

## ZZZZ384 – Validation of the key word MASS\_REP order AFFE\_CARA\_ELEM

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### Summary:

The objective is to test and validate the various uses of the key word MASS\_REP order AFFE\_CARA\_ELEM. This key word makes it possible to distribute masses on meshes of the types POI1 in proportion to the surface of the meshes connected to the node concerned.

The case test validates several methods of assignments:

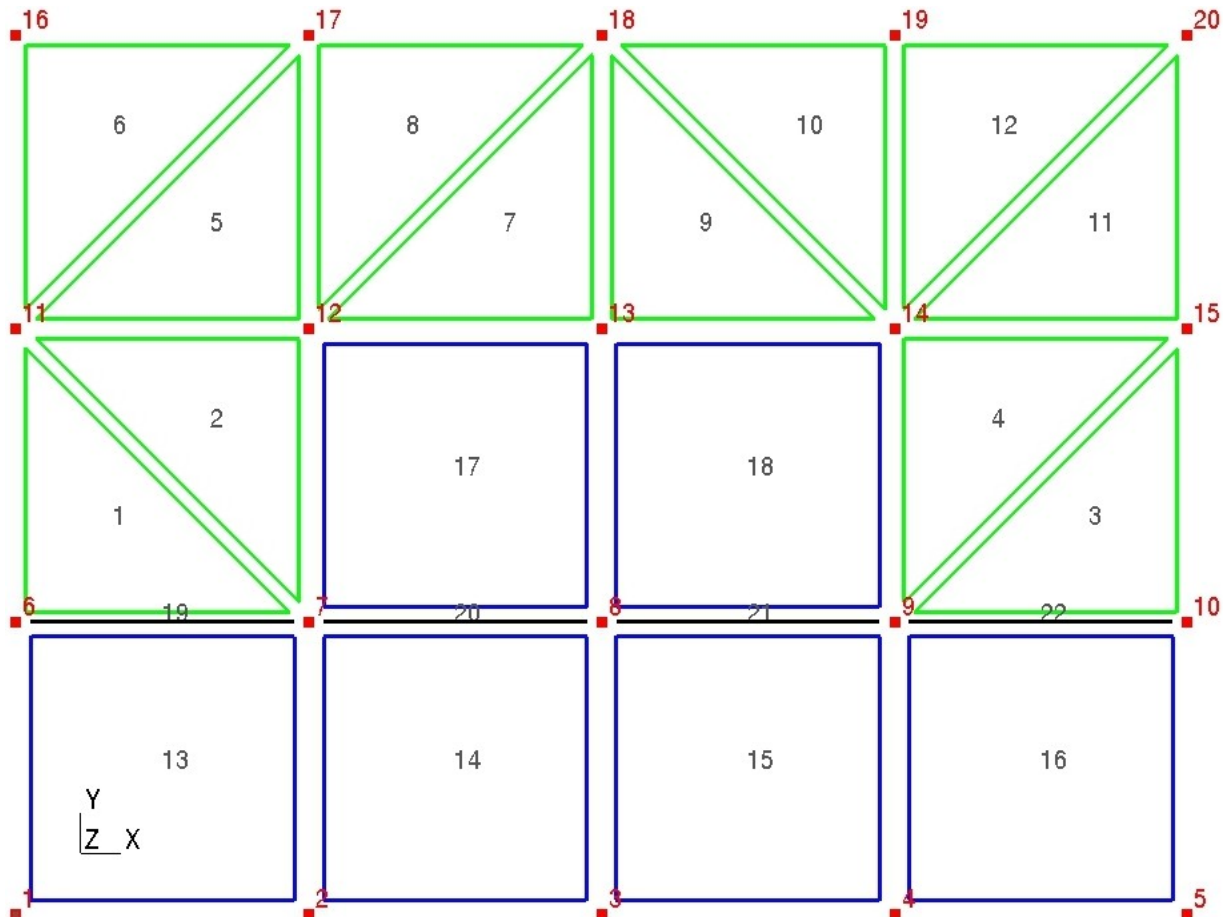
- distribution of a mass on a surface;
- distribution of a surface mass on a surface;
- distribution of a mass on a line;
- distribution of a linear density on a line;
- distribution of a mass, balanced by a function depending on space, on a surface.

## 1 Problem of reference

### 1.1 Geometry used

The geometry is carried out with:

- 12 meshes of type triangle: TRIA3.
- 6 meshes of type quadrangle: QUA4.
- 4 meshes of type segment: SEG2.



