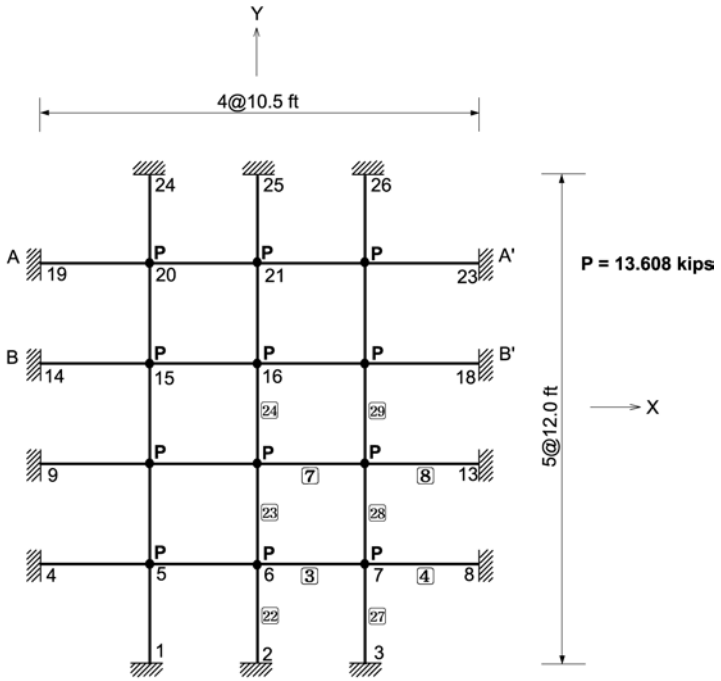
GNL-2

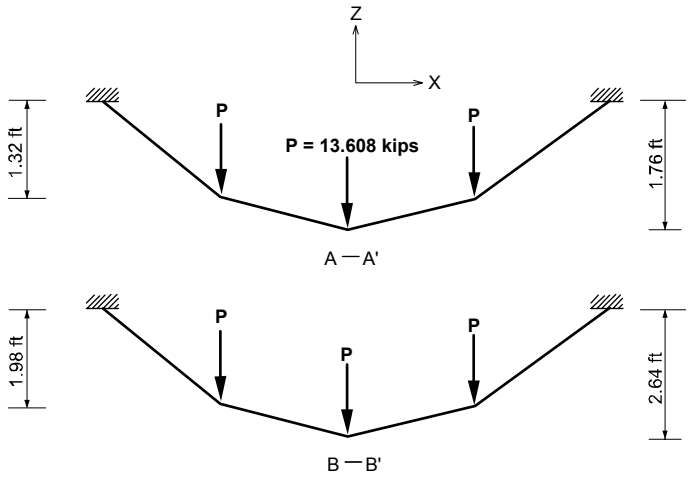
Title

Stress analysis of a cable net structure

Description

A cable net structure is subjected to vertical loads applied at every interior node. Determine the displacements of the nodes and member forces.





Structural geometry and analysis model

MODEL

Analysis Type

3-D geometrical nonlinear analysis

Unit System

ft, kips

Dimension

Length 60 ft (Projected)

Element

Truss element

Material

Modulus of elasticity $E = 3.6\times10^6$ ksf (kips/ft^2)
Poisson's ratio $\nu = 0.0$

