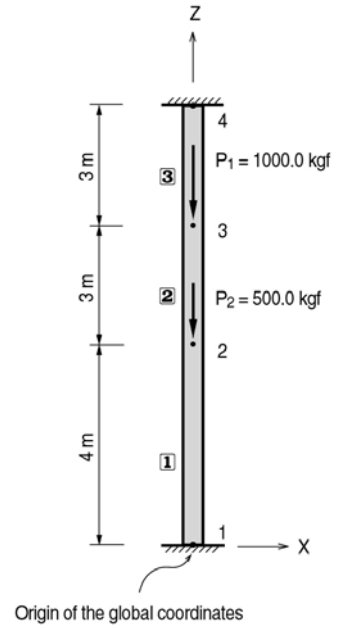
Static-1

Title

Statically indeterminate structural analysis for reaction forces

Description

A prismatic bar with fixed ends is loaded axially at two intermediate points with forces P_1 and P_2.
Determine the reaction forces at the supports.



Structural geometry and analysis model

Model

Analysis Type

2-D static analysis (X-Z plane)

Unit System

m, kgf

Dimension

Length 10.0 m

Element

Beam element

Material

Modulus of elasticity $E = 3.0 \times 10^7$ kgf/m^2

Section Property

$B \times H = 1.0$ m $\times$ 1.0 m

Area $A = 1.0$ m^2

Boundary Condition

Nodes 1 and 4 ; Constrain all DOFs.

Load Case

Axially concentrated loads P_1 and P_2 are applied at the nodes 3 and 2 respectively in the -Z direction.

$P_1 = 1000.0$ kgf, $P_2 = 500.0$ kgf

Results

Reaction Forces

	Node	Load	FX (kgf)	FY (kgf)	FZ (kgf)	MX (kgf - m)	MY (kgf - m)	MZ (kgf - m)
▶	1	CASE1	0,000000	0,000000	600,000000	0,000000	0,000000	0,000000
	4	CASE1	0,000000	0,000000	900,000000	0,000000	0,000000	0,000000
	SUMMATION OF REACTION FORCES PRINTOUT							
			FX (kgf)	FY (kgf)	FZ (kgf)			
		CASE1	0,000000	0,000000	1500,000000			

Comparison of Results

Unit : kgf

Node	Reaction force	
	Theoretical	MIDAS/Civil
1	600.0	600.0
4	900.0	900.0

Reference

Timoshenko, S., "*Strength of Materials, Parts I, Elementary Theory and Problems*", 3rd Edition, D. Van Nostrand Co., Inc., New York, 1956, p. 26.