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## SSNV139 - Plate skews

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### Summary:

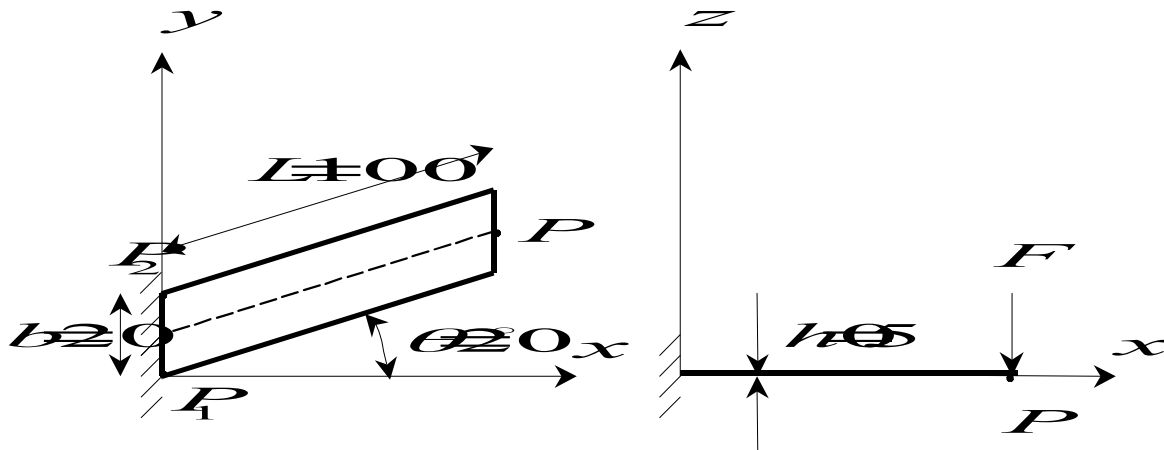
Quasi static calculation of a horizontal oblique elastic plate embedded on a side and subjected to a vertical concentrated force. The results are compared with those of software the SAMCEF software.

The interest is to test the finite element of COQUE\_3D into nonlinear geometrical COQUE\_3D by using the algorithm of update of great rotations 3D GROT\_GDEP in STAT\_NON\_LINE.

Rotations are 3D and slightly higher than 1 radian.

## 1 Problem of reference

### 1.1 Geometry



Oblique plate embedded in  $P_1P_2$  and subjected in  $P$  with a concentrated vertical force:

$$f = -F e_z ; F > 0$$

### 1.2 Material properties

Elastic behavior:

$$E = 2100000 ; \nu = \frac{1}{3}$$

### 1.3 Boundary conditions and loadings

Embedding in  $P_1P_2$ . One seeks the successive states of balance under the loading made up of the force:

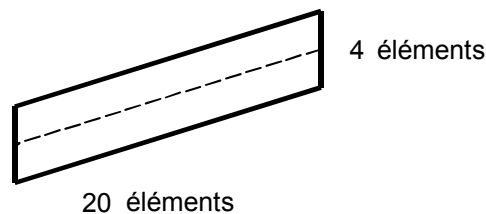
$$F(t) = t$$

in  $P$ ,  $t$  being the pseudonym time.

One is interested particularly in displacements horizontal and vertical in  $P$ .

## 2 Reference solution

This solution [bib4] is that which is obtained with software the SAMCEF software [bib1]. Modeling is based on a theory of hull in resulting efforts with a Co-rotational formulation [bib3] and a discretization DSQ [bib2].



The grid considered is of  $20 \times 4$  quadrilateral elements with 4 nodes each one.

### 2.1 Bibliographical references

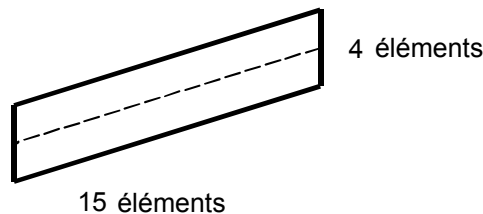
- 1) The SAMCEF software, Handbook of reference V7.1 Elements Volume, 1998
- 2) J-L. BATOZ, G.DHATT: "Modeling of the Structures by Finite elements: Beams and Plates", Hermes, Paris, 1992
- 3) M.A. CRISFIELD: "Non-linear Finite Element Analysis of Solids and Structures", Volume 1: Essentials, John Wiley, Chichester, 1994
- 4) PH. JETTEUR: Kinematics Non Linéaire of the Hulls. Report SAMTECH, Contract PP/GC - 134/96, 1998

## 3 Modeling A

### 3.1 Characteristics of modeling

Element MEC3QU9H (voluminal hull)

Modeling COQUE\_3D



### 3.2 Characteristics of the grid

Many nodes: 387

Many meshes and types: 60 QUAD9

### 3.3 Features tested

- Modeling COQUE\_3D into nonlinear geometrical.
- The static algorithm of update of great rotations GROT\_GDEP of STAT\_NON\_LINE.

### 3.4 Values tested

History of horizontal displacement  $DX$  with the node charged

Moment	Force $F$	Reference
250.	250.	- 3.807E+01
500.	500.	- 5.200E+01

History of vertical displacement  $DZ$  with the node charged

Moment	Force $F$	Reference
250.	250.	- 7.240E+01
500.	500.	- 8.073E+01

### 3.5 Remarks

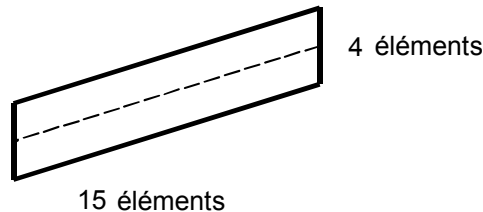
One uses the value by default of COEF\_RIGI\_DRZ = 0.00001.

## 4 Modeling B

### 4.1 Characteristics of modeling

Element MEC3TR7H (voluminal hull)

Modeling COQUE\_3D



### 4.2 Characteristics of the grid

Many nodes: 507

Many meshes and types: 120 TRIA7

### 4.3 Features tested

- Modeling COQUE\_3D into nonlinear geometrical.
- The static algorithm of update of great rotations GROT\_GDEP of STAT\_NON\_LINE.

### 4.4 Values tested

History of horizontal displacement  $DX$  with the node charged

Moment	Force $F$	Reference
250.	250.	- 3.807E+01
500.	500.	- 5.200E+01

History of vertical displacement  $DZ$  with the node charged

Moment	Force $F$	Reference
250.	250.	- 7.240E+01
500.	500.	- 8.073E+01

### 4.5 Remarks

One uses the value by default of COEF\_RIGI\_DRZ = 0.00001.

## 5 Summary of the results

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The model used for the reference solution is based on a theory in resulting efforts with Co-rotational formulation [bib3], whereas that of *Code\_Aster* use a voluminal approach with a formulation in Lagrangian total [R3.07.04].

For this thin hull, the triangle and the quadrangle give good performances.