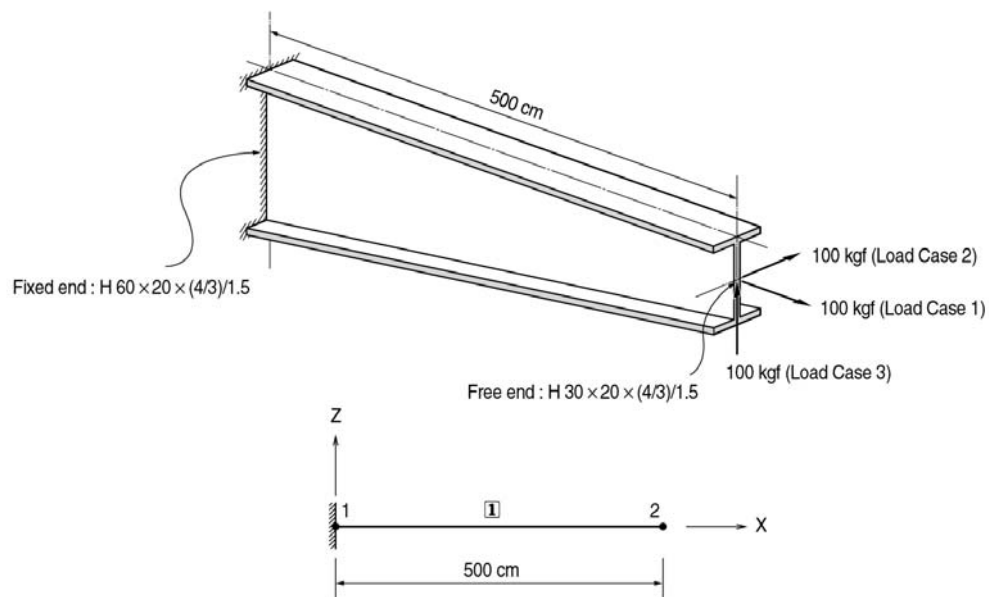
Static-10

Title

Tapered cantilever beam subjected to a concentrated load at the free end

Description

A concentrated load is applied at the free end of a tapered cantilever beam.
Analyze this tapered cantilever beam modeled with beam and solid elements individually.



Structural geometry and analysis model

Model

Analysis Type

3-D static analysis

Unit System

cm, kgf

Dimension

Length 500cm

Element

Tapered beam element

Material

Steel Modulus of elasticity steel $E = 2.1 \times 10^6 \text{ kgf/cm}^2$

Poisson's ratio $\nu = 0.3$

Section Property

Fixed end section $H 60 \times 20 \times (4/3)/1.5$

Free end section $H 30 \times 20 \times (4/3)/1.5$

I_{yy} varies parabolically and other section properties vary linearly

Boundary Condition

Node 1 ; Constrain all DOFs

Load Case

A concentrated load, 100 kgf is applied to the node 2 in each direction of X, Y and Z for the load cases 1,2 and 3 respectively.

Results

Displacements

	Node	Load	DX (cm)	DY (cm)	DZ (cm)	RX ([rad])	RY ([rad])	RZ ([rad])
▶	1	CASE1	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
	2	CASE1	0.0002073	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
	1	CASE2	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
	2	CASE2	0.0000000	0.9892034	0.0000000	0.0000000	0.0000000	0.0029639
	1	CASE3	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
	2	CASE3	0.0000000	0.0000000	0.0403868	0.0000000	-0.0001365	0.0000000

Comparison of Results

Unit : cm			
Load Case	Displacement	SAP2000	MIDAS/Civil
1	X	0.0002073	0.0002073
2	Y	0.9884755	0.9892034
3	Z	0.0403868	0.0403868

Reference

Tomas J.R. Hughes “*The Finite Element Method*”, Chapter 5