

RamSeries - Validation Case 15

In-plane Vibration (NAFEMS FV2)



RamSeries

Version
15.1.0

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1 Validation Case 15 - In-plane vibration

Model Description

This test case is based on the NAFEMS test case FV2 "In-plane vibration of a pin-ended double cross", described in Ref. [1], and is used for testing modal analysis in RamSeries.

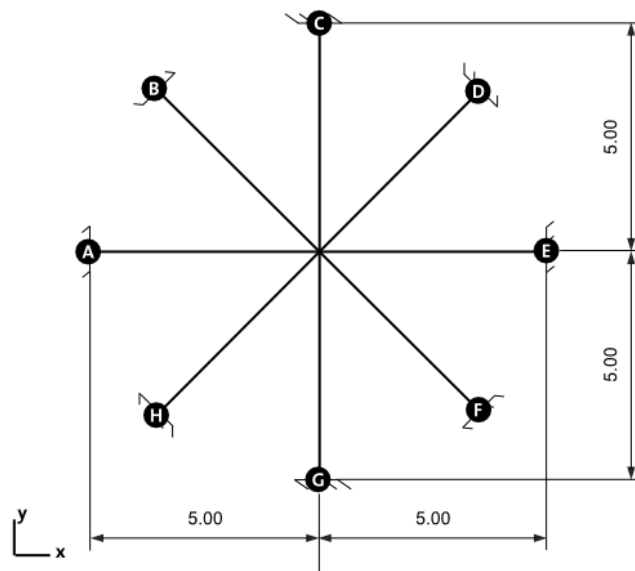
Part of a double cross with square section of side w is pinned at 8 ends, and is constrained to vibrate in plane.

The first 16 natural frequencies of this model will be determined.

Dimensions:

$$L = 5000 \text{ mm}$$

$$w = 125 \text{ mm}$$



Material properties:

The material is assumed to be linear elastic.

$$E = 2.0e5 \text{ MPa}$$

$$\mu = 0.3$$

$$\text{Mass density} = 8.0e-6 \text{ kg/mm}^3$$

Results

For the sake of validation, a simulation was run using the properties described in the previous chapter.

The results summary is the following:

Total mass result

Length: 5000 mm

Section: 125 x 125 mm = 15625 mm²

Material density: 8e-6 kg/mm³

Beam mass: 625 kg

Number of beams: 8

Total mass: 5000 kg

Mass calculated in simulation: 5000 kg

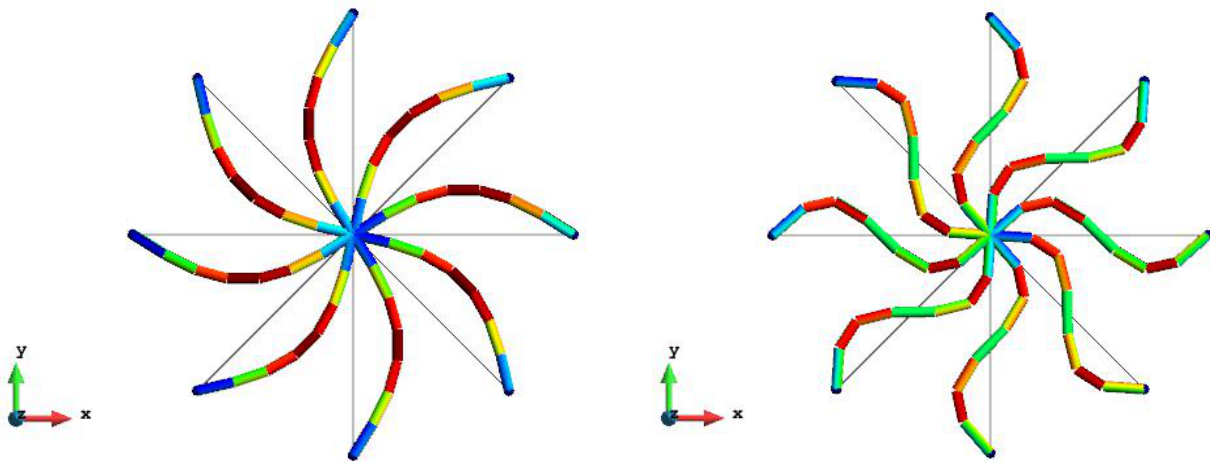
Error: 0.0%

Natural Frequencies results

Natural frequencies (s-1)	f1	f2	f3	f4	f5	f6	f7	f8
NAFEMS FV2	11.336	17.709	17.709	17.709	17.709	17.709	17.709	17.709
RamSeries	11.33	17.68	17.62	17.71	17.71	17.71	17.71	17.71
Difference (%)	0.053	0.164	0.503	0.006	0.006	0.006	0.006	0.006

Natural frequencies (s-1)	f9	f10	f11	f12	f13	f14	f15	f16
NAFEMS FV2	45.345	57.390	57.390	57.390	57.390	57.390	57.390	57.390
RamSeries	45.32	57.05	57.05	57.37	57.37	57.37	57.37	57.37
Difference (%)	0.055	0.592	0.592	0.035	0.035	0.035	0.035	0.035

The following images show the 1st and the 9th vibration modes (left and right, respectively):



References

[1] NAFEMS FiniteElement Methods & Standards. Selected Benchmarks for Natural Frequency Analysis, Test No.2. Abbassian, F., Dawswell, D. J. , and Knowles, N.C. Glasgow:NAFEMS, Nov., 1987.

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