

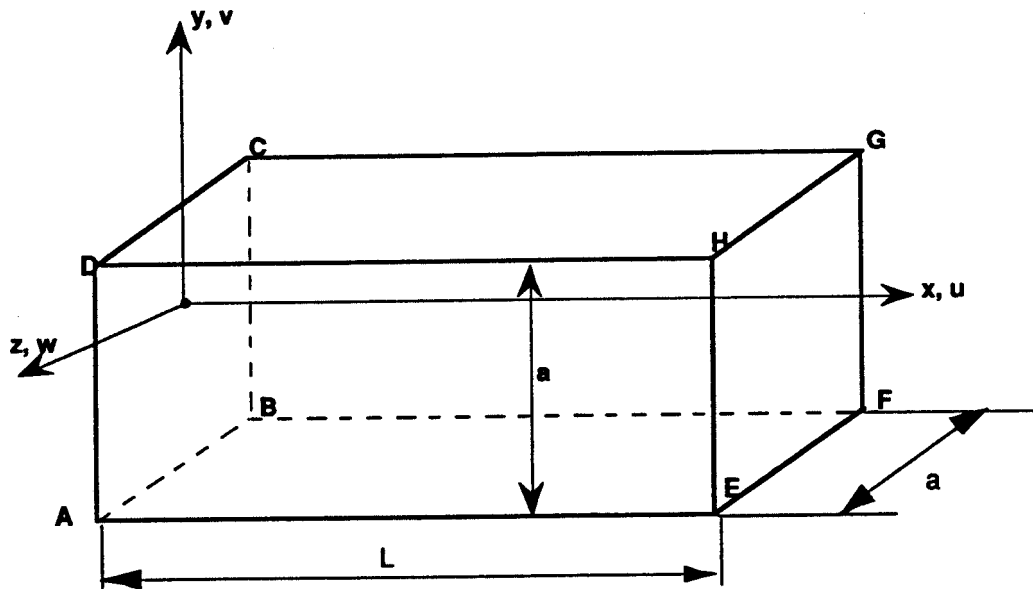
SSLV306 - Beam 3D in imposed displacements

Summary:

The purpose of the test is to validate the displacements imposed on faces (`FACE_IMPO`), their values being variable in space. These values are imposed at the end of a beam 3D, modelling a bending strain.

1 Problem of reference

1.1 Geometry



Length : $L = 2\text{ m}$
 Square section, on side : $a = 0.2\text{ m}$
 Moment of inertia : $I = 1.333 \times 10^{-4}\text{ m}^4$

1.2 Material properties

$E = 2.1 \times 10^{11}\text{ Pa}$
 $\nu = 0.3$

1.3 Boundary conditions and loadings

Embedding of the section $ABCD$

Displacement imposed on the face $EFGH$:

- constant v_o in the direction y , $v_o = 0.952 \times 10^{-5}\text{ m}$
- varying according to the position y point of the section, and being worth:
 $u_o = -y\theta_o$, $\theta_o = 0.714 \times 10^{-5}\text{ radians}$

1.4 Initial conditions

Without object for the static analysis.

2 Reference solution

2.1 Method of calculating used for the reference solution

The displacements imposed equivalent on a force applied at the end of resultant:

$$F = \frac{3EI}{L^3} v_o = 100N$$

θ_o represent the rotation of the section $EFGH$:

$$\theta_o = \frac{FL^2}{2EI}$$

The bending stress σ_{xx} with embedding is worth then:

$$\sigma_{xx}(ABCD) = \pm \frac{FL}{I/y}$$

2.2 Results of reference

- 1) Displacement v points E, F, G, H
- 2) Bending stresses σ_{xx} at the points A, B, C, D

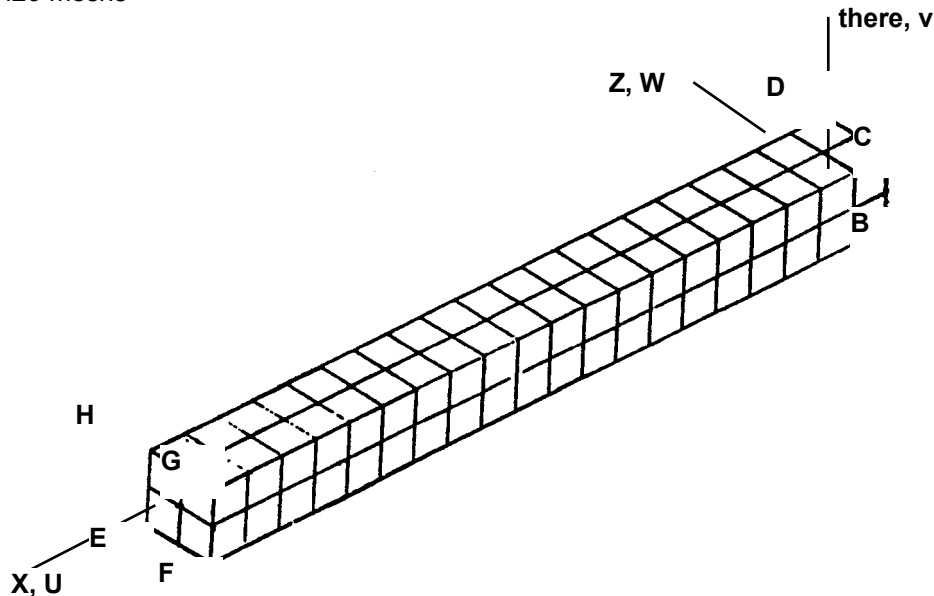
2.3 Uncertainty on the solution

Analytical solution.

3 Modeling A

3.1 Characteristics of modeling

3D, H20 meshes



Loading by displacements imposed on face $EFGH$:

$$DY : 0.952 \times 10^{-5}$$

$$DX : \text{function of } y \text{ defined in 2 points: } \begin{aligned} f(0) &= 0 \\ f(0,1) &= -0.0714E-5 \end{aligned}$$

Cutting:

- 1) 20 elements according to the length
- 2) 2 elements according to the width and the thickness

3.2 Characteristics of the grid

Many nodes: 621

Many meshes and types: 80 HEXA20

4 Results of modeling A

4.1 Values tested

Localization	Type of value	Reference	Aster	% difference
Points E, F, G, H	$v(m)$	9.52×10^{-6}	9.52×10^{-6}	0
Points E, F	$u(m)$	7.14×10^{-7}	7.14×10^{-7}	0.
Points G, H	$u(m)$	-7.14×10^{-7}	-7.14×10^{-7}	0.
Points A, B	$\sigma_{xx}(Pa)$	1.5×10^5	1.64×10^5	9.5
Points C, D	$\sigma_{xx}(Pa)$	-1.5×10^5	-1.64×10^5	-9.5

5 Summary of the results

The functionality "displacements imposed function" provides the expected results; the values of bending stresses are satisfactory, given that with the dealt problem is a problem of inflection.