

ZZZZ208 – Validation of the methods of extraction and recovery of the generalized terms

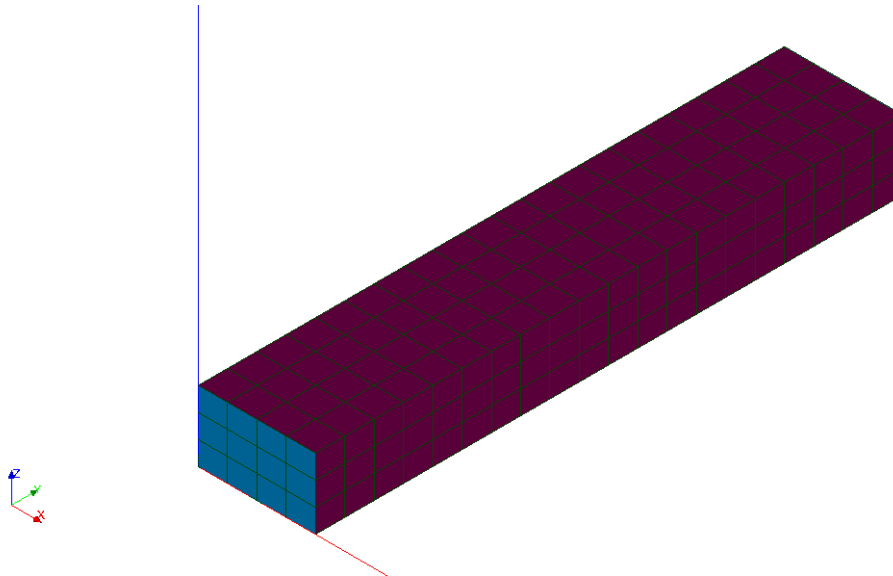
Summary:

The objective of this test is to validate the methods `EXTR_MATR_GENE`, `EXTR_VECT_GENE`, `RECU_MATR_GENE` and `RECU_VECT_GENE`. The generalized terms are extracted, one carries out a modification in the environment python and one carries out a validation crossed by comparing the results got with the library numpy and those obtained with the generic orders.

1 Problem of reference

1.1 Geometry

One considers a slim structure length 0.25 m and of section $0.05\text{ m} * 0.03\text{ m}$.



1.2 Properties of material

The material is elastic isotropic whose properties are:

- Young modulus $E = 2.1 \cdot 10^{11}\text{ Pa}$
- Poisson's ratio $\nu = 0.3$
- Density $\rho = 7800\text{ kg/m}^3$
- Damping hysteretic $\eta = 0.01$

1.3 Boundary conditions and loadings

One imposes a null displacement on the face of X-coordinate $y = 0.25\text{ m}$

For the calculation of the harmonic answer, one applies a vertical specific excitation of amplitude $(1 + 0.5j)/2$ at the point of coordinates $(0\text{ m}, 0.1375\text{ m}, 0.03\text{ m})$.

2 Reference solution

2.1 Method of calculating

One carries out two types of calculation in order to test the methods for handling of the generalized sizes.

The first modeling carries out a modal calculation and a harmonic calculation of answer on the generalized sizes.

The second modeling carries out a modal calculation by using the dynamic technique of under-structuring.

2.2 Sizes and results of reference

One carries out a validation crossed by comparing the results resulting from the standard operators and the calculations carried out with the library numpy.

One checks the Eigen frequencies obtained and the field of displacement for the harmonic calculation of answer.

2.3 Uncertainties on the solution

It is considered that there is a regression if the got results are not identical.

2.4 Bibliographical references

Without object

3 Modeling A

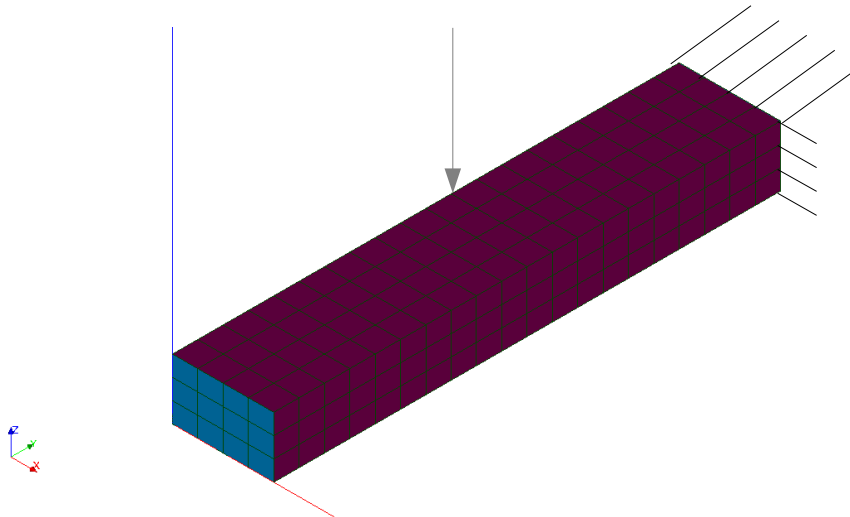
3.1 Characteristics of modeling

One carries out a modal calculation and harmonic calculation of answer on a basis made up of 10 clean modes.

To test the extraction and the recovery of the generalized sizes, one carries out in the environment python a modification of the generalized terms which consists in multiplying the rigidity generalized by two and to divide the vector second member generalized by two.

One calculates then the clean modes of the generalized model and the harmonic answer to 500 Hz .

For the calculation of the harmonic answer, one applies a specific excitation to the point of coordinates $(0\text{ m}, 0.1375\text{ m}, 0.03\text{ m})$.



