SSNV108 - Test-tube CT-round Robin European in Breaking process (1985)

Summary

It is about a test in statics for a three-dimensional non-linear elastic problem. This test allows:

- to make sure of nonthe regression of the features of*Aster* in breaking process,
- to check the invariance of the calculation of G compared to the crowns of integration.

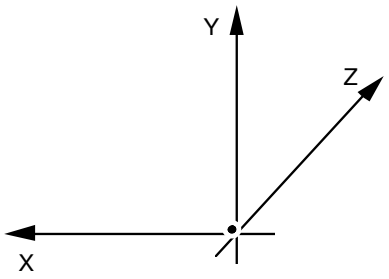
The functionality tested is CALC_G .

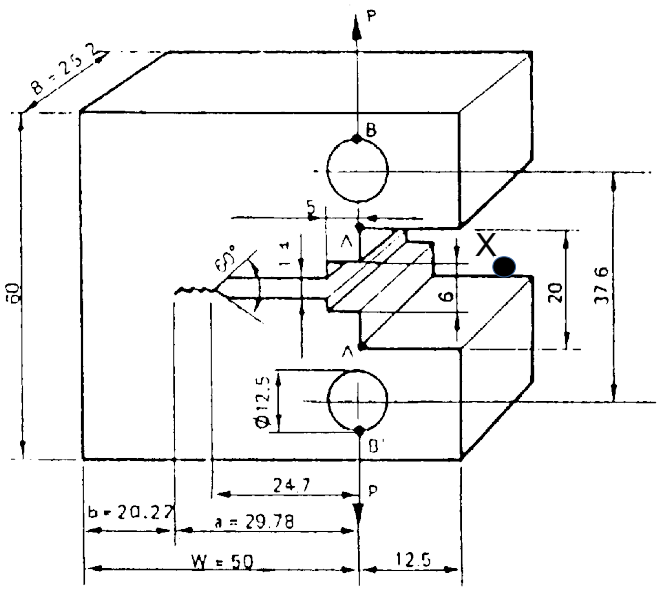
Four modelings are available:
- modeling a: fissures with a grid, quadratic isoparametric elements 3D,
- modeling b: fissures nonwith a grid (X-FEM), elements 2d
- modeling C: crack nonwith a grid (X-FEM), elements 3D

The formulation of this test is resulting from the Round European Robin in breaking process of 1985.

1 Problem of reference

1.1 Geometry



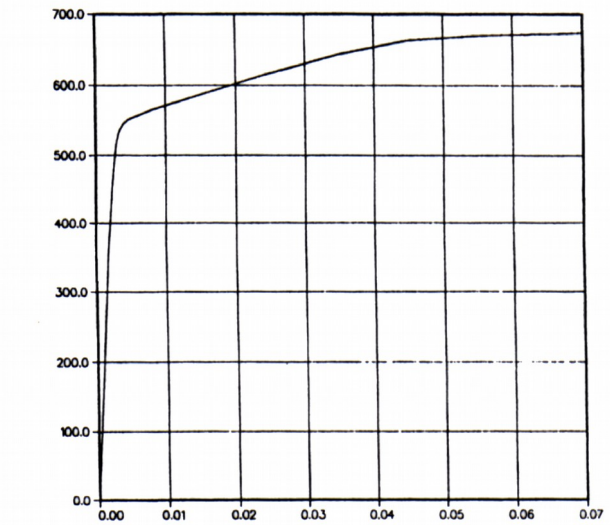


1.2 Properties of materials

Nonlinear elasticity (Von Mises Isotrope)

$E = 205\,000\ Mpa$

$\nu = 0.3$



1.3 Boundary conditions and loadings

By reason of symmetry one models $1/4$ structure, (half of the upper part).

- Displacements imposed on a line parallel with the axis Z and passing by the point B : $u_y = -1.$
- Symmetry plane $y=0$: $u_y = 0.$
- Symmetry plane $z=0$: $u_z = 0.$
- Not O blocked: $u_x = u_y = u_z = 0.$

2 Reference solution

2.1 Method of calculating used for the reference solution

Without object.

2.2 Results of reference

There strictly speaking does not exist reference solution but a set of results of the participants in the Round Robin. These results are got by calculations elements Finis with various codes and by using very different modelings: 2D (plane constraints, plane deformations), 3D, small or great displacements, etc…

However, the digital values tested in this case test result from a former execution of Aster. It is a case test of not-regression.

2.3 Uncertainty on the solution

Without object.

2.4 Bibliographical references

1) L.H. LARSSON: EGF Numerical Round Robin one EPFM.

2) J.L. CHEISSOUX: “Round Robin” of calculation in elastoplastic mechanics of the rupture - Note DRE/STRE/LMA 82/480 (09/82).

