SDLS08 - Eigen modes of a square plate calculated on reduced basis

Summarized:

This case test aims to test the computation of the eigen modes of a square plate with static condensation of the matrixes assembled on the internal degrees of freedom and the restitution on physical base.

The test is carried out with a modelization DKT, whose only one node is left free. One applies a unit stress to this node.

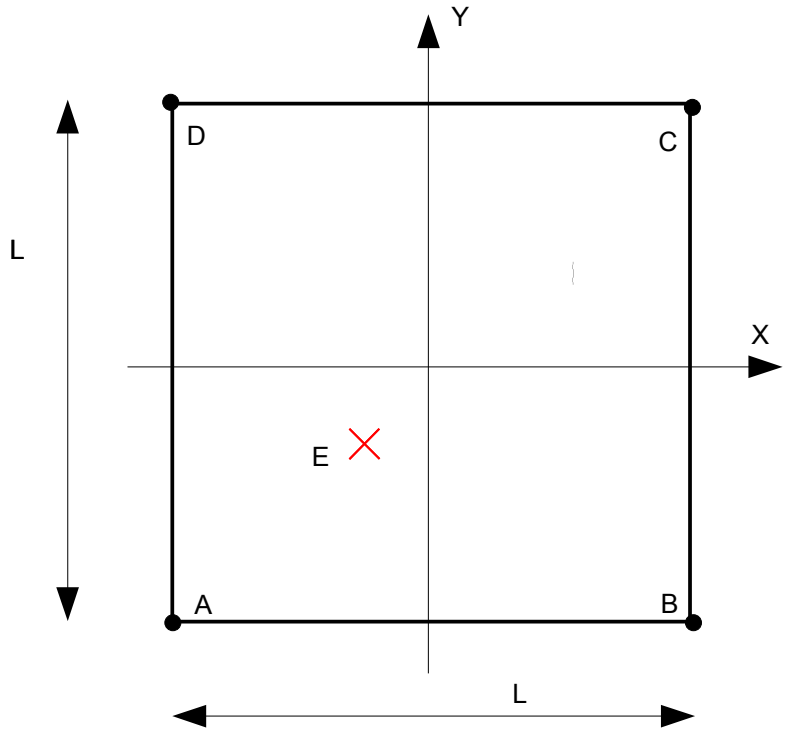
In a first part, one tests the construction of a base modal obtained from the assembly two bases of dynamic eigen modes.

Then, one calculates the base of static modes, on which the mass matrixes and of stiffness are projected. The eigen modes are then calculated on this basis. The results are restored in physical base.

The last stage consists has to carry out a harmonic computation on the basis of reduced static mode. The results are also restored in physical base.

1 Problem of reference

1.1 Geometry



Geometry of the plate (m):

$L=1$
thickness $e=0.001$

Coordinated of the points (m) :

$O(0.0,0.0)$
$E(-0.1,-0.1)$

Mesh group:

$CONT\_NO$: Dimensioned AB, BC, CD, DA
$COND2\_NO$: Face $ABCD$ except the point E

1.2 elastic Properties of the material

- $E = 7.1\text{E}10\ Pa$ Modulus Young
- $\nu = 0.3$ Poisson's ratio
- $\rho = 7820.0\ kg.m^{-3}$ Density
- $AMOR\_ALPHA = 0.5\ N.s.m^{-1}$
- $AMOR\_BETA = 0.1\ N.kg^{-1}$

the coefficients α and β make it possible to build a viscous damping matrix proportional to the stiffness and the mass: $[C] = \alpha[K] + \beta[M]$.

1.3 Boundary conditions and loadings

- imposed Displacement:
  - $CONT\_NO$: null displacements and rotations
  - $COND2\_NO$: null displacements and rotations
- Forces excitation (N) :
  - Point: $E \quad Fz = 1$

2 Reference solution

2.1 Computations of reference

Not of results of reference. The frequencies and the displacements are tested by non regression.

2.2 Quantities and results of reference

- $FREQ$: frequency
- DZ : displacement following z

got Results:

- From a modal base defined from the assembly of two bases of dynamic mode.

Component	N° Reference	mode (Hz)
$FREQ$	1	29.0604
	2	76.2281
	3	76.2281
	4	76.2281
	5	5058.51
	6	5058.51

- From a modal base defined from static modes

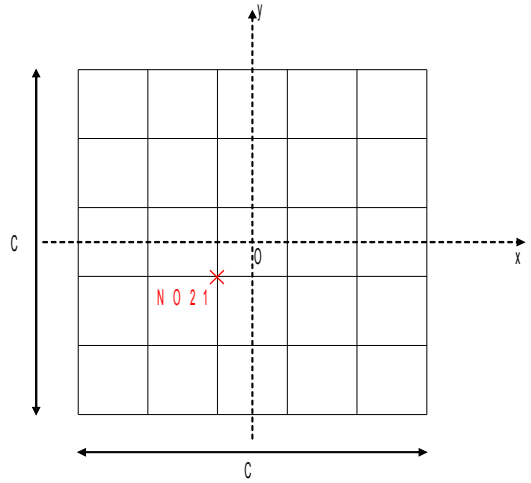
Component	N ° Reference	mode (Hz)
$FREQ$	1	4.9762

- From a harmonic computation carried out on the basis of static mode modal base.

Component		Not	Reference (m)
DZ	Left real	E	2.02777×10^{-6}
	imaginary Part		-5.38827×10^{-5}

3 Modelization A

3.1 Characteristic of the modelization



Modelization DKT :

Many nodes 36
Number of meshes 25 Are:

QUAD4 25

3.2 Quantities tested and Modal base

- results defined from the assembly of two bases of Component dynamic

mode	N° mode	Reference (Hz)	Tolerance %
$FREQ$	1	29.0604	10^{-4}
	2	76.2281	10^{-4}
	3	76.2281	10^{-4}
	4	76.2281	10^{-4}
	5	5058.51	10^{-4}
	6	5058.51	10^{-4}

- Modal base defined from static modes

Component	N° mode	Reference (Hz)	harmonic %
$FREQ$	1	4.9762	10

- Tolerance Computation carried out on the basis of static mode modal base.

Component		Node	Reference (m)	Tolerance %
DZ	Left real	$NO21$	2.02777×10^{-6}	10.
	imaginary Part		-5.38827×10^{-5}	10.

4 Summary of the results

the got results are satisfactory.