ZZZZ323 – Validation of the printing of the local coordinate systems by Summarized

IMPR_RESU/CONCEPT:

The purpose of this test is to validate the printing in med file local coordinate systems assigned to elements by the operator AFFE_CARA_ELEM .

5 modelizations are made:
- A: beams, discrete elements
- b: shells and grids on meshes linear
- C: shells and grids on meshes quadratic
- D: solid elements 3D
- E: solid elements 2D

the 5 modelizations have different geometries, the paragraphs “Geometry” and “Results of reference” will thus be treated in each modelization.

To test med file, it is read again by LIRE_CHAMP after being created by IMPR_RESU .

1 Modelization A

1.1 Geometry and modelization

The mesh is composed of:
•9 meshes SEG2 on which are modelled the 7 types of beams and the 2 element types discrete with two nodes.
•2 meshes SEG3 on which the 2 types of pipes with 3 nodes are modelled.
•1 meshes SEG4 on which is modelled pipes with 4 nodes.
•2 meshes POI1 on which 2 the element types discrete ones with a node are modelled.

All meshes having a length are directed according to the vector $(1,1,0)$.

1.2 Directional sense of the local coordinate system

In order to define the local coordinate system of these elements one uses key word ANGL_VRIL for the beams and the discrete elements with two nodes, GENE_TUYAU for the pipes and ANGL_NAUT for the discrete elements with a node of factor key word the ORIENTATION of operator AFFE_CARA_ELEM (see U4.42.01).

The table above gives the directional senses chosen for each element:

Beams	ANGL_VRIL	90
Discrete with two Discrete	nodes	-90
ANGL_VRIL with a node	ANGL_NAUT	$(90,-90.0,90.0)$
Pipes	GENE_TUYAU	$(0.,0.,1.)$

1.3 Computation of the local coordinate systems

the local coordinate systems are formed by the vectors x, y and z.

1.3.1 Beams

the vector x east defines by the geometry and is thus equal to $(\frac{\sqrt{2}}{2},\frac{\sqrt{2}}{2},0)$. The value 90 ANGL_VRIL made turn the reference by default of $90°$, which gives $y=(0,0,1)$ and $z=(\frac{\sqrt{2}}{2},-\frac{\sqrt{2}}{2},0)$.

1.3.2 Discrete with two nodes

As for the beams $x=(\frac{\sqrt{2}}{2},\frac{\sqrt{2}}{2},0)$, but this time one swivels in the other meaning what donneformule $y=(0,0,-1)$ and $z=(\frac{-\sqrt{2}}{2},\frac{\sqrt{2}}{2},0)$.

1.3.3 Pipes

No change for x. One gave the value $(0.,0.,1.)$ with GENE_TUYAU, the vector y is then the projection of $(0.,0.,1.)$ on the orthogonal level with x, i.e. $(0.,0.,1.)$ itself.

There is then $z=(\frac{\sqrt{2}}{2},-\frac{\sqrt{2}}{2},0)$.

But a processing different from angle GAMMA1 in Code_Aster induces an additional rotation of 90° around x what gives finally:

$y=(\frac{\sqrt{2}}{2},-\frac{\sqrt{2}}{2},0)$ and $z=(0.,0.,-1.)$

Remark:

The pipes carried of meshes the SEG4 are not Co mpatibles with those carried by meshes SEG3. They are thus treated except for.

1.3.4 Discrete in a node

In this case the local coordinate system is only defined by the values of ANGL_NAUT. The second component of the vector given gives $x=(0.,0.,1.)$. From the three components one determines who $y=(0.,-1.,0.)$ and $z=(1.,0.,0.)$.

