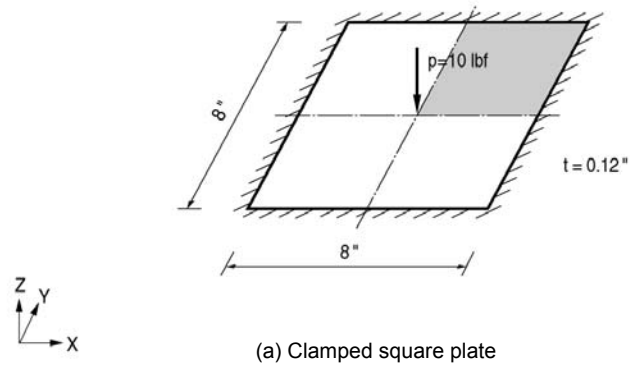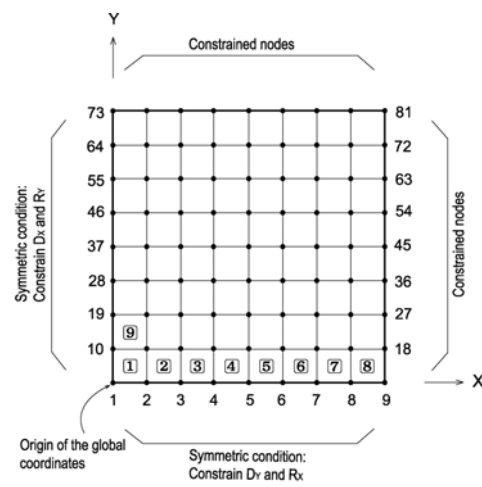# Static-20

Title

Clamped square plate with a central concentrated load

Description

A square plate supported on fixed four edges is subjected to a central concentrated load.
Determine the displacements and stresses of the plate.
Only a quarter model may be analyzed due to symmetry.

(a) Clamped square plate

(b) Quarter model

Structural geometry and analysis model

Model

Analysis Type
3-D static analysis

Unit System
in, lbf

Dimension
Length 4.0 in   Width 4.0 in

Element
Plate element (Thick type)

Material
Modulus of elasticity   E $= 9.1 \times 10^{6}$ psi
Poisson's ratio ν $= 0.3$

Element Property
Size $a \times b$ $= 4.0/8$ in $\times$ 4.0/8 in
Thickness   t $= 0.12$ in

Boundary Condition
Nodes 1 ~ 8   ; Constrain Dy and Rx. (Symmetric about X-axis)
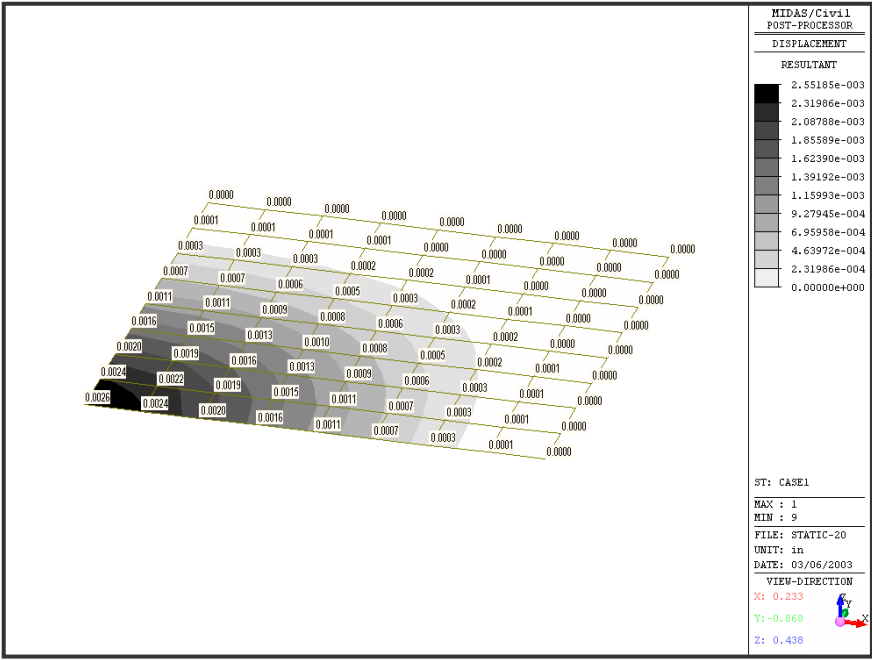Nodes 1,10,19,28,37,46,55 and 16 ; Constrain Dx and Ry. (Symmetric about Y-axis)
Nodes 73 ~ 81   ; Constrain all DOFs. (Fixed nodes)
Nodes 18,27,36,45,54,63 and 73   ; Constrain all DOFs. (Fixed nodes)

Load Case
A concentrated load, P/4 = 10.0/4 lbf is loaded to the node 1 in the -Z direction.

3

Results

Displacements of the structure

Comparison of Results

Unit : in

Node	Z-displacement (δ_z)	
	NISA	MIDAS/Civil
1	0.00242	0.00255
3	0.00194	0.00198
5	0.0011	0.00111
7	0.00034	0.00035

References

S. P. Timoshenko, S, Woinowsky-Krieger, "*Theory of Plates and Shells*", 2nd Edition, McGraw-Hill, New York, 1959.

"*NISA II, Verification Problems Manual*", Version 91.0, Engineering Mechanics Research Corporation, 1991, Problem 2.11.