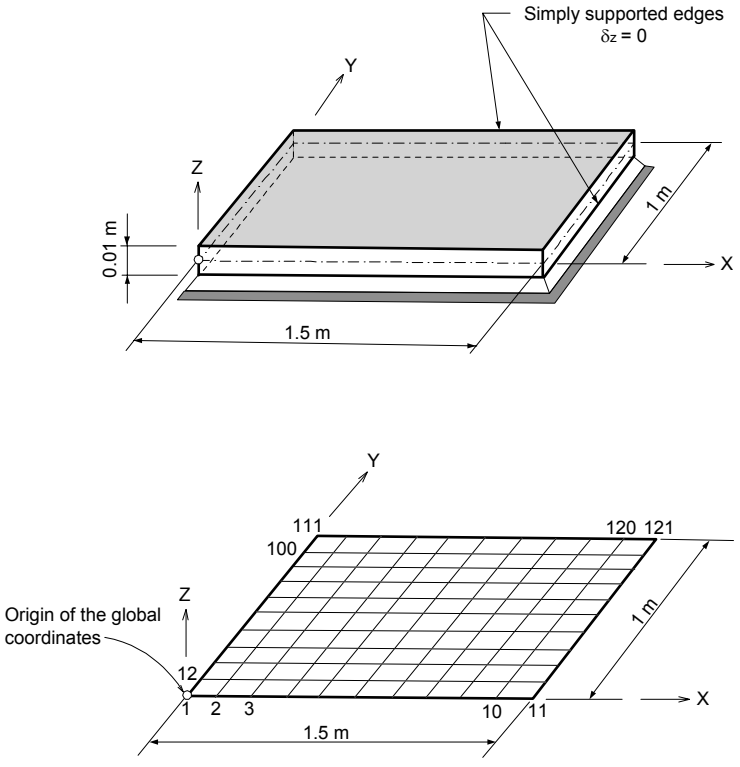
# Eigen-11

## Title

Eigenvalue analysis of a thin simply supported rectangular plate

## Description

Calculate the natural frequencies of a simply supported plate.




*Structural geometry and analysis model*

# MODEL

***Analysis Type***

3-D eigenvalue analysis

***Unit System***

m, tf

***Dimension***

Length 1.5m  Width 1m  Thickness 0.01m

***Element***

Plate element (Thin type)

***Material***

Modulus of elasticity  $E = 2.1 \times 10^5$ MPa
Poisson's ratio  $\nu = 0.3$
Weight density  $\gamma = 7.8$ tf/m³