Coordinates of the nodes:

Nodes	X [m]	Y [m]	Z [m]	Nodes	X [m]	Y [m]	Z [m]
1	2.00	1.00	0.00	11	2.00	3.00	0.00
2	3.00	1.00	0.00	12	3.00	3.00	0.00
3	4.00	1.00	0.00	13	4.00	3.00	0.00
4	5.00	1.00	0.00	14	5.00	3.00	0.00
5	6.00	1.00	0.00	15	6.00	3.00	0.00
6	2.00	2.00	0.00	16	2.00	4.00	0.00
7	3.00	2.00	0.00	17	3.00	4.00	0.00
8	4.00	2.00	0.00	18	4.00	4.00	0.00
9	5.00	2.00	0.00	19	5.00	4.00	0.00
10	6.00	2.00	0.00	20	6.00	4.00	0.00

### 1.2 Properties of materials

Without object.

## 1.3 Boundary conditions and loadings

Without object.

## 1.4 Initial conditions

Without object.

## 2 Reference solution

### 2.1 Method of calculating

Entire surface is of 12m<sup>2</sup> .

Surface in with respect to the nodes is given in the following table:

Nodes	X [m]	Y [m]	Z [m]	Surface [m <sup>2</sup> ]	Nodes	X [m]	Y [m]	Z [m]	Surface [m <sup>2</sup> ]
1	2.00	1.00	0.00	0.2500	11	2.00	3.00	0.00	0.6667
2	3.00	1.00	0.00	0.5000	12	3.00	3.00	0.00	0.9167
3	4.00	1.00	0.00	0.5000	13	4.00	3.00	0.00	0.8333
4	5.00	1.00	0.00	0.5000	14	5.00	3.00	0.00	1.0833
5	6.00	1.00	0.00	0.2500	15	6.00	3.00	0.00	0.5000
6	2.00	2.00	0.00	0.4167	16	2.00	4.00	0.00	0.1667
7	3.00	2.00	0.00	1.0833	17	3.00	4.00	0.00	0.5000
8	4.00	2.00	0.00	1.0000	18	4.00	4.00	0.00	0.6667
9	5.00	2.00	0.00	1.0833	19	5.00	4.00	0.00	0.3333
10	6.00	2.00	0.00	0.4167	20	6.00	4.00	0.00	0.3333

For a mass to be distributed on a surface, meshes of the type POI1 are affected by the mass:

$$Masse_{POI1} = \frac{Masse_{Totale} * Surface_{Noeud}}{Surface_{Totale}}$$

For a surface mass to distribute on a surface, meshes of the type POI1 are affected by the mass:

$$Masse_{POI1} = Masse_{Surfacique} * Surface_{Noeud}$$

If a function of distribution is given, the mass (surface or linear) is balanced by the value of the function calculated in the centre of gravity of the mesh (surface or linear). This balanced mass is then distributed on the meshes of the type POI1.

### 2.2 Sizes and results of reference

All masses affected to GROUP\_MA\_POI1.

### 2.3 Uncertainties on the solution

None.

## 3 Modeling A

### 3.1 Characteristics of the grid

Cf §1.1 Geometry used.

- GROUP\_MA = 'FLAGSTONE' : all the meshes triangles and quadrangles;
- GROUP\_MA\_POI = 'MASSE\_DALLE' : all nodes of the group of meshes 'FLAGSTONE' ;
- GROUP\_MA = 'LINE' : all the meshes segments;
- GROUP\_MA\_POI = 'MASSE\_LIGNE' : all nodes of the group of meshes 'LINE' .

### 3.2 Assignments tested

Distribution of a mass on a surface.

```
MASS_REP = _F (GROUP_MA = 'FLAGSTONE', GROUP_MA_POI1 = 'MASSE_DALLE',  
              VALE = 12.0, TYPE = 'TOTAL')
```

Distribution of a surface mass on a surface.

```
MASS_REP = _F (GROUP_MA = 'FLAGSTONE', GROUP_MA_POI1 = 'MASSE_DALLE',  
              VALE = 1.0, TYPE = 'SURFACE')
```

Distribution of a mass on a line.

```
MASS_REP = _F (GROUP_MA = 'LINE', GROUP_MA_POI1 = 'MASSE_LIGNE',  
              VALE = 4.0, TYPE = 'TOTAL')
```

Distribution of a linear density on a line.

```
MASS_REP = _F (GROUP_MA = 'LINE', GROUP_MA_POI1 = 'MASSE_LIGNE',  
              VALE = 1.0, TYPE = 'LINEAR')
```

Definition of a function:

```
function = FORMULA (NOM_PARA = ('X', 'Y', 'Z'), VALE = "2*X+3*Y")
```

Distribution of a mass, balanced by the function, on a surface.

```
MASS_REP = _F (GROUP_MA = 'FLAGSTONE', GROUP_MA_POI1 = 'MASSE_DALLE',  
              VALE = 12.0, TYPE = 'TOTAL', FONC_MULT = function)
```

### 3.3 Sizes tested and results

The concept resulting from the order AFF\_CARA\_ELEM is printed in a file and one TEST\_FICHER is carried out.

## 4 Summary of the results

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The distribution of the masses is carried out in a way in conformity with expected.