Sectional Property

Area: 0.01 ft^2

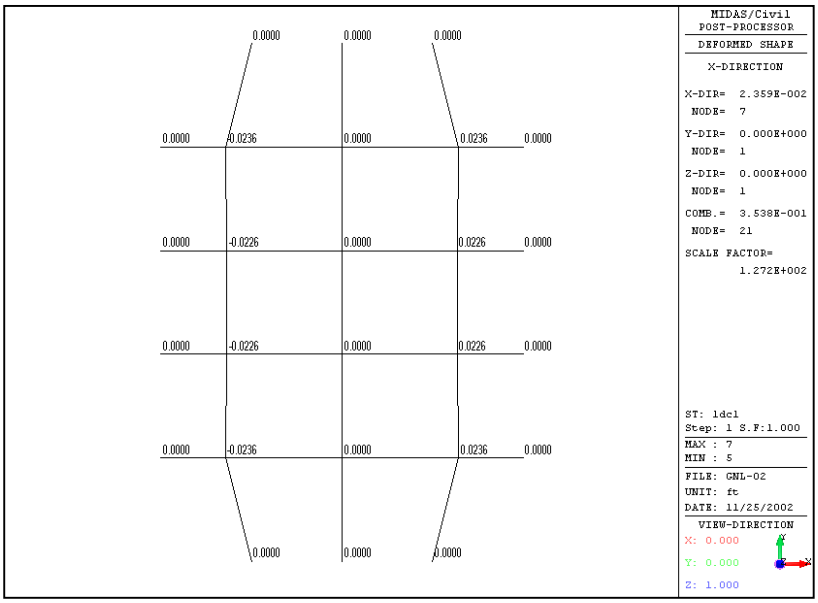
Boundary Condition

Node 1~4, 8, 9, 13, 14, 18, 19, 23~26: Constrain all DOFs

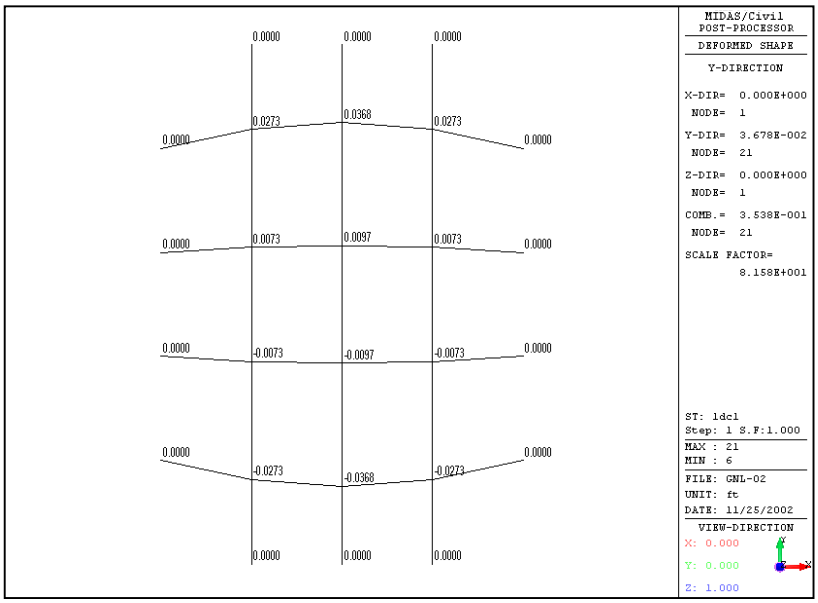
Load Case

A concentrated load, P = 13.608 kips is applied at every interior node in –Z direction.

