

SSNA108 - Weibull models, Bordet and of Rice and Summarized

Tracey:

This test of nonlinear quasi-static mechanics makes it possible to validate the Weibull models and of Rice - Tracey in 2D (command `POST_ELEM`) and of Bordet (command `CALC_BORDET`) in the case of a notched axisymmetric test-tube subjected to a simple traction test.

The modelization of the test-tube is realized with elements 2D (QUA8).

1 Problem of reference

1.1 Geometry

One considers a notched cylindrical test-tube:

diameter of the test-tube: 18 mm ,
radius of the notch: 5 mm .

1.2 Properties of the material

One adopts an elastoplastic constitutive law of Von Mises with isotropic hardening *TENSION* whose curve of tension is given point by point:

ε	the	0.005	0.01	0.015	0.02	0.025	0.03	0.04	0.05	0.075	0.1
	0.0027										
σ (MPa)	555.58			657.6			704.7			772.7	
	9.631			76.69			25.74			94	
				1			1				
	0.125	0.15	0.2.0.		0.5.0.		0.8.0.				
			3.0.4		6.0.7		9.812				
	827.8			912.9			965.9				
	51.88			33.95			78.99				
	7			0			0				

strains used in the behavior model are the linearized strains. The Young modulus E rises with 200 GPa while the Poisson's ratio ν is worth $0,3$.

The coefficients of the Weibull models and Bordet used are the following:

$$m=8$$

$$V_0=100\ \mu\text{m}$$

$$\sigma_u=2630\ \text{MPa}$$

$$\sigma_{ys,0}=\sigma_{ys}555\ \text{MPa}$$

$$\sigma_{th}=600\ \text{MPa} .$$

1.3 Boundary conditions and loadings

While referring to the figure of [§3.1] the boundary conditions are the following ones:

BC : following imposed displacement (Y)

OA : displacements blocked according to (Y)

OB : displacements blocked according to (X) .

1.4 Forced

initial conditions and null strains.

2 Reference solution

2.1 numerical

Method of calculating Solution calculated by CASTEM2000 and Zébulon for the Weibull models and Rice and Tracey; test of non regression for the model of Bordet.

2.2 Quantities and results of reference

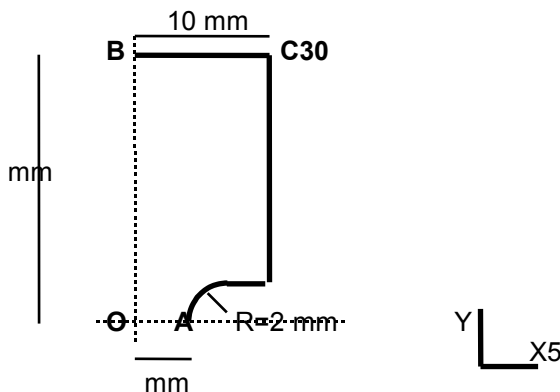
the stresses of Weibull (WEIBULL) and Bordet as well as the rate of triaxiality (RICE_TRACEY) on different meshes were calculated at various times.

2.3 Uncertainties on the solution

Accuracy of the codes.

3 Modelization A

3.1 Characteristic of the mesh



3.2 Characteristic of the mesh

Many nodes: 1219
Number of meshes and types: 320 (QUA8).

3.3 Quantities tested and results

the variation noted with the reference solution remains lower than 1%.

4 Results of the modelization A

4.1 Values tested

One tests the parameters of the data structure results:

Identification	Reference	Test	Tolerance
INST for NUME ORDRE= 1 0	10,0	ANALYTIQUE	0,10%
ITER_GLOB	8	NON REGRESSION	0.00%

Weibull model:

Identification	Reference	Test	Tolerance
C ontrainte of Weibull for <i>INST</i> = 2,0	1.4079E+003	NON_DEFINI	0,1% (relative)
C ontrainte of Weibull for <i>INST</i> = 4,0	2.4973E+003	NON_DEFINI	0,1% (relative)
C ontrainte of Weibull for <i>INST</i> = 6,0	3.3332E+003	NON_DEFINI	0,1% (relative)
C ontrainte of Weibull for <i>INST</i> = 8,0	3.7537E+003	NON_DEFINI	0,1% (relative)
C ontrainte of Weibull for <i>INST</i> = 10,0	4.0477E+003	NON_DEFINI	0,1% (relative)

Models of Rice-Tracey:

Identification	Reference	Test	Tolerance
Growth rate of the cavity for <i>INST</i> = 1,0	1.0000E+000	NON_DEFINI	0,1% (relative)
Volume of the cavity for <i>INST</i> = 1,0	3.7500E+000	NON_DEFINI	0,1% (relative)
Growth rate of the cavity for <i>INST</i> = 3,0	1.0014E+000	NON_DEFINI	0,1% (relative)
Volume of the cavity for <i>INST</i> = 3,0	6.2372E-001	NON_DEFINI	0,1% (relative)
Growth rate of the cavity for <i>INST</i> = 5,0	1.0076E+000	NON_DEFINI	0,1% (relative)
Growth rate of the cavity for <i>INST</i> = 7,0	1.0170E+000	NON_DEFINI	0,1% (relative)
Growth rate of the cavity for <i>INST</i> = 10,0	1.0315E+000	NON_DEFINI	0,1% (relative)

Models of Bordet:

Identification	Reference	Test	Tolerance
Forced of Bordet for <i>INST</i> = 2,0	0.0000E+000	NON_DEFINI	0,1% (relative)
Forced of Bordet for <i>INST</i> = 4,0	7.2180E+002	NON_DEFINI	0,1% (relative)
Forced of Bordet for <i>INST</i> = 6,0	1.3024E+003	NON_DEFINI	0,1% (relative)
Forced of Bordet for <i>INST</i> = 8,0	1.7305E+003	NON_DEFINI	0,1% (relative)
Forced of Bordet for <i>INST</i> = 10,0	2.0225E+003	NON_DEFINI	0,1% (relative)

5 Summary of the results

the results got by *Code_Aster* are close to the reference solution since the variation with the reference solution is lower than 1%.