
SSNV193 – Contact with static macro-elements

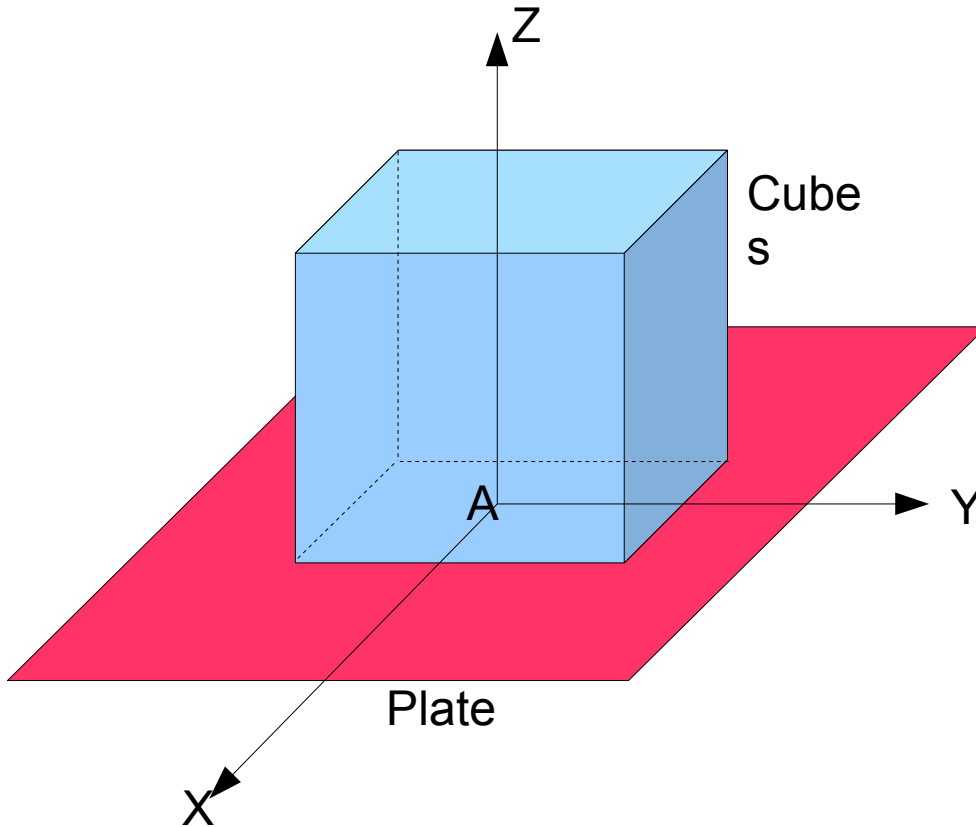
Abstract:

The purpose of this test is to CONTINUE validate the use of static macro-elements with the unilateral contact in formulation and DISCRETE.

1 Problem of reference

1.1 Geometry

One considers a cube of with dimensions 1 m posed on a rigid level.



1.2 Properties of the material

the material is elastic isotropic whose properties are:

- $E = 209\,000\text{ MPa}$
- $\nu = 0.3$

1.3 Boundary conditions and loadings

On the upper face, one imposes a vertical displacement of -0.1 m . The rigid plane is clamped and one imposes a unilateral condition of contact between the cube and the rigid plane.

2 Reference solution

2.1 Method of calculating

The computation is a computation of NON-regression between various situations. The computation of reference is made without static macro-element.

2.2 Quantities and results of reference

One tests displacement on the lower face of the cube, with the medium and the reaction of contact. Vertical displacement is necessarily null (cubic initially in contact, rigid plane)

2.3 Uncertainties on the solution

displacement is an analytical solution.

3 Modelization A

3.1 Characteristic of the modelization

One uses a modelization 3D.

3.2 Characteristics of the mesh

The mesh contains 1128 elements of the type `HEXA8`.

- The first calculation is done with the contact in formulation `CONTINUE` and without macro-element;
- The second calculation is done with the contact in formulation `CONTINUE` and the cube is represented by a macro-element;
- The third calculation is done with the contact in formulation `DISCRETE` and the cube is represented by a macro-element;

3.3 Quantities tested and results

One tests displacement and the vertical reaction at the point A .

The first computation (without macro-element) – Contact in formulation `CONTINUE` – **Standard**

Reference	Identification of reference	Value of reference	Tolerance
Not A - DZ	"ANALYTIQUE"	0	1.00E-012
Not A - RZ	"NON_REGRESSION"	-1.380156E+009	1.00E-006

the Second computation (with macro-element) – Contact in `Standard` formulation

CONTINUE	Identification of reference	Value of reference	Tolerance
Not A - DZ	"ANALYTIQUE"	0	1.00E-012
Not A - RZ	"AUTRE_ASTER"	-1.380156E+009	1.00E-006

the Third computation (with macro-element) – Contact in `Standard` formulation

DISCRETE	Identification of reference	Value of reference	Tolerance
Not A - DZ	"ANALYTIQUE"	0	1.00E-012
Not A - RZ	"AUTRE_ASTER"	-1.380156E+009	1.00E-006

3.4 Remarks

three computations give the same results exactly.

4 Summary of the results

This benchmark shows the possibility of using static macro-elements to represent the stiffness of a structure subjected to a unilateral contact, and this, some is the formulation of the latter (continuous or discrete). There is no restriction on the conditions of use, potential surfaces of contact can belong to the macro-elements. The model comparison complete/static macro-elements shows as the results are identical, as well in displacement as in force.