

SDND123 – Calculation of linear mode for a system with 2 degrees of freedom with an elastic bilateral thrust

Summary:

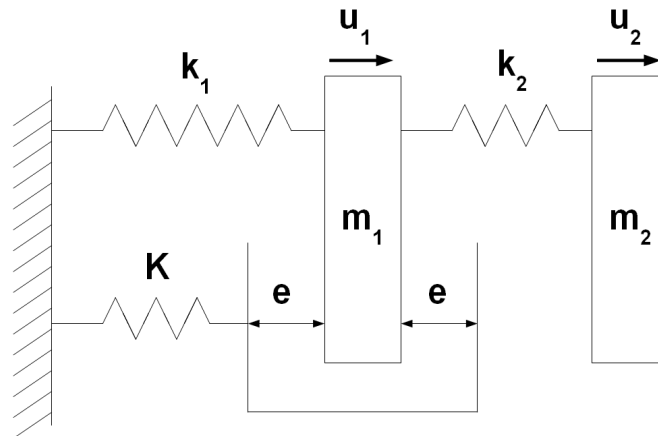
The objective of this test is to validate the calculation of non-linear mode with the operator `MODE_NON_LINE`. One particularly validates the system with a bilateral non-linearity of the obstinate type.

One also carries out postprocessings with `CALC_STABILITE` and `REST_MODE_NONL`.

1 Problem of reference

1.1 Geometry

The following system is considered:



1.2 Properties of material

The characteristics of the system are:

- $k_1 = k_2 = 1 \text{ N/m}$
- $m_1 = m_2 = 1 \text{ kg}$
- $e = 1 \text{ m}$
- $K = 30 \text{ N/m}$

1.3 Boundary conditions and loadings

The left edge of the system is fixed and the masses move along the axis of the springs.

1.4 Initial conditions

One tries to follow the evolution of the periodic solution starting from the second mode of the subjacent linear system (system without contact).

2 Reference solution

One is interested in calculation of periodic solutions of the system characterizing the non-linear mode thus.

2.1 Method of calculating

For the resolution of the system, one uses method EHMAN [1]. One tries to follow the branch of the periodic solutions starting from the second mode of the linear system.

One calculation also the stability of the periodic solution obtained while basing itself on the theory of Floquet, by a diagram of Newmark and a calculation with the eigenvalues.

2.2 Sizes and results of reference

The selected reference variables are the couple frequency – energy and the stability of the periodic solution obtained.

The periodic solution is stable for the couple frequency – energy such as:
 $0.2578 \text{ Hz} < f < 0.2580 \text{ Hz}$ and $1.0 \text{ J} < E < 1.3 \text{ J}$

2.3 Uncertainties on the solution

Solution of not-regression.

2.4 Bibliographical references

- [1] E.H. MOUSSI, Analyzes vibrating structures equipped with located non-linearities with game using the non-linear modes. Doctorate 2013.

3 Modeling A

3.1 Characteristics of modeling

A modeling is used DIS_T.

3.2 Characteristics of the grid

The grid contains 2 elements of the type SEG2.

3.3 Sizes tested and results

One tests the couple frequency – energy by interpolation starting from the table produced by MODE_NON_LINE. A solution of not-regression is suggested. The values obtained are presented in the table below.

| Frequency (Hz) | Energy (J) | Stability of the periodic solution |
|------------------|--------------|------------------------------------|
| 0.2579052851 | 1.19768 | STABLE |

4 Summary of the results

This case test validates the operator of calculation of non-linear modes (MODE_NON_LINE), the operator of calculation of stability of the non-linear modes (CALC_STABILITE) and the operator of restitution of the periodic solution (REST_MODE_NONL).

A solution of not-regression is suggested.