SSNV139 - Plate skews

Summary:

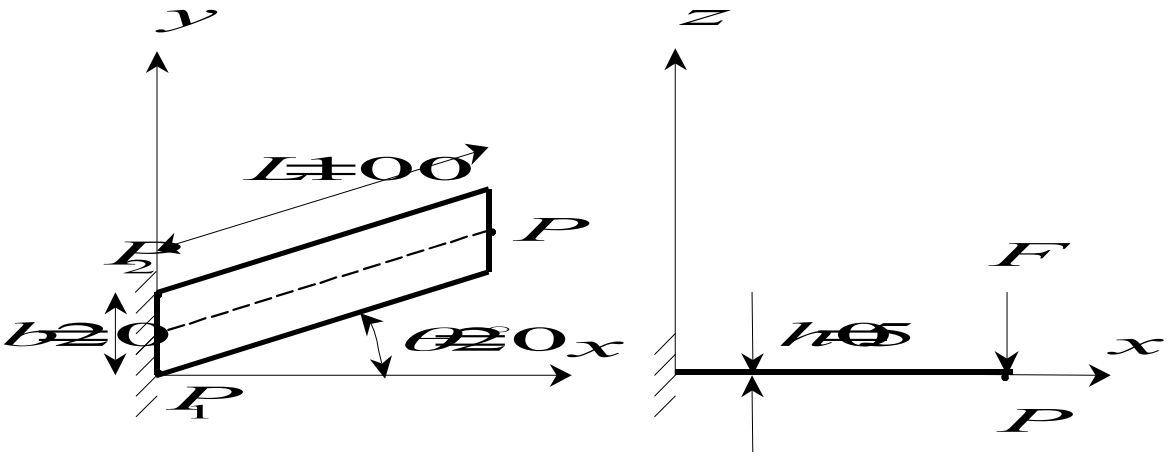
Quasi static calculation of a horizontal oblique elastic plate embedded on a side and subjected to a vertical concentrated force. The results are compared with those of software the SAMCEF software.

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:

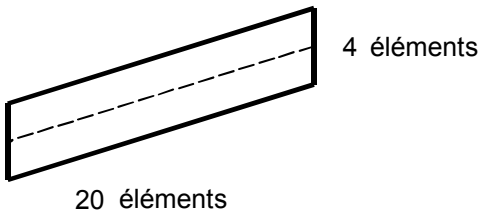
$$F(t)=t$$

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 20×4 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

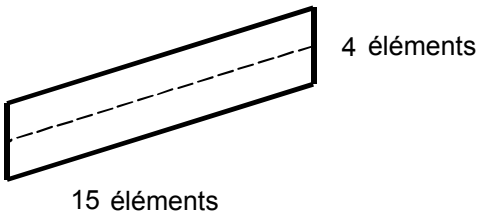
4) PH. JETTEUR: Kinematics Non Linéaire of the Hulls. Report SAMTECH, Contract PP/GC - 134/96, 1998

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 meshs 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

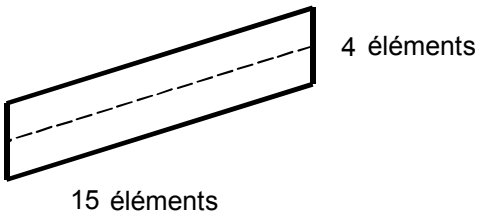
One uses the value by default of COEF_RIGI_DRZ = 0.00001.

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 meshs 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

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.