1.4 Quantities tested

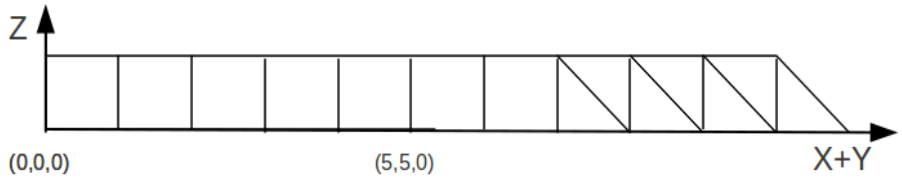
the results tested are presented in the following table:

X	NET	Vector	**Component Value of reference**	
Tolerance	x	POU1	0.707106781186E0	1.E−8
POU3	x	Y	0.707106781186E0	1.E−8
POU5	x	formula	0.707106781186E0	1.E−8
POU7	x	Y	0.707106781186E0	1.E−8
DISL1	x	X	0.707106781186E0	1.E−8
TUY32	x	Y	0.707106781186E0	1.E−8
DISN2	x	Z	1.0	1.E−8
POU2	y	formula	1.0	1.E−8
POU4	y	formula	1.0	1.E−8
POU6	y	formula	1.0	1.E−8
DISL2	y	DISN1	−1.0	1.E−8
Z	y	Y	−1.0	1.E−8
TUY31	y	Y	−0.707106781186E0	1.E−8
TUY41	x	X	0.707106781186E0	1.E−8
TUY41	x	Y	0.707106781186E0	1.E−8
TUY41	y	X	0.707106781186E0	1.E−8
TUY41	y	Y	−0.707106781186E0	1.E−8

TUY41	z	Z	−1.0	1.E−8

2 Modelization B

2.1 Geometry and modelization



The mesh is composed of:
•7 meshes QUAD4 on which one affects modelization DKT, DST, Q4G, DKTG, Q4GG, GRILLE_EXCENTRE and GRILLE_MEMBRANE.
•7 meshes TRIA3 on which one affects modelization DKT, DST, Q4G, DKTG, Q4GG, GRILLE_EXCENTRE and GRILLE_MEMBRANE.

2.2 Directional sense of the local coordinate system

In order to define the local coordinate system of these elements one uses key word ANGL_REP for the shells and the grids present in factor key word the COQUE and GRILL of operator AFFE_CARA_ELEM (see U4.42.01).

The table above gives the directional senses chosen for each element:

Shells	ANGL_REP	(45.0,−45.0)
Grids	ANGL_REP	(45.0,−45.0)

2.3 Computation of the local coordinate systems

the local coordinate systems are formed by the vectors x, y and z.
For the shells and the grids the vector z is defined by the normal outgoing one in the shell. In our example there will be $z=(\frac{-\sqrt{2}}{2},\frac{\sqrt{2}}{2},0)$.
The value given to ANGL_REP defines a vector whose projection on the tangent level with the element gives the vector x. The values of the example thus give $x=(0.5,0.5,\frac{\sqrt{2}}{2})$ and $y=(-0.5,-0.5,\frac{\sqrt{2}}{2})$ for the shells and $x=(0.5,0.5,-\frac{\sqrt{2}}{2})$ and $y=(0.5,0.5,\frac{\sqrt{2}}{2})$ for the grids.

2.4 Quantities tested

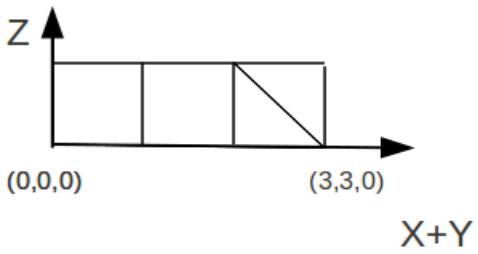
the results tested are presented in the following table:

NET	Vector	Component	**Value of reference**	**Tolerance**

DKT4	x	X	0.5	1.E−8
DKT3	x	Y	0.5	1.E−8
DST4	x	Z	0.707106781186E0	1.E−8
DST3	x	X	0.5	1.E−8
Q4G4	x	Y	0.5	1.E−8
DKTG4	x	Z	0.707106781186E0	1.E−8
GRME3	x	X	0.5	1.E−8
Q4GG3	x	Y	0.5	1.E−8
GREX4	x	Z	0.707106781186E0	1.E−8
DKT4	z	X	−0.707106781186E0	1.E−8
DKT3	z	Y	0.707106781186E0	1.E−8
DST3	z	X	−0.707106781186E0	1.E−8
Q4G4	z	Y	0.707106781186E0	1.E−8
GRME3	z	X	−0.707106781186E0	1.E−8
Q4GG3	z	Y	0.707106781186E0	1.E−8

