PLEXU11 – Validation use within the competences of ground Dyears \texttt{CALC\_EUROPLEXUS}

Summary:

This test aims at validating the use of elements \texttt{DISCRETE} in \texttt{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 1000 kg is also additionée 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.

<table>
<thead>
<tr>
<th>Points</th>
<th>System 1</th>
<th>System 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>With</td>
<td>T_0_0_0</td>
<td>P_0_0_0</td>
</tr>
<tr>
<td>B</td>
<td>T_1_0_0</td>
<td>P_1_0_0</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>P_1_L_0</td>
</tr>
</tbody>
</table>

1.2.2 Properties of materials

Beam:
Young modulus: 2E11 Pa
Poisson's ratio: 0.
Density: 7800 kg/m³
Spring shock 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, force 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

<table>
<thead>
<tr>
<th>GROUP_NO</th>
<th>NUME_ORDRE</th>
<th>Component</th>
<th>Reference</th>
<th>Value of reference</th>
</tr>
</thead>
<tbody>
<tr>
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<td>91609</td>
<td>DY</td>
<td>SOURCE_EXTERNE</td>
<td>3.52220E-03</td>
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<tr>
<td>T_1_0_0</td>
<td>91609</td>
<td>DY</td>
<td>SOURCE_EXTERNE</td>
<td>1.29492E-02</td>
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</table>

1.3.2 Calculation 2

<table>
<thead>
<tr>
<th>GROUP_NO</th>
<th>NUME_ORDRE</th>
<th>Component</th>
<th>Reference</th>
<th>Value of reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_1_0_0</td>
<td>25064</td>
<td>DX</td>
<td>SOURCE_EXTERNE</td>
<td>-1.62766E-05</td>
</tr>
<tr>
<td>T_1_0_0</td>
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<td>DX</td>
<td>SOURCE_EXTERNE</td>
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<td>P_1_0_0</td>
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<td>SOURCE_EXTERNE</td>
<td>3.67804E-03</td>
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<td>25064</td>
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<tr>
<td>P_1_0_0</td>
<td>25064</td>
<td>DZ</td>
<td>SOURCE_EXTERNE</td>
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<td>25064</td>
<td>DZ</td>
<td>SOURCE_EXTERNE</td>
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</tbody>
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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 composed of only one element rests on a carpet made up here from 4 comes out. 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 one with modeling DIS_T that with modeling DIS_TR (reference).

2.2.1 Geometry

![Diagram of structure](image)

2.2.2 Parameters of materials

**Structure**:
- Young modulus: $30000\text{ MPa}$
- Poisson's ratio: $0.3$
- Density: $2500\text{ kg/m}^3$

**Springs**:

<table>
<thead>
<tr>
<th>GROUP_NO</th>
<th>Stiffnesses</th>
<th>Damping</th>
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<tbody>
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<td>DIS_T</td>
<td>1E6, 1E6, 1E6</td>
<td>1E3, 1E3, 1E3</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>GROUP_NO</th>
<th>NUME_ORDRE</th>
<th>Component</th>
<th>Reference</th>
<th>Value of reference</th>
</tr>
</thead>
<tbody>
<tr>
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<td>DX</td>
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3 Conclusion

results of comparison for these tests show that the various features are correctly taking into account by CALC_EUROPLEXUS.