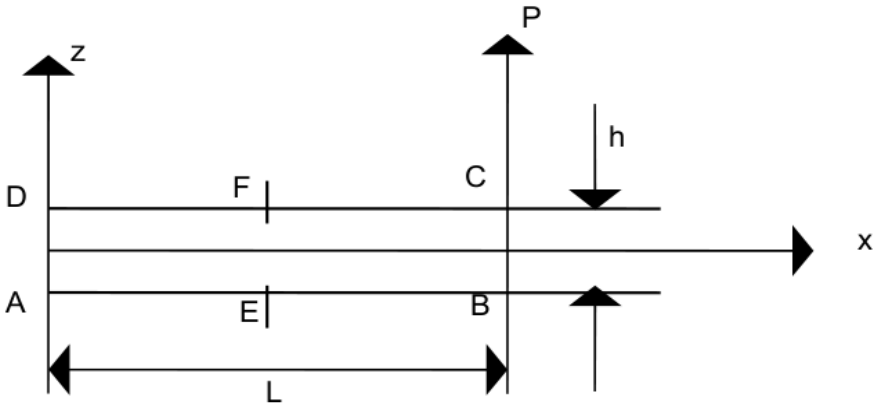
SSLP303 - Plate cantilever charged with sound end

Summary:

The goal of the test is to validate the keyword FORCE_CONTOUR, starting from a load applied at the end of a plate. With the problem is dealt in plane constraints.

1 Problem of reference

1.1 Geometry



Not E = medium of AB not F = medium of DC

Length: $L=1\,m$

Width: $l=0.1\,m$

Thickness: $h=0.005\,m$

Moment of inertia of section: $l_Y=\frac{h^3 l}{12}=1.042\times10^{-9}\,m^4$

1.2 Material properties

Young modulus: $E=2.1\times10^{11}\,Pa$

Poisson's ratio: $\nu=0.3$

1.3 Boundary conditions and loadings

- Embedding of the edge AD ($u=v=0$).
- Load of resultant $P=85\,N$, applied to the edge BC (constant linear load).

1.4 Boundary conditions and loadings

Without object for the static analysis.

2 Reference solution

2.1 Method of calculating used for the reference solution

The value of the field of displacement v, at the loose lead of the plate (edge BC) is given by:

$v_L = \frac{PL^3}{3EI_y}$ (neglected shearing)

from where $v_L = 0.129\,m$

The stress field σ_{xx} of inflection is given by:

$\sigma_{xx} = \frac{Ph}{2I_y}(L-x)$ on the edge AB

that is to say $\sigma_{xx} = 2.04 \times 10^8 (L-x)(Pa)$

2.2 Results of reference

- Displacement v_L Nœuds B and C
- Constraints σ_{xx} with Nœuds A and B and E

2.3 Uncertainty on the solution

Analytical solution.

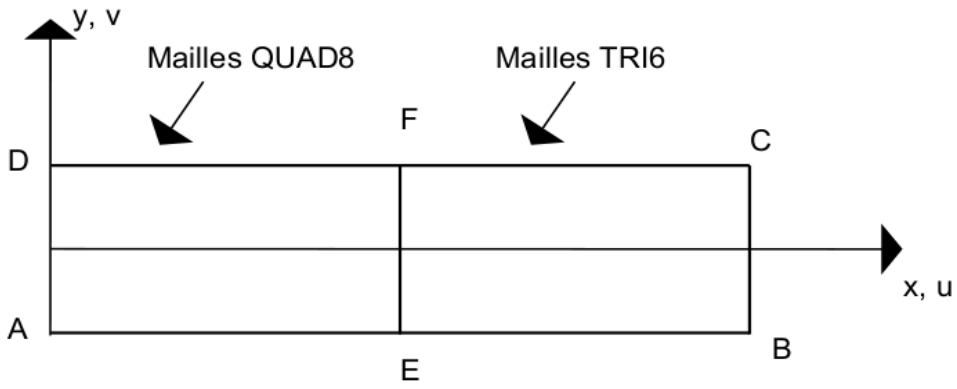
2.4 Bibliographical references

1) S. TIMOSHENKO, Resistance of Materials, 1era part. Polytechnic bookstore CH. Béranger, Paris, 1947. p 169 to 168

3 Modeling A

3.1 Characteristics of modeling

C-PLAN, meshs TRI6 and QUAD8



Not E = medium of AB not F = medium of CD

Name of the nodes:
Not $A=N1$ Not $D=N403$
Not $B=N455$ Not $E=N201$
Not $C=N756$ Not $F=N352$

3.2 Characteristics of the grid

Many nodes: 905

Number of meshs and ty pes: 100 QUAD8 , 200 TRIA6 , 208 SEG3

3.3 Values tested

Localization	Type of value	Reference	% difference
Points B , C	v_L (m)	0.129	0.4
Not A	σ_{xx} (Pa)	2,04E+8	2.3
Not E	σ_{xx} (Pa)	1,02E+8	0.5

3.4 Remarks

The variation with the analytical solution, of standard beam or hurled plate, is due to modeling used: dimensions of the structure, very slim, do not make it possible indeed to observe the conditions of plane constraints.

4 Summary of the results

This test, based on a solution of hurled plate, is treated in 2D (forced plane) in order to validate the loading of edge (keyword FORCE_CONTOUR). The solution obtained is close to the analytical solution (0.4% of difference on displacements) and thus validates this kind of modeling.