3 Modelization C

3.1 Geometry and modelization



The mesh is composed of:

- 1 mesh QUAD9 on which one affects modelization COQUE_3D
- 1 nets QUAD8 on which one affects modelization GRILLE_MEMBRANE
- 1 nets TRIA7 on which one affects modelization COQUE_3D
- 1 nets TRIA6 on which one affects modelization GRILLE_MEMBRANE

3.2 Directional sense of the local coordinate system

In order to define the local coordinate system of these elements one uses key word ANGL_REP for the shells and the grids present in factor key word the COQUE and GRILL of operator AFFE_CARA_ELEM (see U4.42.01).

The table above gives the directional senses chosen for each element:

Shells	ANGL_REP	$(45.0,-45.0)$
Grids	ANGL_REP	$(45.0,-45.0)$

3.3 Computation of the local coordinate systems

the local coordinate systems are formed by the vectors x, y and z.
For the shells and the grids the vector z is defined by the normal outgoing one in the shell. In our example there will be $z=(\frac{-\sqrt{2}}{2},\frac{\sqrt{2}}{2},0)$.
The value given to ANGL_REP defines a vector whose projection on the tangent level with the element gives the vector x. The values of the example thus give $x=(0.5,0.5,\frac{\sqrt{2}}{2})$ and $y=(-0.5,-0.5,\frac{\sqrt{2}}{2})$ for the shells and $x=(0.5,0.5,-\frac{\sqrt{2}}{2})$ and $y=(0.5,0.5,\frac{\sqrt{2}}{2})$ for the grids.

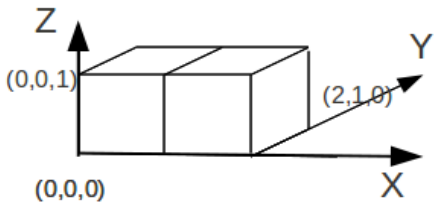
3.4 Quantities tested

the results tested are presented in the following table:

NET	Vector	Component	**Value of reference**	**Tolerance**
CQ3D4	x	formula	0.5	1.E−8
CQ3D3	x	Y	0.5	1.E−8
CQ3D4	x	formula	0.707106781186E0	1.E−8
GRME4	x	formula	0.5	1.E−8
GRME3	x	Y	0.5	1.E−8
GRME4	x	formula	0.707106781186E0	1.E−8
CQ3D4	z	formula	0.707106781186E0	1.E−8
X	z	Y	−0.707106781186E0	1.E−8
GRME4	z	X	0.707106781186E0	1.E−8
GRME3	z	Y	−0.707106781186E0	1.E−8

4 Modelization D

4.1 Geometry and modelization



The mesh is composed of:

•2 meshes HEXA8 on which one 3D affects the modelization

4.2 Directional sense of the local coordinate system

In order to define the local coordinate system of these elements one use factor key word the MASSIF of operator AFFE_CARA_ELEM (see U4.42.01).
Several way define a local coordinate system are proposed, we test here ANGL_REP and couple ANGL_AXE/ORIG_AXE.

The table above gives the directional senses chosen for each element:

HEXA1	ANGL_REP	$(45.0,45.0,90.0)$
HEXA2	ORIG_AXE/ANGL_AXE	$(100.0,0.5,0.5)$ /formule $(0.0,-45.0)$

4.3 Computation of the local coordinate systems

the local coordinate systems are formed by the vectors x, y and z.

The values given in ANGL_REP define the references according to:
$x=(0.5,0.5,-\frac{\sqrt{2}}{2})$, $y=(0.5,0.5,\frac{\sqrt{2}}{2})$ and $z=(\frac{\sqrt{2}}{2},-\frac{\sqrt{2}}{2},0)$.

Couple ANGL_AXE/ORIG_AXE is used in the case of a model with cylindrical geometry. They define an axis e_z on this axis of the cylindrical coordinate system being.
x corresponds to the vector e_z of this cylindrical coordinate system, the point of reference being the barycenter of the mesh here $(1.5,0.5,0.5)$. y corresponds to the vector $-e_\theta$ and z have vector e_r.

