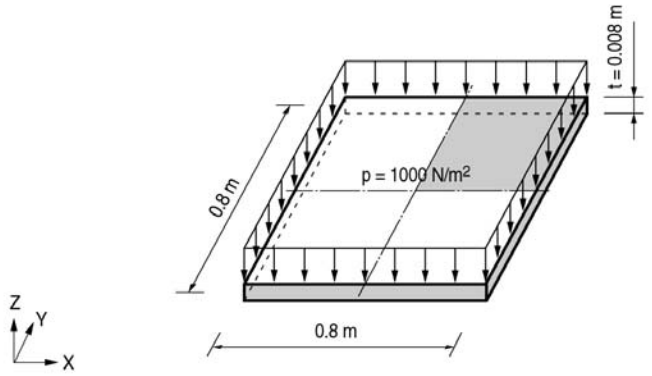
Static-19

Title

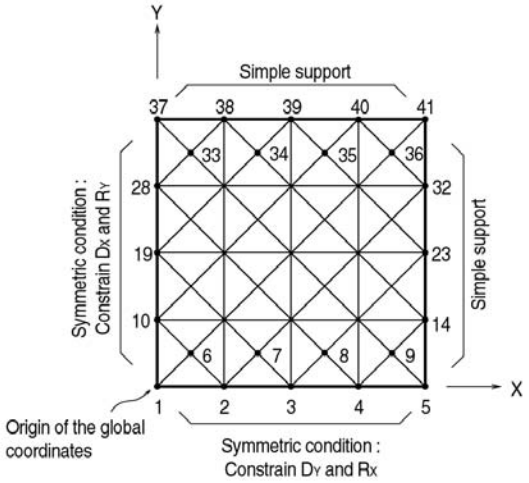
Simply supported square plate under a uniform pressure load

Description

Calculate the vertical displacements of a square plate under a uniform pressure load. Only a quarter model may be analyzed due to symmetry.



(a) Simply suppoted along four edges



(b) Quarter model

Structural geometry and analysis model

Model

Analysis Type

3-D static analysis

Unit System

m, N

Dimension

Length 0.4 m Width 0.4 m

Element

Plate element (Thick type)

Material

Modulus of elasticity $E = 2.1 \times 10^{11}$ N/m^2

Poisson's ratio $\nu = 0.3$

Element Property

Triangular base × Height = 0.1 × 0.05

Thickness t = 0.008 m

Boundary Condition

Nodes 1 ~ 5 ; Constrain Dy and Rx . (Symmetric about X-axis)

Nodes 1, 10, 19, 26 and 37 ; Constrain Dx and Ry. (Symmetric about Y-axis)

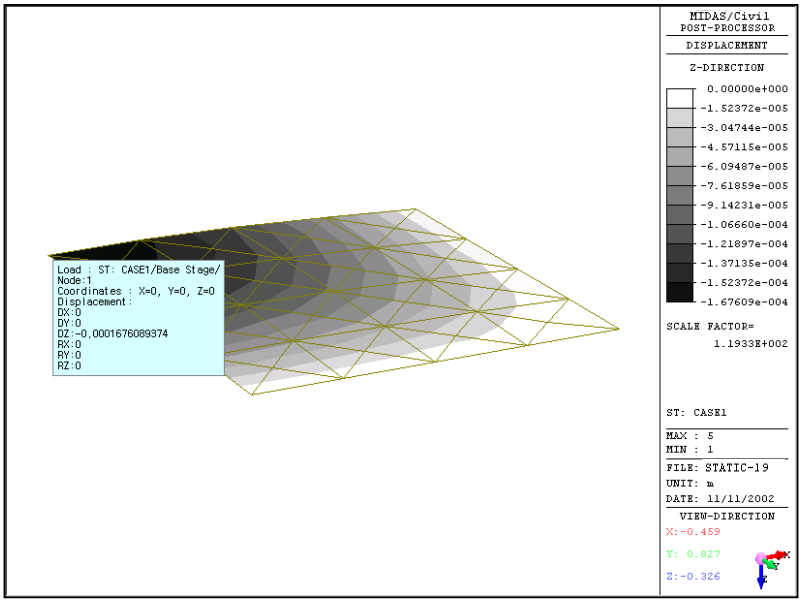
Nodes 37 ~ 41 ; Constrain Dz and Ry. (Simple supports)

Nodes 5, 14, 23, 32 and 41 ; Constrain Dz and Rx. (Simple supports)

Load Case

A pressure load, 1000 N/m^2 is applied in the -Z direction.

Results



Z-displacements of the structure (Node 1)

Comparison of Results

Unit : m

Node 1	Theoretical	ADINA	MIDAS/Civil
Z-displacement (δ_Z)	1.689×10^{-4}	1.675×10^{-4}	1.676×10^{-4}

References

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

"*ADINA, Verification Manual - Linear Problems*", Version 6.1, ADINA R&D, Inc, 1992, Example A. 27.