

## PLEXU11 – Validation use within the competences of ground Dyears CALC\_EUROPLEXUS

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### Summary:

This test aims at validating the use of elements DISCRETE in CALC\_EUROPLEXUS.

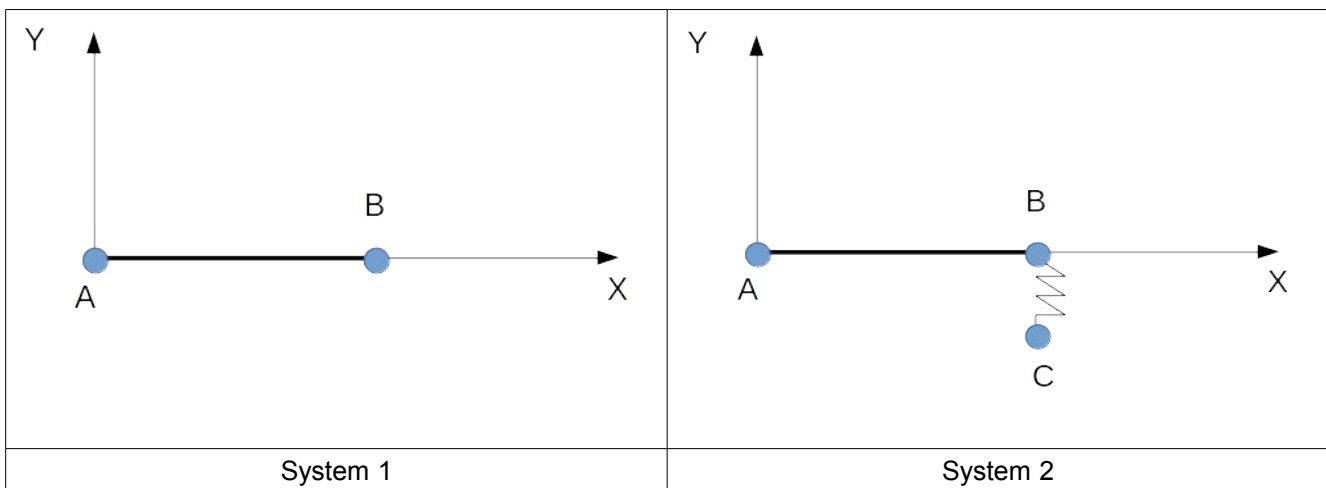
## 1 Modeling A

### 1.1 Goal

In this modeling one wishes to validate the couples characteristic modeling/  $DIS\_T/K\_T\_D\_NR$  and  $DIS\_T/A\_T\_D\_N$  as well as the couples  $DIS\_T/K\_T\_D\_L$  and  $DIS\_T/With\_T\_D\_L$ , in TOTAL reference mark and LOCAL reference mark. For that, one reproduces the tests EPX  $bm\_str\_resl\_nl$  (calculation 1) and  $bm\_str\_resg\_nl$  (calculation 2). This modeling also validates the use of the steel rings in  $CALC\_EPX$ .

### 1.2 Description

#### 1.2.1 Geometry and modeling



Two systems are compared. In both cases it is about a beam  $AB$  ( $POU\_D\_E$ ) of length  $1m$  connected to a spring in  $B$ . One mass of  $1000kg$  is also additionnée at the point  $B$ . In the first system, the beam is connected to a specific spring ( $DIS\_T/K\_T\_D\_N+A\_T\_D\_N$ ), in the second with a linear spring  $BC$  directed according to  $Y$  ( $DIS\_T/K\_T\_D\_L+A\_T\_D\_L$ ).

Section circular beam :  $R = 0.02$

**Correspondence of the groups of nodes with points indicated on the figure above.**

| Points | System 1 | System 2 |
|--------|----------|----------|
| With   | T_0_0_0  | P_0_0_0  |
| B      | T_1_0_0  | P_1_0_0  |
| C      | -        | P_1_L_0  |

#### 1.2.2 Properties of materials

**Beam:**

Young modulus:  $2E11 Pa$

Poisson's ratio:  $0$ .

Density:  $7800 kg/m^3$

**Springsshock absorbers:**

Elements in local reference mark (DIS\_T/SEG2 calculation 1 only) :

Stiffness according to  $X$  : 75000.  $N/m$   
Stiffness according to  $Y$  : 60000.  $N/m$   
Stiffness according to  $Z$  : 50000.  $N/m$   
Damping according to  $X$  : 7500.  $N/(m/s)$   
Damping according to  $Y$  : 6000.  $N/(m/s)$   
Damping according to  $Z$  : 5000.  $N/(m/s)$

Elements in total reference mark (DIS\_T calculation 2 and DIS\_T/POI1 calculation 1) :

Stiffness according to  $X$  : 60000.  $N/m$   
Stiffness according to  $Y$  : 75000.  $N/m$   
Stiffness according to  $Z$  : 50000.  $N/m$   
Damping according to  $X$  : 6000.  $N/(m/s)$   
Damping according to  $Y$  : 7500.  $N/(m/s)$   
Damping according to  $Z$  : 5000.  $N/(m/s)$

## 1.2.3 Boundary condition and loadings

The node  $A$  is embedded for the two systems. For system 2, the node  $C$  is also embedded. Two calculations are carried out.

