ZZZZ205 – Calculation of the kinetic energy of a rectangular plate

Summary:

This case test is intended to validate the calculation of the kinetic energy for massive modelings 2D.

Only one modeling is carried out made up of meshes QUAD4 and TRIA3.
1 Problem of reference

1.1 Geometry

![Diagram of a rectangular plate with dimensions 0.35x0.25, 0.3x0.45]

1.2 Properties of material

- Steel
  - \( E = 2 \times 10^{11} \text{ MPa} \)
  - \( \nu = 0.3 \)
  - \( \rho = 7800 \text{ kg/m}^3 \)

1.3 Boundary conditions

Calculation of the kinetic energy starting from speed \( E_c = \frac{1}{2} V^T M V \):

- A uniform speed is imposed:
  - with \( t = 1 \text{s} \) : according to \( X \) of 1.5 m/s
  - with \( t = 2 \text{s} \) : according to \( X \) of 1.5 m/s and following \( Y \) of 2.5 m/s

1.4 Initial conditions

None.
2 Reference solution

2.1 Method of calculating

The solution is analytical. The kinetic energy is deduced from speed:

\[ E_c = \frac{1}{2} V^2 M V \]

2.2 Sizes and results of reference

<table>
<thead>
<tr>
<th>Sizes</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>2.0475 \times 10^3</td>
<td>kg</td>
</tr>
<tr>
<td>( E_c (t = 1s) )</td>
<td>2.3034375 \times 10^3</td>
<td>W</td>
</tr>
<tr>
<td>( E_c (t = 2s) )</td>
<td>8.70187 \times 10^3</td>
<td>W</td>
</tr>
</tbody>
</table>
3 Modeling A

3.1 Characteristics of modeling

![Mesh representation]

3.2 Characteristics of the grid

Many meshes: 541 (320 TRIA3, 221 QUAD4)
Many nodes: 423

3.3 Sizes tested and results

<table>
<thead>
<tr>
<th>Identification</th>
<th>Size</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>TOTALE</td>
<td>2.047510³</td>
</tr>
<tr>
<td>Kinetic energy</td>
<td>TOTALE</td>
<td>2.30344 10³</td>
</tr>
<tr>
<td>(t = 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinetic energy</td>
<td>TOTALE</td>
<td>8.70187 10³</td>
</tr>
<tr>
<td>(t = 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 Summary of the results

This test makes it possible to validate the calculation of the kinetic energy for modeling D_PLAN.