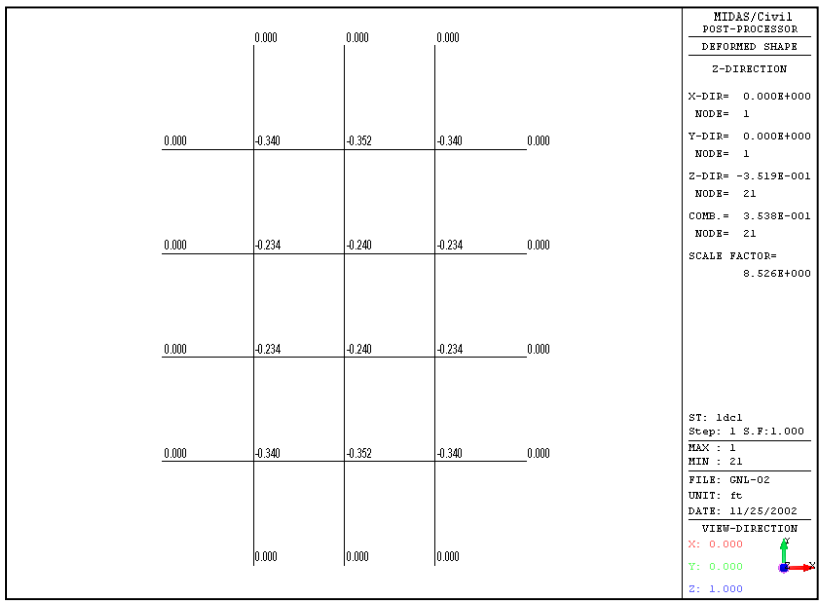
Results



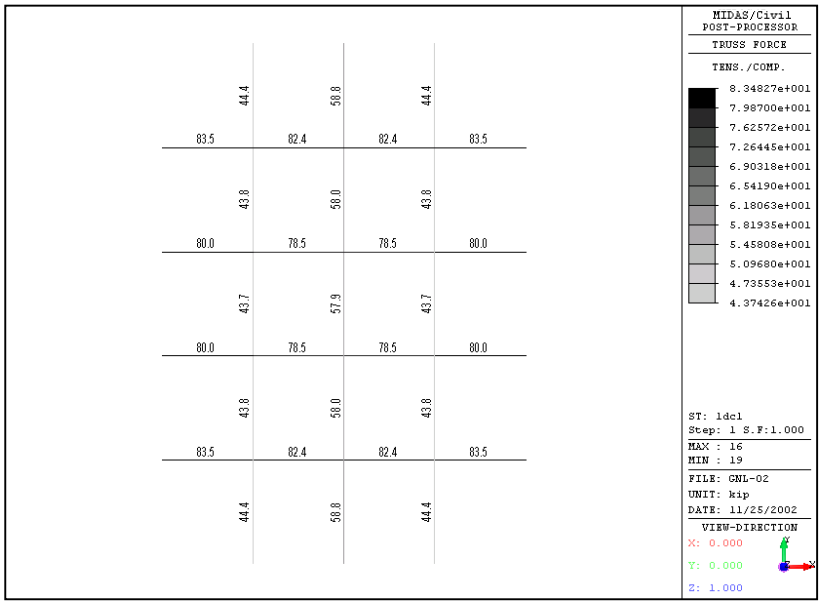
X-displacements (δ_X)



Y-displacements (δ_Y)



Z-displacements (δ_Z)



Member forces

Comparison of Results

Unit: ft, kips

Results	Node	Ref.1 & Ref.2	Ref.3	MIDAS/Civil
Displacement (δ_X)	15	-0.0225	-0.0226	-0.0226
	16	0.0000	0.0000	0.0000
	20	-0.0235	-0.0236	-0.0236
	21	0.0000	0.0000	0.0000
Displacement (δ_Y)	15	0.0073	0.0073	0.0073
	16	0.0096	0.0096	0.0097
	20	0.0273	0.0273	0.0273
	21	0.0366	0.0367	0.0368
Displacement (δ_Z)	15	-0.234	-0.234	-0.234
	16	-0.239	-0.240	-0.240
	20	-0.340	-0.340	-0.340
	21	-0.351	-0.352	-0.352

Member forces										
Element	3	4	7	8	22	23	24	27	28	29
Ref.1 & Ref.2	82.5	83.6	78.5	80.0	58.9	58.0	57.9	44.4	43.8	43.8
Ref.3	82.4	83.5	78.5	80.0	58.9	58.0	57.8	44.4	43.9	43.8
MIDAS/Civil	82.4	83.5	78.5	80.0	58.8	58.0	57.9	44.4	43.8	43.7

References

John W. Leonard, "*Tension Structures*", McGraw Hill Book Company, pp. 115-117, 1988

Lo, A, "*Nonlinear Dynamic Analysis of Cable and Membrane structures*", Ph. D. Dissertation, Oregon State University, 1981

Baron, F. and M.S. Vendatesan, "*Nonlinear Analysis of Cable and Truss Structures*", Journal of the Structural Division, ASCE, Vol. 97 pp. 679-710, 1971