One tests the results got by successively using diagonal storage and full storage with real matrices and complex matrices.

3.2 Characteristics of the grid

The grid contains 240 elements of the type `HEXA8`.

3.3 Sizes tested and results

One tests the first five Eigen frequencies of the generalized model and the field of displacement at the frequency of excitation equalizes with 500 Hz (without and with modification of the generalized terms).

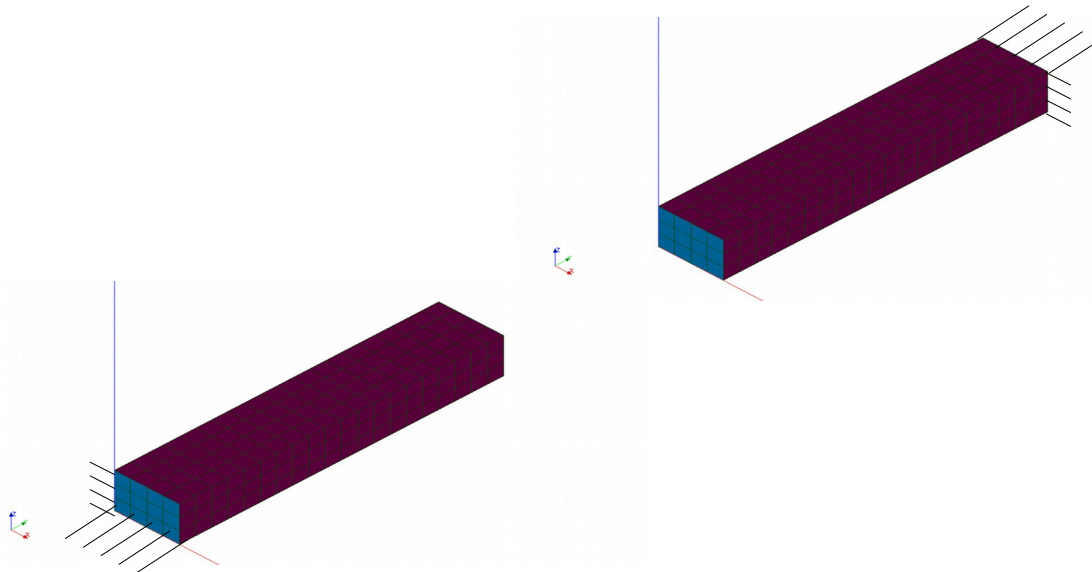
Identification	Type of reference	Value of reference
f_1 (not modified generalized sizes)	'SOURCE_EXTERNE'	419.834215191 Hz
f_2 (not modified generalized sizes)	'SOURCE_EXTERNE'	668.578057732 Hz
f_3 (not modified generalized sizes)	'SOURCE_EXTERNE'	2485.22786476 Hz

f_4 (not modified generalized sizes)	'SOURCE_EXTERNE'	2745.91955475 Hz
f_5 (not modified generalized sizes)	'SOURCE_EXTERNE'	3626.81541778 Hz
f_1 (modified generalized sizes)	'SOURCE_EXTERNE'	593.735241082 Hz
f_2 (modified generalized sizes)	'SOURCE_EXTERNE'	945.51215675 Hz
f_3 (modified generalized sizes)	'SOURCE_EXTERNE'	3514.64295193 Hz
f_4 (modified generalized sizes)	'SOURCE_EXTERNE'	3883.31667551 Hz
f_5 (modified generalized sizes)	'SOURCE_EXTERNE'	5129.09155204 Hz
Harmonic answer to 500 Hz : nap of the components of the field of displacement (not modified generalized sizes)	'SOURCE_EXTERNE'	-3.27788511305 10 ⁻⁵ m
Harmonic answer to 500 Hz : nap of the components of the field of displacement (modified generalized sizes)	'SOURCE_EXTERNE'	1.18096814505 10 ⁻⁵ m

4 Modeling B

4.1 Characteristics of modeling

One carries out a modal calculation by using the dynamic technique of under-structuring.
The first calculation is carried out by using a base of projection of the substructure only made up of the static modes. For the second calculation, one uses a base made up of normal modes and five modes of interface.



4.2 Characteristics of the grid

The complete structure is made up of two substructures.
The first substructure is resulting from a grid made up of 240 elements of the type `HEXA8`.
The second substructure is obtained by carrying out a translation of the first substructure of -0.25 m .

4.3 Sizes tested and results

One tests the first five Eigen frequencies of the complete structure

Identification	Type of reference	Value of reference
f_1 (bases: static modes)	'NON_REGRESSION'	660.430033152 Hz
f_2 (bases: static modes)	'NON_REGRESSION'	1030.71541399 Hz
f_3 (bases: static modes)	'NON_REGRESSION'	1772.49983 Hz
f_4 (bases: static modes)	'NON_REGRESSION'	2652.54751842 Hz
f_5 (bases: static modes)	'NON_REGRESSION'	2746.67605831 Hz
f_1 (bases: normal modes + five modes of interface)	'SOURCE_EXTERNE'	660.430033153 Hz
f_2 (bases: normal modes + five modes of interface)	'SOURCE_EXTERNE'	1030.71541399 Hz

f_3 (bases: normal modes + five modes of interface)	'SOURCE_EXTERNE'	1772.49983 Hz
f_4 (bases: normal modes + five modes of interface)	'SOURCE_EXTERNE'	2652.54751842 Hz
f_5 (bases: normal modes + five modes of interface)	'SOURCE_EXTERNE'	2746.67605831 Hz

5 Summary of the results

This case test made it possible to check the methods of extraction and recovery of the generalized terms. One carries out a validation crossed between the results resulting from the library numpy and those resulting from the standard operators.
The got results are practically identical.