Calculation 1:

In both Systèmes, a force constant of a value of 1000  $N$  is imposed in  $B$  according to  $Y$ .

Calculation 2:

In both Systèmes, forceS constants of a value of 1000  $N$  are imposed according to  $X$ ,  $Y$  and  $Z$  in  $B$ .

## 1.2.4 Values of reference

The values of reference are given by tests EUROPLEXUS mentioned in 1.1.

## 1.3 Values tested

### 1.3.1 Calculation 1

| GROUP_NO | NUME_ORDRE | Component | Reference      | Value of reference |
|----------|------------|-----------|----------------|--------------------|
| P_1_0_0  | 91609      | $DY$      | SOURCE_EXTERNE | 3.52220E-03        |
| T_1_0_0  | 91609      | $DY$      | SOURCE_EXTERNE | 1.29492E-02        |

### 1.3.2 Calculation 2

| GROUP_NO | NUME_ORDRE | Component | Reference      | Value of reference |
|----------|------------|-----------|----------------|--------------------|
| P_1_0_0  | 25064      | $DX$      | SOURCE_EXTERNE | -1.62766E-05       |
| T_1_0_0  | 25064      | $DX$      | SOURCE_EXTERNE | -1.62766E-05       |
| P_1_0_0  | 25064      | $DY$      | SOURCE_EXTERNE | 3.67804E-03        |
| T_1_0_0  | 25064      | $DY$      | SOURCE_EXTERNE | 3.67804E-03        |
| P_1_0_0  | 25064      | $DZ$      | SOURCE_EXTERNE | 4.58138E-03        |
| T_1_0_0  | 25064      | $DZ$      | SOURCE_EXTERNE | 4.58138E-03        |

## 2 Modeling B

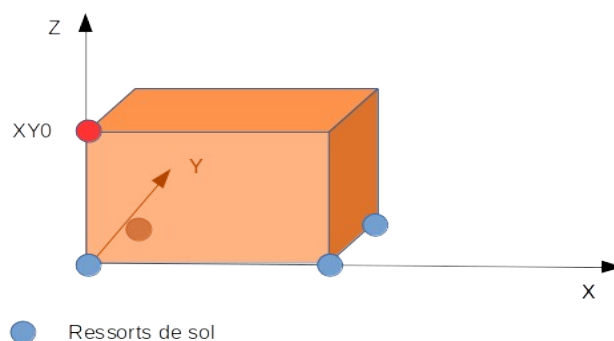
### 2.1 Goal

In this modeling, one wishes to validate the use of the carpets of springs with elements DIS\_T of worthless length. The functionality is already validated for elements DIS\_TR worthless length. That thus provides the values of reference.

### 2.2 Description

OneE structure in the form of parallelepiped composedE of only one element rests on a carpet made up here from 4 comes outS. One imposes a constant force on a node top of the cube XY 0 (with components in the 3 directions of space). It is checked then that the values of displacement to the node XY 0 are the same oneS with modeling DIS\_T that with modeling DIS\_TR (reference).

#### 2.2.1 Geometry



#### 2.2.2 Parameters of materials

**Structure :**

Young modulus: 30000 MPa

Poisson's ratio: 0.3

Density: 2500 kg/m<sup>3</sup>

**Springs:**

| GROUP_NO | Stiffnesses                  | Damping                           |
|----------|------------------------------|-----------------------------------|
| DIS_TR   | 1E6,1E6,1E6,2.5E5,2.5E5,5.E5 | 1E3, 1E3, 1E3, 2.5E2, 2.5E2, 5.E2 |
| DIS_T    | 1E6,1E6,1E6                  | 1E3,1E3,1E3                       |

**Note:** values in rotation on DIS\_TR data with RIGI\_PARASOL in this precise case allow that the values of rotations are worthless on each element of the carpet of springS.

#### 2.2.3 Loadings

Forces constants following are imposed on the node XY 0 :

- $FX = 1000 \text{ N}$
- $FY = 2000 \text{ N}$
- $FZ = -3000 \text{ N}$

## 2.3 Values tested

One tests the values at the final moment: 0.5 s

| GROUP_NO | NUME_ORDRE | Component | Reference   | Value of reference |
|----------|------------|-----------|-------------|--------------------|
| XY0      | 4331       | <i>DX</i> | AUTRE_ASTER | -0.00210267324236  |
| XY0      | 4331       | <i>DY</i> | AUTRE_ASTER | 0.00175325119557   |
| XY0      | 4331       | <i>DZ</i> | AUTRE_ASTER | -0.00691531181833  |

## 3 Conclusion

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results of comparison for these tests show that the various features are correctly takings into account by CALC\_EUROPLEXUS.