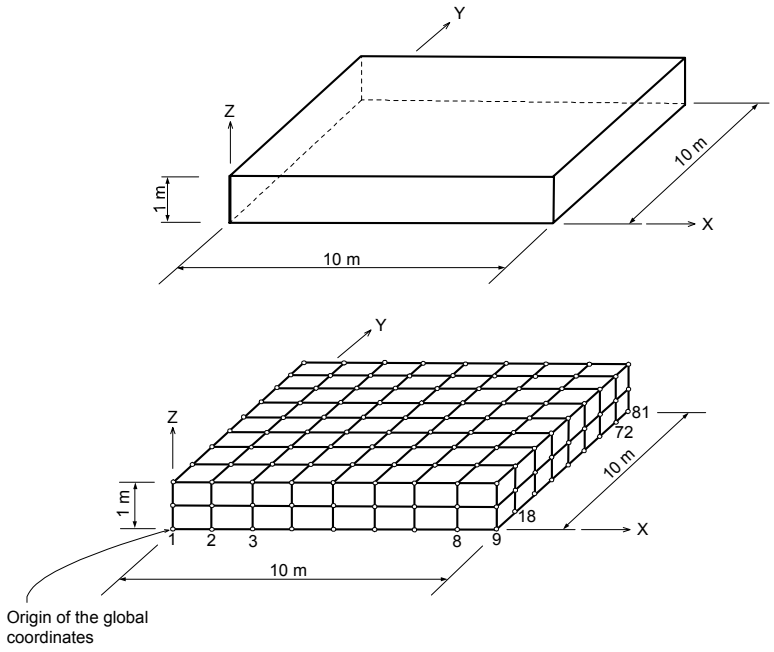
Eigen-14

Title

Eigenvalue analysis of a simply supported solid square plate

Description

A simply supported solid square plate is analyzed to determine the first 7 natural frequencies (the first three of which are rigid body modes).
Determine the natural frequencies and mode shapes.



Structural geometry and analysis model

MODEL

Analysis Type

3-D eigenvalue analysis

Unit System

m, N

Dimension

Length 10 m Width 10 m

Element

Solid element

Material

Modulus of elasticity $E = 2.0\times10^5$ MPa
Poisson's ratio $\nu = 0.3$
Weight density $\gamma = 8000$ kgf/m^3

Sectional Property

Rectangular cross-section: width 10 m, thickness 1 m

Boundary Condition

Node 1, 9, 73, 81: Constrain D_X, D_Y and D_Z
Node 2~8, 10~64, 18~72, 74~80: Constrain D_Z

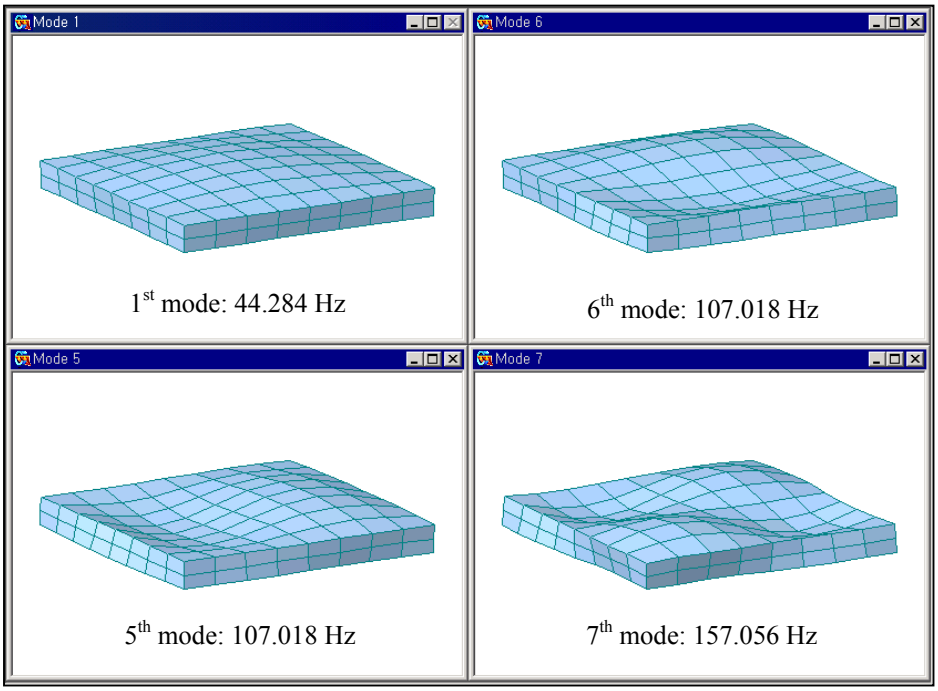
Analysis Case

Eigenvalue analysis

Results

EIGENVALUE ANALYSIS					
Mode No	Frequency (rad/sec)	Frequency (cycle/sec)	Period (sec)	Tolerance	
1	278,246	44,284	0,022581	3,7592e-016	
2	349,717	55,659	0,017966	1,0709e-015	
3	349,717	55,659	0,017966	1,6658e-015	
4	503,530	80,139	0,012478	4,5916e-016	
5	672,416	107,018	0,009344	1,5448e-015	
6	672,416	107,018	0,009344	3,8621e-016	
7	986,810	157,056	0,006367	1,5589e-013	

The first 7 natural frequencies (the first three of which are rigid body modes)



Selective 4 mode shapes

Comparison of Results

Unit: Hz

Result	Mode	Theoretical	MIDAS/Civil
Frequency	1st	45.897	44.284
	5th	109.440	107.018
	6th	109.440	107.018
	7th	167.890	157.056

Reference

NAFEMS. (1989). "*The Standard NAFEMS Benchmarks*", Rev. No TSNB, National Engineering Laboratory, E. Kilbride, Glasgow, UK.