Code_Aster

Titre : ZZZZ285 - Validation de PROJ_CHAMP / Collocation
Responsable : Jacques PELLET

Version default

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ZZZZ285 - Validation of PROJ_CHAMP/Collocation

Summarized:

This test is a data-processing test. It validates command `PROJ_CHAMP METHODE=' COLLOCATION'` for all the types of meshes $2D$ and $3D$, with flat rims or curved.

There exist 6 modelizations (A B C D E , F).

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1   Goal of the test

One wants to validate the implementation of method "COLLOCATION" of projection of the fields at nodes for all the types of meshes $2D$ and $3D$ on right or curved board.

2   Principle of the test

One nets a square (in $2D$) or a cube (in $3D$) by means of the linear elements on right board (TRIA3, QUAD4, HEXA8, PENTA6, TETRA4, PYRAM5). The square (or the cube) is with a grid 2 times with different discretizations. Let us call these 2 meshes MA1 and MA2.

One uses command CREA_MAILLAGE to transform these linear meshes into quadratic meshes ("LINE_QUAD").
One also uses command CREA_MAILLAGE to create meshes "QUAD+": QUAD9, HEXA27 and PENTA18.

One has then for all the types meshes: SORTED,   QUAD,…,   PYRAM of linear meshes (" LIN"), quadratic (" QUAD") or " QUAD+"

With command MODI_MAILLAGE / DEFORME, one can deform meshes MA1 and MA2 so that the edges of the elements become curved.

A field at nodes (CH1) is then created whose form is "analytical" (application of a formula to the coordinates of the nodes of mesh MA1). One can use 3 different formulas:

*   a function closely connected of the coordinates (noted "degree 1")

*   a quadratic function of the coordinates (noted "degree 2")

*   an unspecified function of the coordinates (noted "degree 2+" although one uses actually fractional powers).

One then carries out a projection of CH1 of MA1 towards MA2. CH2 is obtained. This field is again project of MA2 towards MA1. CH1B is obtained.
CH1 and CH1B having the same mesh support, one can then calculate the relative error caused by double projection.

One then calculates (and one tests) the "maximum" of the relative error on the mesh.

Note: As command PROJ_CHAMP is sometimes used between 2 meshes whose nodes are geometrically confused (for example studies THM), one also tests this configuration (MA2 = MA1) to check that in this case, the error of projection is null.

3   Reference solution

the reference solution is 0. Ideally, the error of projection must be null.

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4 Results

In the 2 tables below, one raised the maximum relative error related to the double projection for the various cases: flat rims or curved, types of meshes, field linear, quadratic,…

When the error of projection is lower than 1.e-9, the box is coloured in yellow. It is considered whereas projection is "perfect".

Note:
Combination "curved edges + degree of meshes `the LIN`" does not exist!
Degree `QUAD+` does not exist for `the TETRA / PYRAM`

4.1 Projection of a mesh on another mesh (different)

edges	degree of meshes	the degree of the field	SORTED/QUAD	HEXA/PENTA	TETRA/right
PYRAM	FLAX		1.6.6E-12	4.9E-12	2.2E-16
			2.6.3E-03	4.2E-03	0.046
		2+	2.0E-03	1.3E-03	0.012
	QUAD		1.2.6E-11	2.0E-11	5.2E-16
			2.4.3E-04	2.8E-04	5.5E-16
		2+	1.1E-04	7.7E-05	1.5E-04
	QUAD+		1.3.0E-11	2.2E-11	
			2.1.1E-10	6.5E-11	
		2+	curved	2.5E-06	
4.9E-06	QUAD		1.2.3E-03	1.7E-03	0.023
		2	0.012	6.5E-03	0.048
		2+	2.9E-03	1.9E-03	0.033
	QUAD+		1.2.3E-03	1.7E-03	
		2	0.012	6.5E-03	
		2+	2.9E-03	1.9E-03	

4.2 Projection of a mesh on itself

edges	degree of meshes	the degree of the field	SORTED/QUAD	HEXA/PENTA	TETRA/right
PYRAM	FLAX		1.0.0E+00	4.6E-16	0.0E+00
			2.0.0E+00	3.3E-16	0.0E+00
		2+	0.0E+00	3.9E-16	0.0E+00
	QUAD		1.3.4E-16	9.2E-16	7.8E-16
			2.4.0E-16	1.0E-15	1.1E-15
		2+	3.8E-16	8.0E-16	7.8E-16
	QUAD+		1.8.1E-16	8.8E-16	
			2.8.8E-16	1.2E-15	
		2+	curved	8.4E-16	
8.9E-16	QUAD		1.1.2E-10	9.6E-11	1.1E-10
			2.7.1E-10	3.0E-10	2.7E-10
		2+	2.5E-10	1.8E-10	2.6E-10
	QUAD+		1.1.3E-10	9.6E-11	
			2.5.2E-10	3.0E-10	
		2+	2.5E-10	1.8E-10	

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5   Summary of the results

When one projects a mesh on itself, it does not have there an error of projection (all boxes its yellows)
When the edges are right and that the fields are same degree that the elements, There is no error of projection. In the general case (different meshes and unspecified field), the error can vary 1.e-6 with 5.e-2 (5%) if the edges are right. When the edges are curved the error varies between 2.e-3 and 5.e-2. It is thus noted that for curved edges, even if they disturb algorithm of pairing (in two stages whose first linearizes meshes), the maximum error is not more important than for flat rims (here 5%).