

RamSeries - Validation Case 19

Simply supported thick annular plate (NAFEMS FV23)



RamSeries

Version
15.1.0

Table of Contents

Chapters	Pag.
Validation Case 19 - NAFEMS FV23	1
Model Description	1
Results	2
References	5
Validation Summary	6

1 Validation Case 19 - NAFEMS FV23

Model Description

This test case is based on the NAFEMS FV23 "Simply Supported Thick Annular Plate", described in Ref. [1].

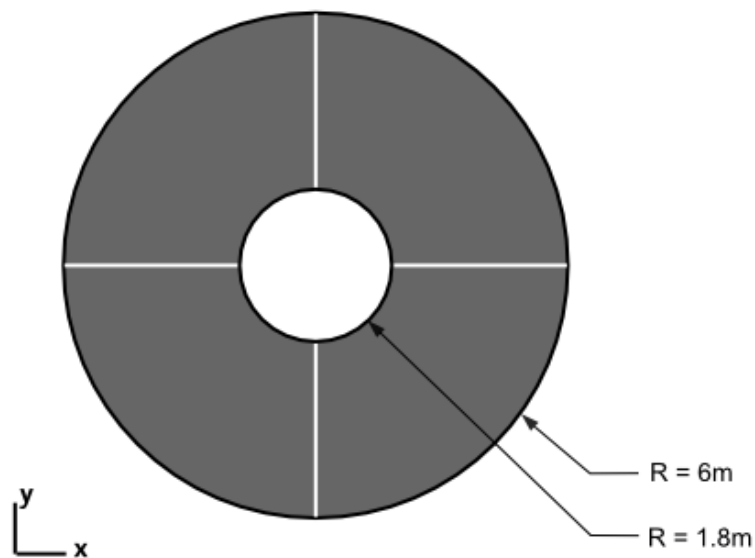
It consists of a normal mode dynamic analysis of a simply supported thick annular plate meshed with shell (quadrilateral) elements.

Dimensions:

$$R_1 = 1.8 \text{ m}$$

$$R_2 = 6.0 \text{ m}$$

$$t = 0.6 \text{ m}$$



Material data:

The material is assumed to be lineal elastic.

$$E = 2.0 \times 10^5 \text{ MPa}$$

$$\mu = 0.3$$

$$\text{Mass density} = 8000 \text{ kg/m}^3$$

Results

The test is run for two different meshes:

- M1: Linear mesh, 160 quadrilateral.
- M2: Parabolic mesh: 640 quadrilateral elements.

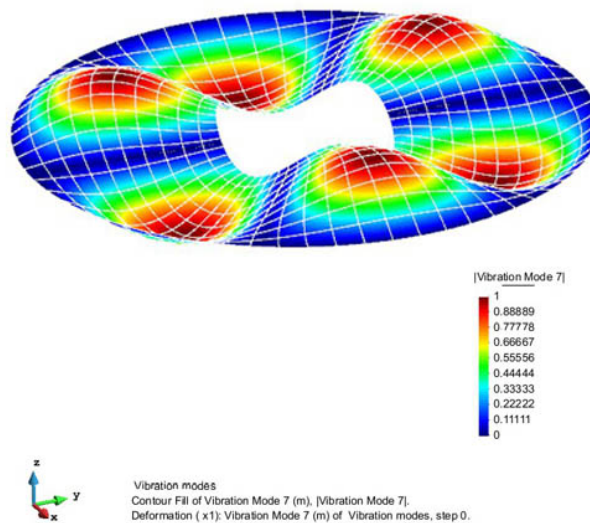
The following summary table shows the differences between obtained values for RamSeries, the reference value, and the NAFEMS test target value.

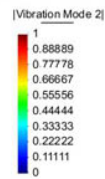
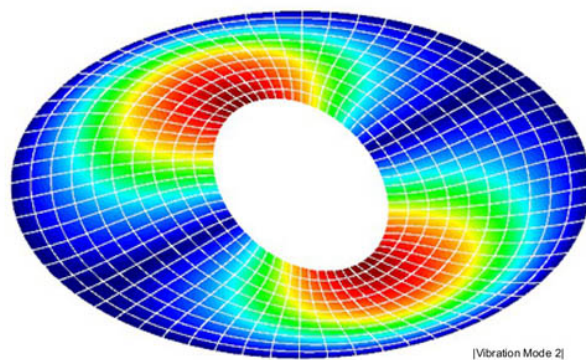
The compared values correspond to the first nine natural vibrating modes.

***Note:** The reference value refers to the accepted solution to the problem.

Mode #	Reference value [Hz]	NAFEMS target value [Hz]	RamSeries (M1-Linear) [Hz]	RamSeries (M2-Parab.) [Hz]
1	18.58	18.82	18.65	18.6
2	48.92	49.82	50.98	48.95
3	48.92	49.82	50.98	48.95
4	92.59	96.06	98.34	92.69
5	92.59	96.06	98.65	92.78
6	140.2	148.3	142.8	141.7
7	(Not available)	153.7	163	146.3
8	(Not available)	153.7	163	146.3
9	166.4	174.5	172.6	168.1

The next images show the 2nd (right) and 7th (left) modes:





Vibration modes
Contour Fill of Vibration Mode 2 (m), [Vibration Mode 2]
Deformation (x1): Vibration Mode 2 (m) of Vibration modes, step 0.

NASTRAN results, coming from Reference [2] are shown in the following table:

Mode #	Reference value [Hz]	NAFEMS target value [Hz]	NX Nastran (M1-Linear) [Hz]
1	18.58	18.82	18.4
2	48.92	49.82	50.0
3	48.92	49.82	50.0
4	92.59	96.06	93.09
5	92.59	96.06	93.09
6	140.2	148.3	134.6
7	(Not available)	153.7	144
8	(Not available)	153.7	144
9	166.4	174.5	162.9

References

- [1] NAFEMS Finite Element Methods & Standards. Selected Benchmarks for Natural Frequency Analysis, Test No.23. Glasgow: NAFEMS, Nov., 1987.
- [2] NX Nastran Verification Manual. UGSCorp. 2007.

Validation Summary

CompassFEM version	15.1.0
Tdyn solver version	15.1.0
RamSeries solver version	15.1.0
Benchmark status	Successfull
Last validation date	27/11/2018