***Sectional Property***

Rectangular cross-section: width 1 m,  thickness 0.01 m

***Boundary Condition***

All edges are simply supported

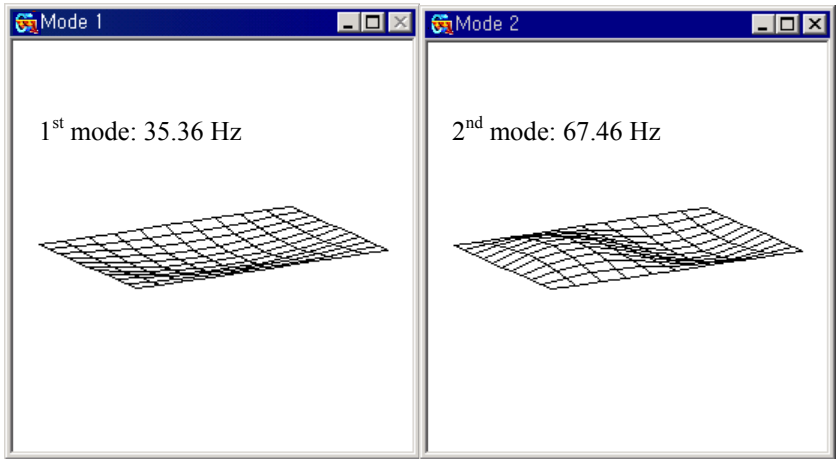
***Analysis Case***

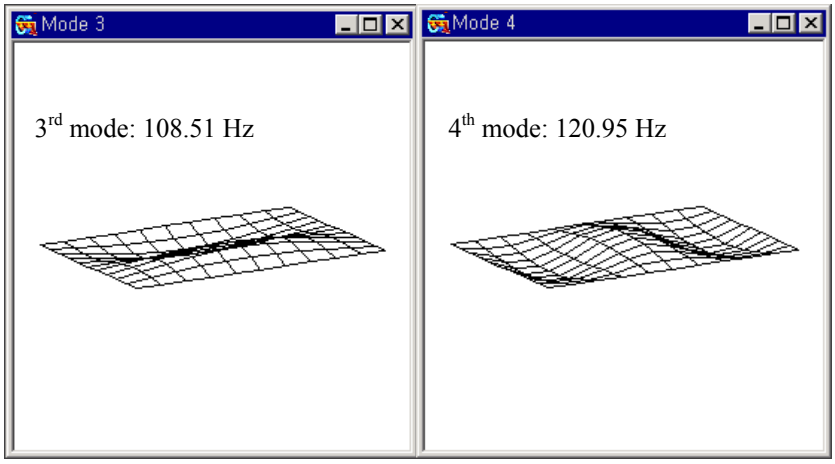
Self weight is converted to nodal masses automatically. (Gravity acceleration g=9.806m/sec²)
Number of natural frequencies to be computed = 6

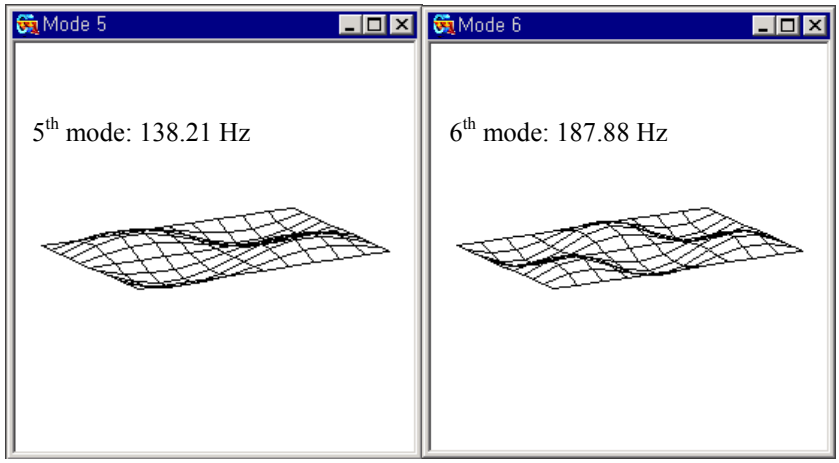
## Results

| EIGENVALUE ANALYSIS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mode No | Frequency | | Period | Tolerance | | | | |
| | | (rad/sec) | (cycle/sec) | (sec) | | | | | |
| | 1 | 222,14 | 35,36 | 0,03 | 0,0000e+000 | | | | |
| | 2 | 423,86 | 67,46 | 0,01 | 3,2400e-016 | | | | |
| | 3 | 681,80 | 108,51 | 0,01 | 3,0428e-014 | | | | |
| | 4 | 759,96 | 120,95 | 0,01 | 1,4735e-013 | | | | |
| | 5 | 868,41 | 138,21 | 0,01 | 1,7462e-011 | | | | |
| | 6 | 1180,46 | 187,88 | 0,01 | 2,6212e-007 | | | | |

*The natural frequencies*






*The mode shapes*

## Comparison of Results

Unit: Hz

| Results | Mode | Theoretical | MIDAS/Civil |
|---|---|---|---|
| Frequency | 1st | 35.63 | 35.36 |
| | 2nd | 68.51 | 67.46 |
| | 3rd | 109.62 | 108.51 |
| | 4th | 123.32 | 120.95 |
| | 5th | 142.51 | 138.21 |
| | 6th | 197.32 | 187.88 |

## References

"*Guide de Validation des Progiciels de Calcul de Structures*", SFM, Afnor Technique, France, 1990.

Barton, M. V. "*Vibration of Rectangular and Skew Cantilever Plate*",J. Appl. Mech. 18, 129-134.