

Cable-1

Title

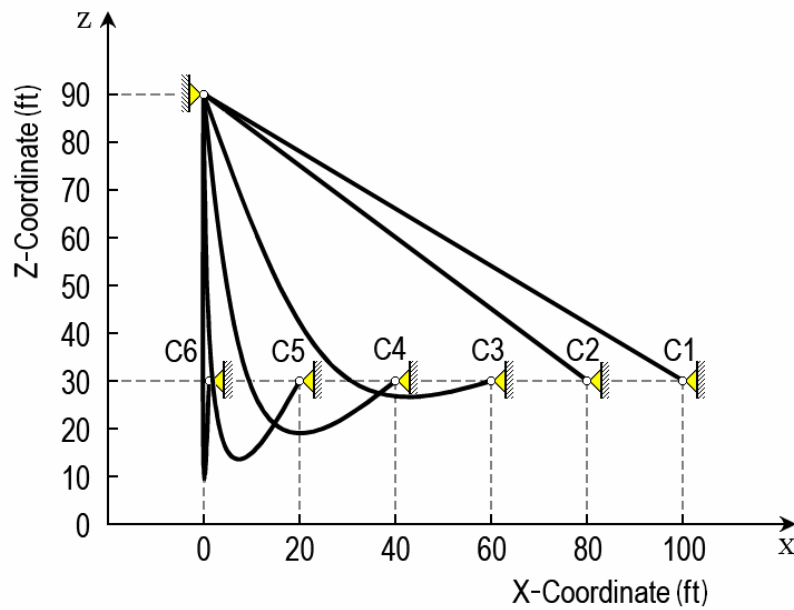
Cables under vertical uniform loads and thermal loads

Description

Six cables each have an initial length of 100 feet and a unique support configuration. Each cable is subjected to a vertical uniform load of 1.0 kip/ft (including cable self-weight) and a thermal load of 100 °F.

The finite element model was created by generating 2-node cable elements.

Perform cable element analysis to determine the support reactions at supports C1-C6.



Structural geometry and boundary conditions

Model

Analysis Type

Cable element analysis

Unit System

ft, kips

Dimension

Unstrained length 100 ft

Element

Cable element

Material

Modulus of elasticity $E = 208,330 \text{ kips/in}^2$

Thermal coefficient $C = 6.5\text{e-}6 \text{ 1/F}$

Section Property

Pipe: Outer diameter 2.4 in , Thickness 0.24 in

Boundary Condition

Both ends pinned

Loads

Self weight 1 kips/ft

Thermal change 100°F

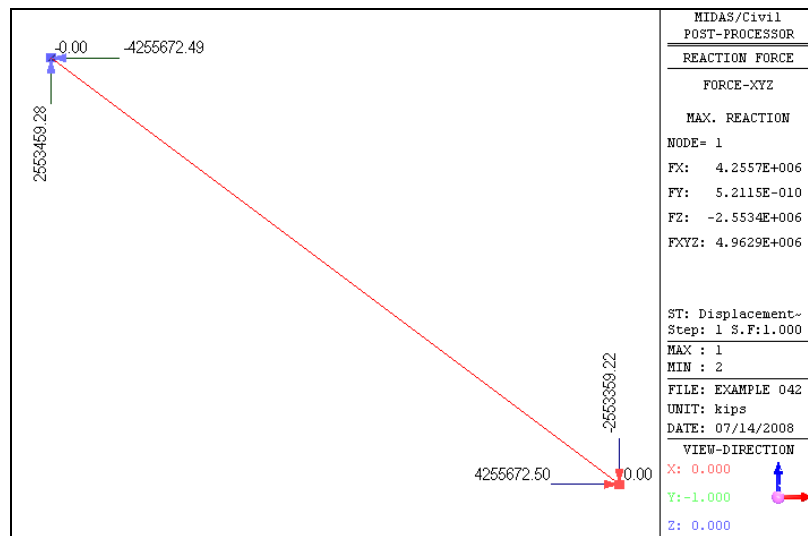
Specified Displacements

Case	Specified Displacements in DX direction (ft)
C1	20
C2	0
C3	-20
C4	-40
C5	-60
C6	-80