In this example $x=(\frac{\sqrt{2}}{2},0,\frac{\sqrt{2}}{2})$, $y=(0,1,0)$ and $z=(\frac{-\sqrt{2}}{2},0,\frac{\sqrt{2}}{2})$.

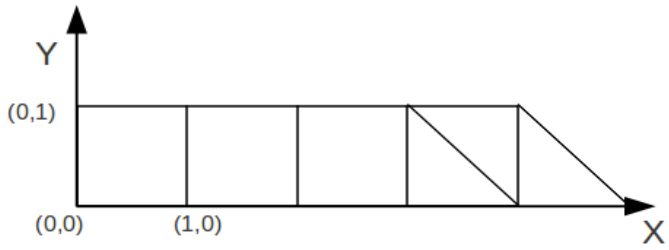
4.4 Quantities tested

the results tested are presented in the following table:

NET	Vector	Component	**Value of reference**	**Tolerance**
HEXA1	x	X	0.5	1.E−8
HEXA1	x	Y	0.5	1.E−8
HEXA1	x	Z	−0.707106781186E0	1.E−8
HEXA2	x	X	0.707106781186E0	1.E−8
HEXA2	x	Y	0	1.E−8
HEXA2	x	Z	0.707106781186E0	1.E−8
HEXA1	y	X	0.5	1.E−8
HEXA1	y	Y	0.5	1.E−8
HEXA1	y	Z	0.707106781186E0	1.E−8
HEXA2	y	Y	1	1.E−8
HEXA2	z	X	−0.707106781186E0	1.E−8
HEXA2	z	Y	0	1.E−8
HEXA2	z	Z	0.707106781186E0	1.E−8

5 Modelization E

5.1 Geometry and modelization



The mesh is composed of:

•3 meshes QUAD4 on which one affects modelizations C_PLAN , D_PLAN and AXIS .
•3 meshes TRIA3 on which one affects modelizations C_PLAN , D_PLAN and AXIS .

5.2 Directional sense of the local coordinate system

In order to define the local coordinate system of these elements one uses factor key word the MASSIF of operator AFFE_CARA_ELEM (see U4.42.01).
In the case 2D, the directional sense of the reference is taken into account by the key word ANGL_REP which has nothing any more but one component.

The table above gives the directional senses chosen for each element:

QUAD4	ANGL_REP	90
TRIA3	ANGL_REP	45

5.3 Computation of the local coordinate systems

the local coordinate systems are formed by the vectors x and y .

The values given in ANGL_REP define the references according to:

• $x=(0,1)$ and $y=(-1,0)$ for the QUAD4
• $x=(\frac{\sqrt{2}}{2},\frac{\sqrt{2}}{2})$ and $y=(\frac{-\sqrt{2}}{2},\frac{\sqrt{2}}{2})$ for the TRIA3

5.4 Quantities tested

the results tested are presented in the following table:

NET	Vector	Component	**Value of reference**	**Tolerance**
CPL4	x	X	0	1.E−8

CPL4	x	Y	1	1.E−8
DPL4	x	X	0	1.E−8
DPL4	x	Y	1	1.E−8
AXI4	x	X	0	1.E−8
AXI4	x	Y	1	1.E−8
CPL3	x	X	0.707106781186E0	1.E−8
CPL3	x	Y	0.707106781186E0	1.E−8
DPL3	x	X	0.707106781186E0	1.E−8
DPL3	x	Y	0.707106781186E0	1.E−8
AXI3	x	X	0.707106781186E0	1.E−8
AXI3	x	Y	0.707106781186E0	1.E−8
CPL4	y	X	−1	1.E−8
CPL4	y	X	0	1.E−8
DPL4	y	Y	−1	1.E−8
DPL4	y	X	0	1.E−8
AXI4	y	Y	−1	1.E−8
AXI4	y	X	0	1.E−8
CPL3	y	Y	−0.707106781186E0	1.E−8
CPL3	y	X	0.707106781186E0	1.E−8
DPL3	y	Y	−0.707106781186E0	1.E−8
DPL3	y	X	0.707106781186E0	1.E−8
AXI3	y	Y	−0.707106781186E0	1.E−8
AXI3	y	X	0.707106781186E0	1.E−8

6 Summary of the results

the local coordinate systems are well written in med file.