SSLL108 - Discrete elements 2D

Summarized:

The problem is quasi-static linear in structural mechanics.

One analyzes the response of a bar, modelled by 10 discrete elements, with a loading of tension, to validate the two-dimensional discrete elements.

Only one modelization uses at the same time operators MECA_STATIQUE, and STAT_NON_LINE, to validate the use of these elements (of which the behavior remains linear) with other finite elements with unspecified behavior.

1 Problem of reference

1.1 Geometry

a bar length $L=10\mathrm{m}$, along the axis X, modelled by 10 discrete elements with 2 nodes.

1.2 Material properties

Each discrete element has a stiffness: $k=1\,000\,N/m$

1.3 Boundary conditions and loadings

In $x=0$	$dx=dy=0$
Of $x=L$	$Fx=10\mathrm{N}$

2 Reference solution

2.1 Method of calculating used for the analytical reference solution

Solution: displacement for an element is given by: $Ux=F/Kx$
Thus for n springs: $Ux=n\,F/Kx$

2.2 Results of reference

Values of displacement for $x=L/2$ and $X=L$, as well as force in the elements (constant):
$U(L/2)=0.05\,m$ $U(L)=0.1\,m$, $N=10\mathrm{N}$

2.3 Uncertainty on the solution

exact analytical Solution.

3 Modelization A

3.1 Characteristic of the modelization

Modelization 2D_DISCRET

3.2 Characteristic of the mesh

10 meshes SEG2.

3.3 Quantities tested and results

Identification	Reference	Tolerance
MECA_STATIQUE		
$DX(L/2)$	0.05	1.0E-07
$DX(L)$	0.10	1.0E-07
N SIEF_ELGA	10.00	1.0E-03
STAT_NON_LINE		
$DX(L/2)$	0.05	1.0E-07
$DX(L)$	0.10	1.0E-07
N SIEF_ELGA	10.0	1.0E-03

4 Summary of the results

This very simple test voluntarily makes it possible to check the correct operation of the discrete elements 2D with STAT_NON_LINE, which makes it possible to use them with other modelizations.