

Eigen-13

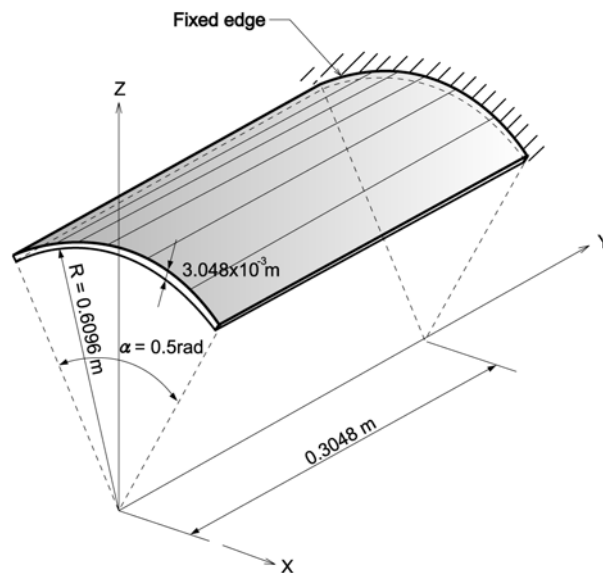
Title

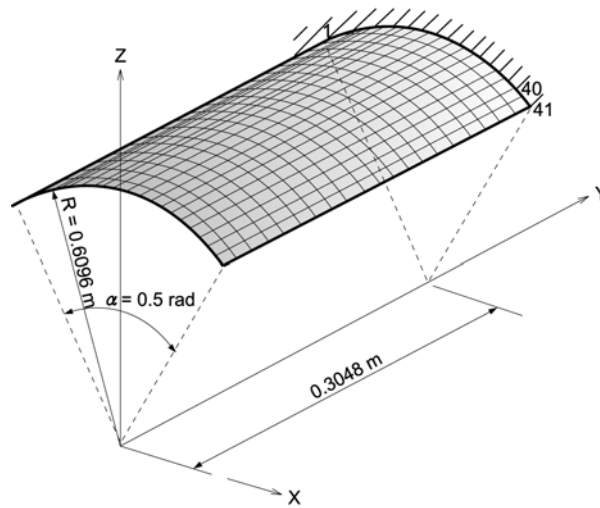
Eigenvalue analysis of cantilever cylindrical vault

Description

A cantilever cylindrical vault fixed at one end is analyzed to determine the first 6 natural frequencies.

Determine the natural frequencies and mode shapes.





Structural geometry and analysis model

MODEL

Analysis Type

3-D eigenvalue analysis

Unit System

m, N

Dimension

Radius 0.6096 m

Element

Plate element

Material

Modulus of elasticity $E = 2.0658 \times 10^5 \text{ MPa}$

Poisson's ratio $\nu = 0.3$

Weight density $\gamma = 7.857 \text{ tf/m}^3$

Sectional Property

Radius 0.6096 m, thickness $3.048 \times 10^{-3} \text{ m}$

Boundary Condition

Node 1~41: Constrain all DOFs

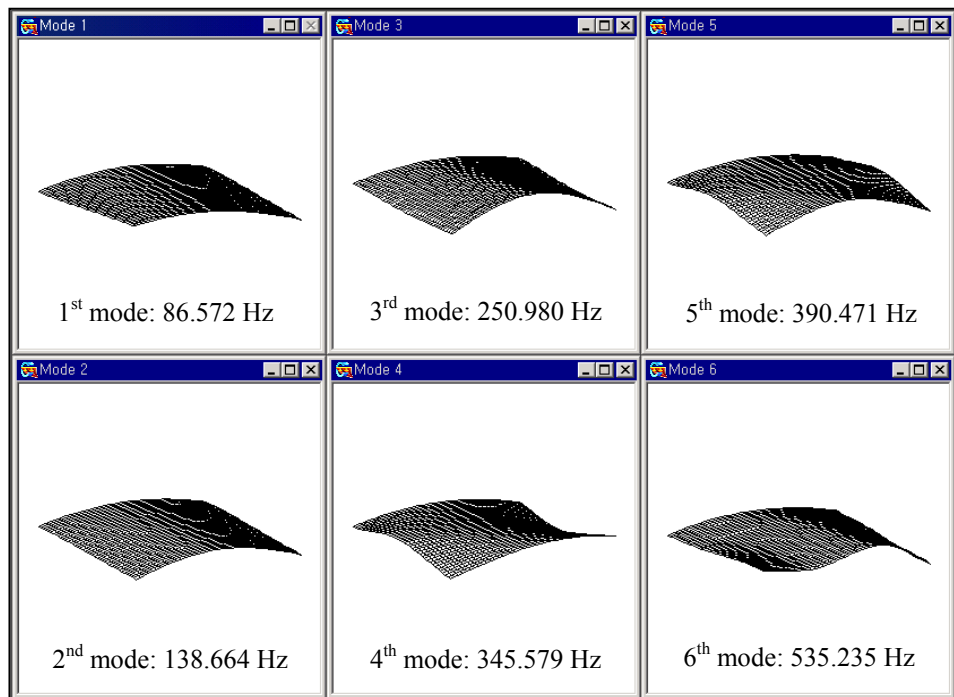
Analysis Case

Eigenvalue analysis

Results

EIGENVALUE ANALYSIS							
	Mode No	Frequency		Period	Tolerance		
		(rad/sec)	(cycle/sec)	(sec)			
	1	543,945	86,572	0,012	1,9673e-016		
	2	871,248	138,664	0,007	4,6009e-016		
	3	1576,957	250,980	0,004	0,0000e+000		
	4	2171,339	345,579	0,003	4,0139e-013		
	5	2453,404	390,471	0,003	6,1890e-016		
	6	3362,978	535,235	0,002	3,3999e-007		

The first 6 natural frequencies



The first 6 mode shapes

Comparison of Results

Unit: Hz			
Results	Mode	Theoretical	MIDAS/Civil
Frequency	1 st	85.600	86.572
	2 nd	134.500	138.664
	3 rd	259.000	250.980
	4 th	351.000	345.579
	5 th	395.000	390.471
	6 th	531.000	535.235

References

Afnor (1990). “*Guide de Validation des Progiciels de Calcul de Structures*”, SFM, Afnor Technique, France.

Geoffroy, P. (1983). “*Development et Evaluation d’un Element fin pour L’analyse non Lineaire Statique et Dynamique des Coques Minces*”, These de doctorat d’ingenieur, Universite de Technologie de Compiegne, France.