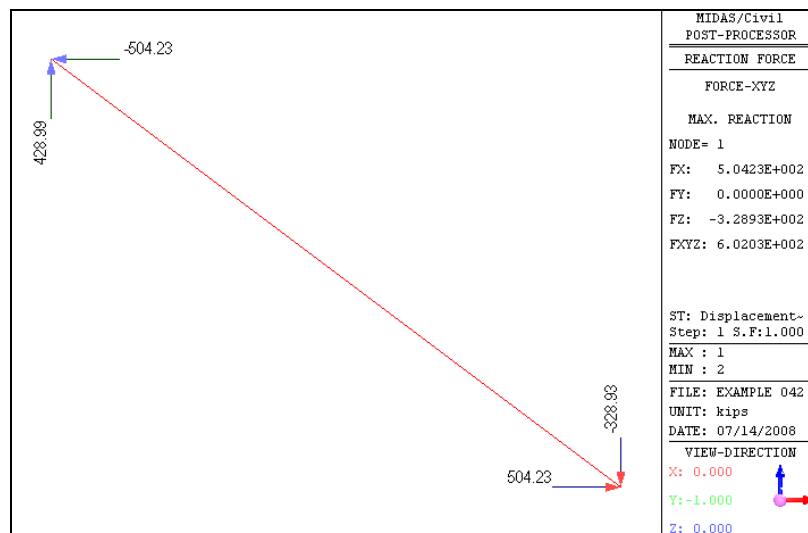
Results

Cable Analysis Results: Reactions of the cable elements

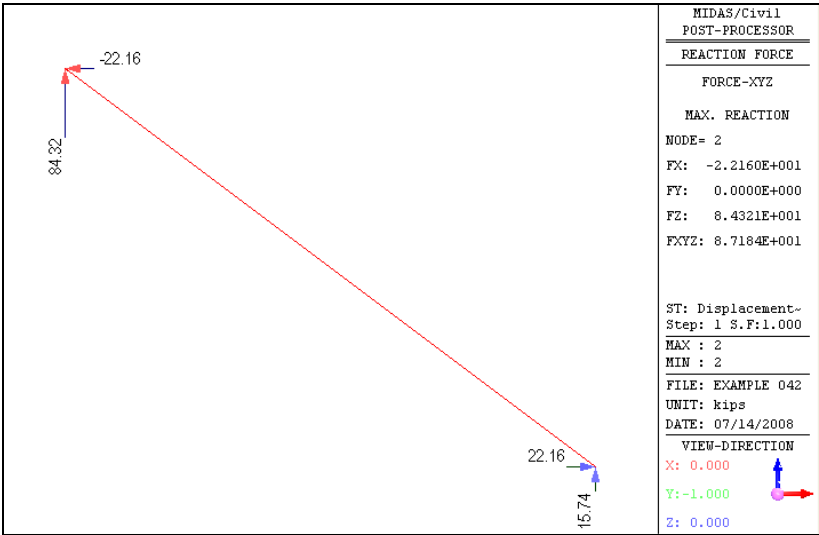
Case 1: C1



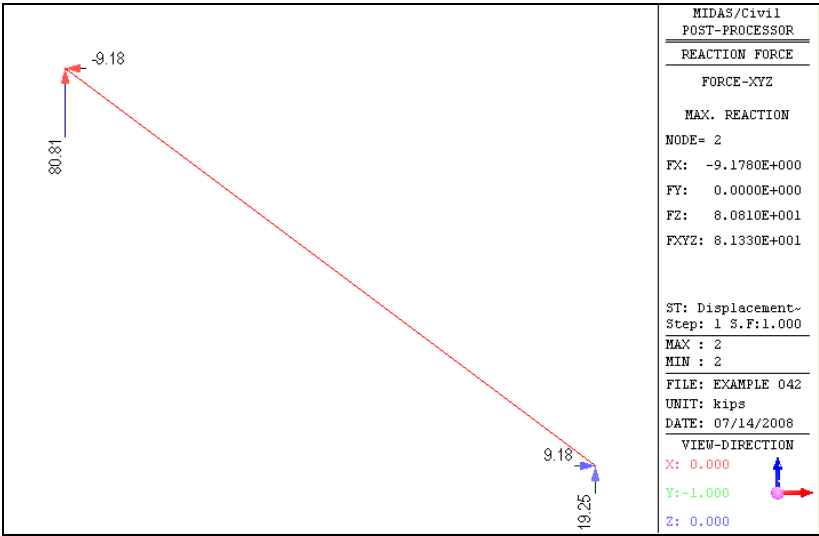
Case 2: C2



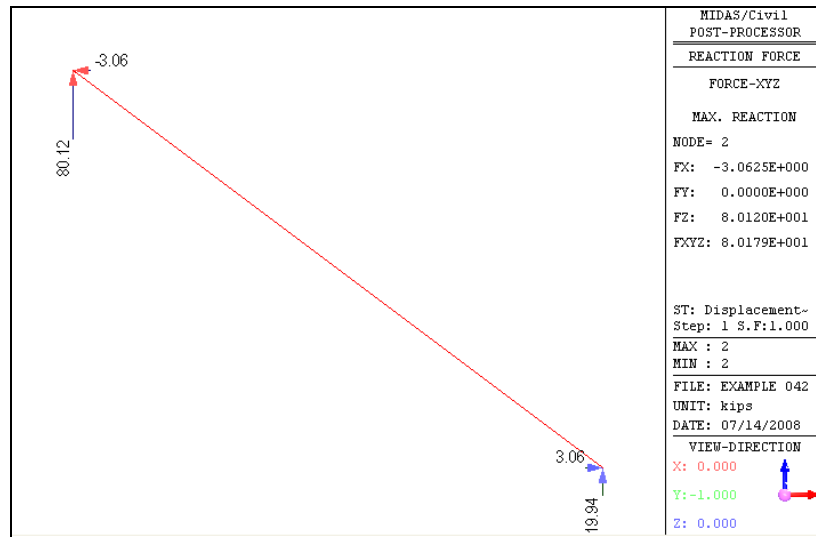
Case 3: C3



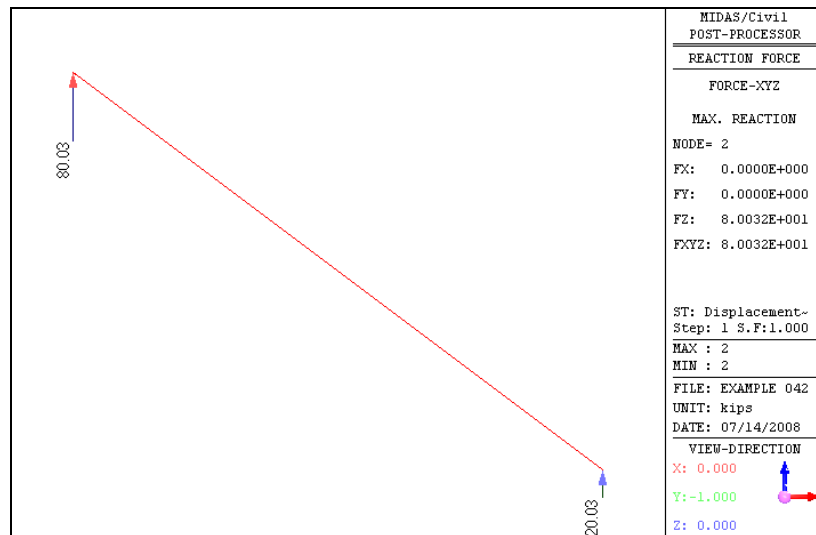
Case 4: C4



Case 5: C5



Case 6: C6



Comparison of Results

The response was computed with a convergence tolerance of 0.0001. The total load was applied in one load step (with the stiffness matrix re-calculated after every iteration). The support reactions at C1-C6 are illustrated in the table below and compared with the target solutions reported by Peyrot and Goulois [1].

Unit: kips				
Cable	Direction	MIDAS	Target	Ratio MIDAS/Target
C1	X-Direction	4,255,672.50	4,170,000.00	1.02
	Z-Direction	-2,553,359.22	-2,511,000.00	1.02
C2	X-Direction	504.23	504.00	1.00
	Z-Direction	-328.93	-328.80	1.00
C3	X-Direction	22.16	22.15	1.00
	Z-Direction	15.74	15.73	1.00
C4	X-Direction	9.18	9.17	1.00
	Z-Direction	19.25	19.24	1.00
C5	X-Direction	3.06	3.06	1.00
	Z-Direction	19.94	19.93	1.00
C6	X-Direction	0.00	0.00	1.00
	Z-Direction	20.03	20.02	1.00

Reference

1. Peyrot, A.H., and Goulois, A.M. (1979). "Analysis of cable structures." Computers & Structures, Vol. 10, No. 5, 805–813.