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RamSeries - Validation Case 18

Simply supported solid square (NAFEMS FV52)

RamSeries

Version
15.1.0

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1 Validation Case 18 - NAFEMS FV52

Model Description

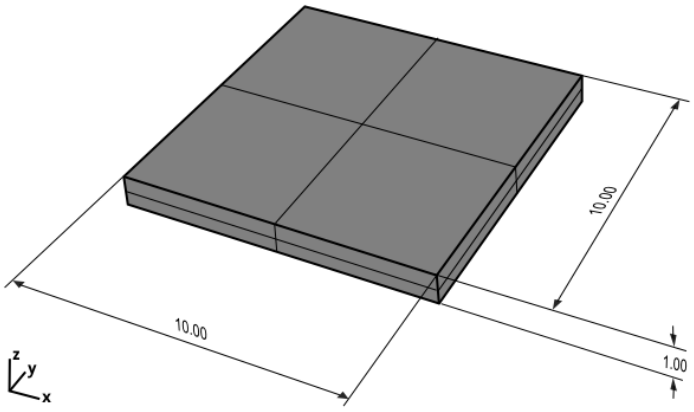
This test case is based on the NAFEMS FV52 "Simply Supported Solid Square Plate", described in Ref. [1].

It consists of a normal mode dynamic analysis of a simply supported square plate meshed with brick (hexahedra) elements.

Dimensions:

L=10 m

t=1 m



Material data:

The material is assumed to be linear elastic.

E = 2.1e5 MPa

μ = 0.3

Mass density = 8000 kg/m^3

Results

The test is run for a two meshes:

- Linear mesh of 64 hexahedral elements and 162 nodes.
- Parabolic mesh of 16 hexahedral elements and 155 nodes.

The following summary table shows the differences between obtained results for both meshes in RamSeries, the reference value, and the NAFEMS test target value.

The compared values correspond to the ten first natural vibrating modes. The first three modes only are known in RamSeries results.

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

Mode #	Reference value [Hz]	NAFEMS target values (Linear) [Hz]	RamSeries (Linear) [Hz]
1	-	-	4.258E-06
2	-	-	6.185E-06
3	-	-	8.372E-06
4	45.9	51.65	55.7
5	109.4	132.7	141.6
6	109.4	132.7	141.6
7	167.9	194.4	196.9
8	193.6	197.2	208.9
9	206.2	210.6	210.7
10	206.2	210.6	210.7

Total mass result

Volume (10 X 10 X 1) : 100 m^3

Material density: 7994.58 kg/m^3

Total mass: 799457.51 kg

Mass calculated in simulation: 799457.51 kg

Error: 0.0%

Mode #	Reference value [Hz]	NAFEMS target values (Parabolic) [Hz]	RamSeries (Parabolic) [Hz]
1	-	-	0
2	-	-	4.558E-06
3	-	-	1.297E-05
4	45.9	44.76	44.81
5	109.4	110.5	110.6
6	109.4	110.5	110.6
7	167.9	169.1	169.2
8	193.6	193.9	194
9	206.2	206.6	206.7
10	206.2	206.6	206.7

Total mass result

Volume (10 X 10 X 1) : 100 m^3

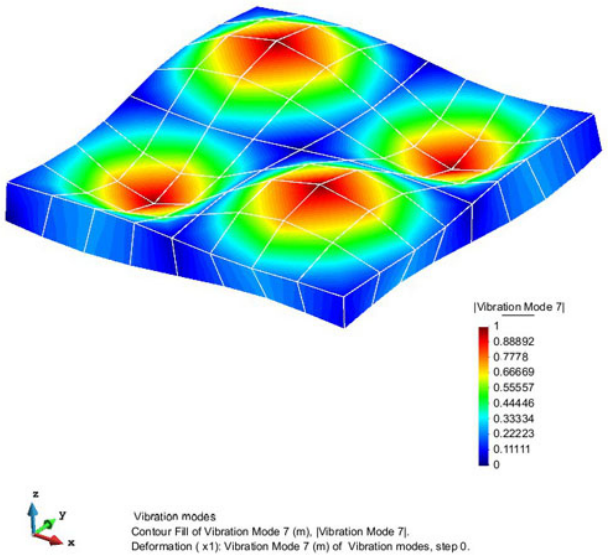
Material density: 7994.58 kg/m^3

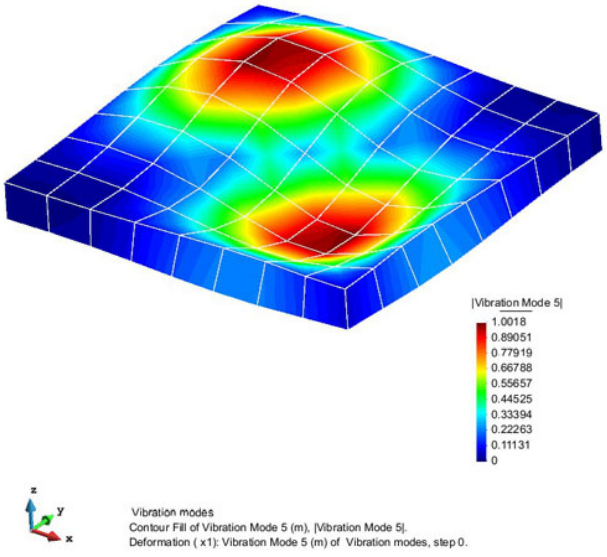
Total mass: 799457.51 kg

Mass calculated in simulation: 799457.51 kg

Error: 0.0%

The next images show the 5^{th} (right) and 7^{th} (left) modes:





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

Mode #	Reference value [Hz]	NAFEMS target value (Linear) [Hz]	NX Nastran (Linear) [Hz]
4	45.9	51.65	45.24
5	109.4	132.7	113.7
6	109.4	132.7	113.7
7	167.9	194.4	155.5
8	193.6	197.2	193.6
9	206.2	210.6	200.1
10	206.2	210.6	200.1

Mode #	Reference value [Hz]	NAFEMS target value (Parabolic) [Hz]	NX Nastran (Parabolic)[Hz]
4	45.9	44.76	44.16
5	109.4	110.5	107.9
6	109.4	110.5	107.9
7	167.9	169.1	163.9
8	193.6	193.9	193.9
9	206.2	206.6	206.6
10	206.2	206.6	206.6

References

[1] NAFEMS Finite Element Methods & Standards. Selected Benchmarks for Natural Frequency Analysis, Test No.52. 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