

SSNV139 - Oblique plate

Abstract:

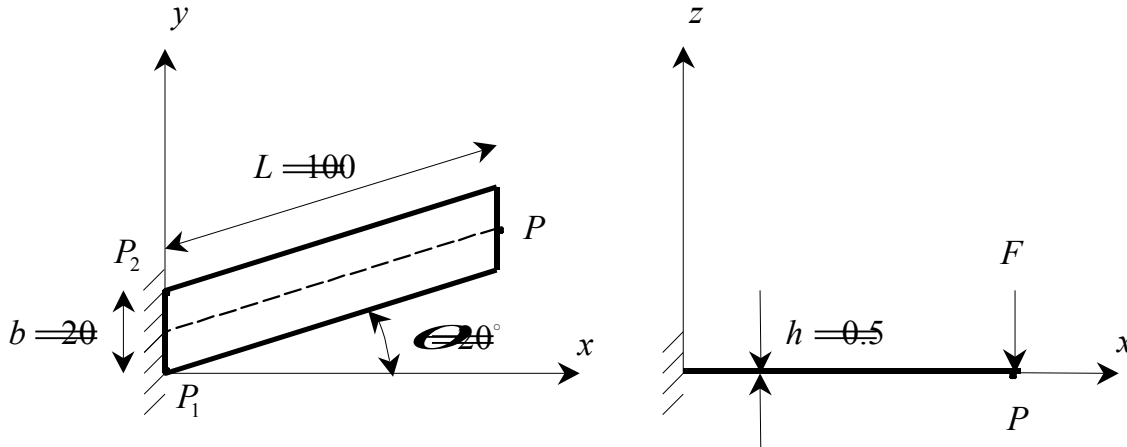
Quasi static computation of a horizontal oblique elastic plate embedded on a side and subjected to a vertical concentrated force. The results are compared with those of software the SAMCEF software.

The interest is to test in nonlinear the finite element of COQUE_3D geometrical COQUE_3D by means of the algorithm of update of large rotations 3D GROT_GDEP in STAT_NON_LINE.

Rotations are 3D and slightly higher than 1 radian.

1 Problem of reference

1.1 Geometry



Plates skewed clamped in P_1P_2 and subjected in P to a concentrated vertical force:

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

1.2 Material properties

Behavior elastic:

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

1.3 Boundary conditions and loadings

Fixed support in P_1P_2 . One seeks the successive states of equilibrium under the loading made up of the force:

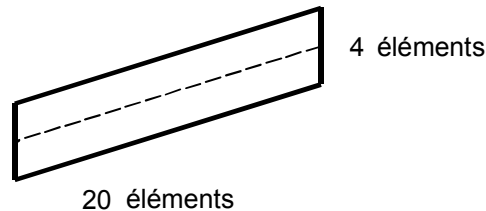
$$F(t) = t$$

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]. The modelization is based on a theory of shell in resulting forces with a CO-rotational formulation [bib3] and a discretization DSQ [bib2].



The mesh considered with 4 20×4 nodes each one is quadrilateral elements.

2.1 Bibliographical references

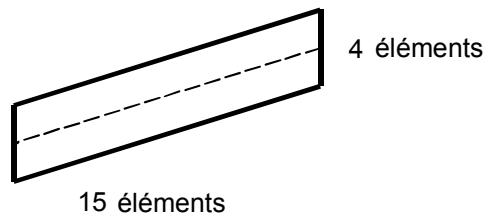
- 1) the SAMCEF software, Handbook of reference V7.1 Elements Volume, 1998
- 2) J-L. BATOZ, G.DHATT: "Modelization of Structures by Finite elements: Beams and Plates", Hermes, Paris, 1992
- 3) M.A. CRISFIELD: "Non-linear Finite Element Analysis of Solids and Structures", Volume 1: Essentials, John Wiley,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

3 Modelization A

3.1 Characteristic of the modelization

Element MEC3QU9H (voluminal shell)

Modelization COQUE_3D



3.2 Characteristics of the mesh

Many nodes: 387

Number of meshes and types: 60 QUAD9

3.3 Functionalities tested

The modelization COQUE_3D in nonlinear geometrical.

The static algorithm of update of large rotations GROT_GDEP of STAT_NON_LINE.

3.4 Values tested

History of horizontal displacement DX to the node charged

Urgent	Forces F	Reference
250.	250.	- 3.807E+01
500.	500.	- 5.200E+01

History of vertical displacement DZ to the node charged

Urgent	Forces F	Reference
250.	250.	- 7.240E+01
500.	500.	-8.073E+01

3.5 Remarks

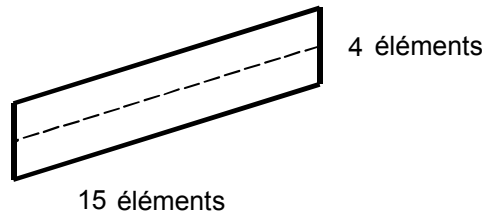
One uses the default value of COEF_RIGI_DRZ = 0.00001.

4 Modelization B

4.1 Characteristic of the modelization

Element MEC3TR7H (voluminal shell)

Modelization COQUE_3D



4.2 Characteristics of the mesh

Many nodes: 507

Number of meshes and types: 120 TRIA7

4.3 Functionalities tested

The modelization COQUE_3D in nonlinear geometrical.

The static algorithm of update of large rotations GROT_GDEP of STAT_NON_LINE.

4.4 Values tested

History of horizontal displacement DX to the node charged

Urgent	Forces F	Reference
250.	250.	- 3.807E+01
500.	500.	- 5.200E+01

History of vertical displacement DZ to the node charged

Urgent	Forces F	Reference
250.	250.	- 7.240E+01
500.	500.	- 8.073E+01

4.5 Remarks

One uses the default value 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 forces with CO-rotational formulation [bib3], whereas that of *Code_Aster* uses a voluminal approach with a formulation in Lagrangian total [R3.07.04].

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