

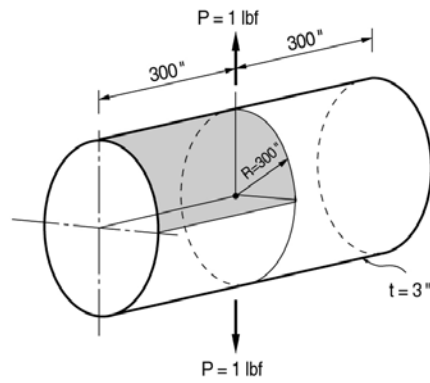
Static-23

Title

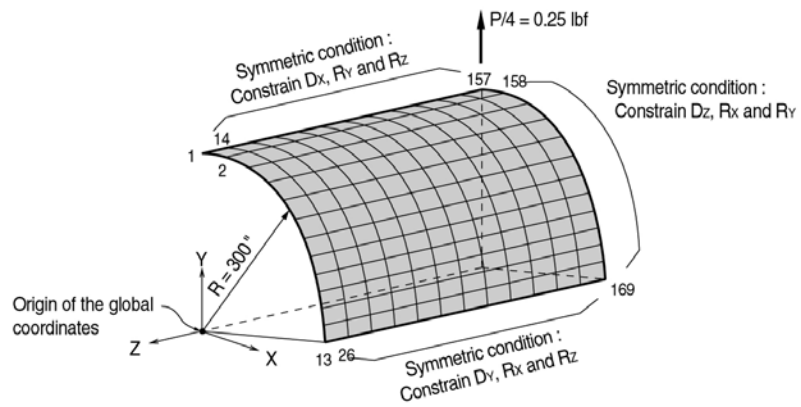
Thin cylindrical shell under two point loads

Description

Compute the displacements of a thin cylindrical shell. A pair of equal and opposite point loads act on a thin cylindrical shell transverse to the cylindrical axis. Only a quarter of a half model may be analyzed due to symmetry.



(a) Thin cylindrical shell



(b) Quarter of a half model

Structural geometry and analysis model

MODEL

Analysis Type

3-D static analysis

Unit System

in, lbf

Dimension

Length 300 in Radius 300 in

Element

Plate element (Thin type)

Material

Modulus of elasticity $E = 3 \times 10^6$ psi

Poisson's ratio $\nu = 0.3$

Element Property

Element size $a \times b = [300/12 \text{ in} \times 2\pi] \times [300/4/12 \text{ in}]$

Thickness $t = 3 \text{ in}$

Boundary Condition

Nodes 157 ~ 169 ; Constrain Dz, Rx and Ry. (Symmetric about X-Y plane)

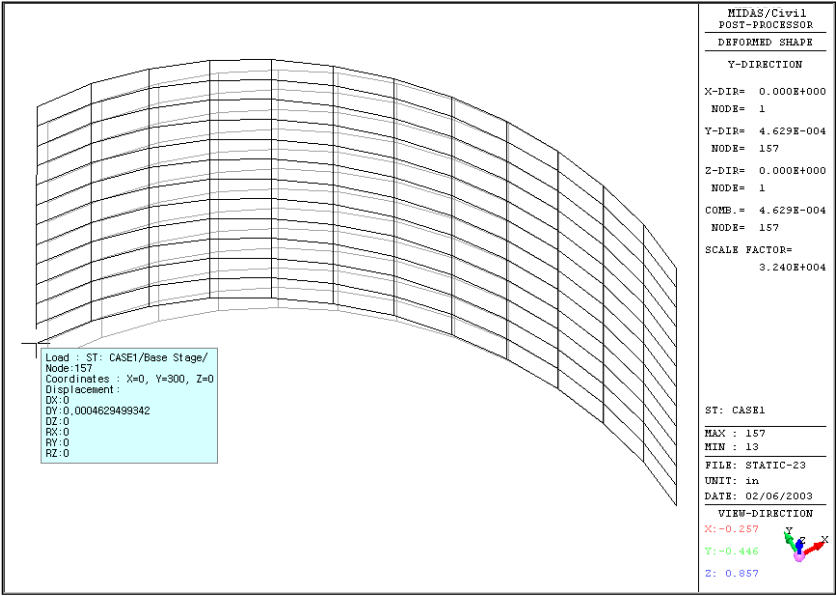
Nodes 1 ~ 157 ; Constrain Dx, Ry and Rz. (Symmetric about Y-Z plane)
(at an increment of 13)

Nodes 13 ~ 169 ; Constrain Dy, Rx and Rz. (Symmetric about Z-X plane)
(at an increment of 13)

Load Case

A point load, 1.0/4 lbf acts at the node 157 in the Y direction.

Results



Deformed shape of the structure (Node 157)

Comparison of Results

Unit : in			
Result	Theoretical	NISA II	MIDAS/Civil
Maximum displacement (δ_Y)	4.5197×10^{-4}	4.62516×10^{-4}	4.6295×10^{-4}

※ The maximum displacement occurs at the node 157.

References

S. Timoshenko, S. Woinowsky-Krieger, “*Theory of Plates and Shells*”, 2nd Edition
McGraw-Hill Book Co. Inc., New York, 1959.

“*NISA II, Verification Problems Manual*”, Version 91.0, Engineering Mechanics
Research Corporation, 1991, Problem 2.13.