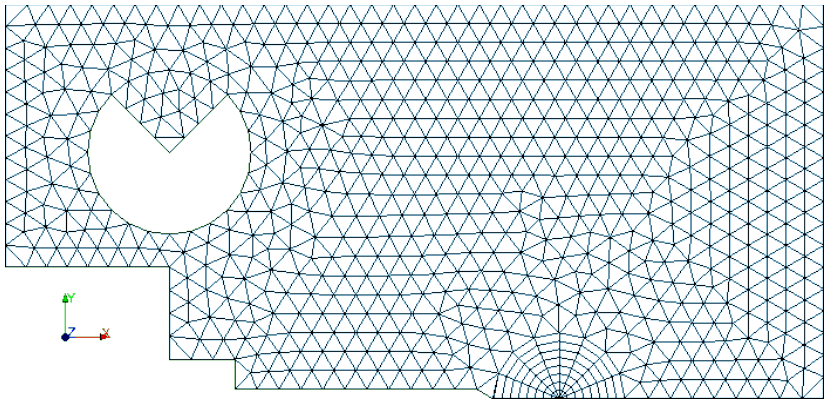
3) Y. WADIER: Application of the method Theta under investigation of a test-tube CT in three-dimensional elastoplastic rupture. Note EDF HI/5696-07 of the 2/25/87.

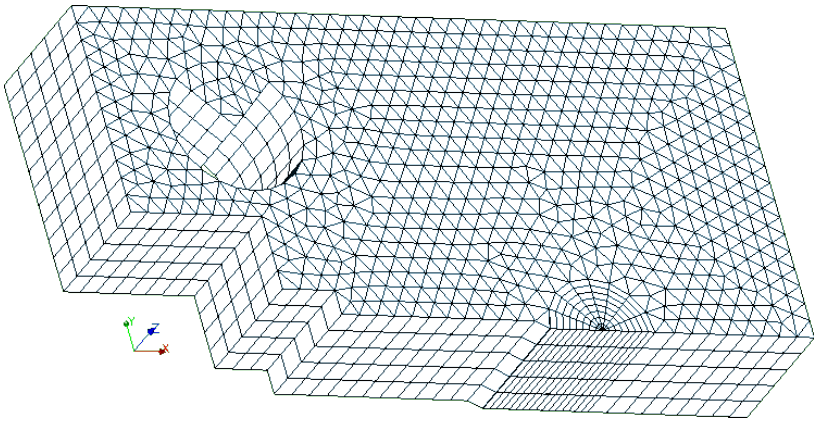
4) L.H. LARSSON: “Calculationnal Round Robin of the EPFM: specifications for phase 2”. 162/194/19B2 (Ispra, June 1982).

5) M.P. VALETA, MR. BUSSON: “Study modeling of a CT25” - Report DMT/95-602.

3 Modeling A

3.1 Characteristics of modeling





3.2 Characteristics of the grid

Number of nodes : 21048
Many meshs and types: 6380 PENTA18 and 280 HEXA20

The nodes mediums of the edges of the elements touching the bottom of crack are moved with the quarter of these edges.

3.3 Values tested and results of modeling A

Identification	Standard test	Value	Precision
DY with the node X	NON_REGRESSION	0.864211781008	1.e-12

Identification	Standard test	Value	Precision
INST	NON_REGRESSION	1.0E0	0,10%
ITER_GLOB	NON_REGRESSION	7	0

The keyword is used SYME in the operator DEFI_FOND_FISS, what results in taking into account half of the structure in the operator CALC_G. It is thus necessary to multiply by two the following results to have the rate of refund of energy of the complete structure.

Identification	Standard test	Value	Precision
G_GLOBAL – Crown 1	NON_REGRESSION	4204.11	0,02%
G_GLOBAL – Crown 2	NON_REGRESSION	4067.96	0,02%
G_GLOBAL – Crown 3	NON_REGRESSION	4066.88	0,02%

Identification	Standard test	Value	Precision
G_LOCAL – Crown 1	NON_REGRESSION	51.21	0,02%
G_LOCAL – Crown 2	NON_REGRESSION	54.35	0,02%
G_LOCAL – Crown 3	NON_REGRESSION	53.06	0,02%

G_LOCAL is calculated in the symmetry plane perpendicular to the crack

3.4 Remarks

Nothing.

4 Modeling B

4.1 Characteristics of modeling

The crack is not with a grid (modeling X-FEM).
One places oneself in assumption of Plane Constraints.
One models the upper part and the lower part of the structure.

4.2 Values tested and results of modeling B

One tests the value of the displacement of the node (even node that tested in modeling A).

Identification	Standard test	Value	Precision
DY with the node X	AUTRE_ASTER	-8.64270887097E-01	0,16

This test is doubled of a test of not-regression.

5 Modeling C

5.1 Characteristics of modeling

The crack is not with a grid (modeling X-FEM).
The structure in 3D is modelled.
One models the upper part and the lower part of the structure.

5.2 Values tested and results of modeling C

One tests the value of the displacement of the node (even node that tested in modeling A).

Identification	Standard test	Value	Precision
DY with the node X	AUTRE_ASTER	-8.64270887097E-01	0,18

This test is doubled of a test of not-regression.

Identification	Standard test	Value	Precision
G (local)	NON_REGRESSION	408,87	0,02%

6 Summaries of the results

This test makes it possible to validate the calculation of the rate of refund in non-linear elasticity with a crack with a grid or not-with a grid (X-FEM).