Code_Aster

Titre : SSNL137 - Barres en traction en élastoplasticité a[...]
Responsable : BARGELLINI Renaud

Version
default

Date : 06/10/2011 Page : 1/4
Clé : V6.02.137 *Révision :*
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SSNL137 - Draw bars in elastoplasticity with the method `IMPLEX`

Summary:

This test allows a simple checking of calculations with the law `VMIS_ISOT_LINE` for the elements of bar.

One considers an elastoplastic bar in simple traction. The resolution is carried out with the method `IMPLEX`. The tests are carried out on the constraints and the deformations and are compared with the analytical solution.

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Date : 06/10/2011 *Page : 2/4*
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1   Problem of reference

1.1   Geometry

A bar of $1\,\text{cm}$ of length, cut out in 4 elements of $2,5\,mm$. It is embedded at an end and undergoes an imposed displacement U with the other.
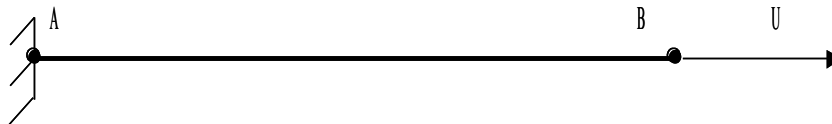

Illustration 1 : Diagram of the geometry of the bar in traction

The surface of the cross sections is worth $A=1\,\text{m}^2$.

1.2   Material properties

One considers an elastoplastic material with linear isotropic work hardening (VMIS_ISOT_LINE) with the following characteristics:

$E=100\,000\,\text{MPa}$

$\nu=0,3$

$E_T=10000\,\text{MPa}$

$\sigma_Y=100\,\text{MPa}$

1.3   Boundary conditions and loadings

Embedding in A $\left(DZ=DY=DX=0\right)$.

In order to avoid the movements of rigid body, $DZ=DY=0$ for all the nodes.

Only one loading is applied: a traction in displacement imposed of $U=1\,\text{mm}$ with the node B .

2   Reference solution

2.1   Method of calculating used for the reference solution

Traction simple armature of the uniform fields of constraints and deformation. By definition, one a:

$$\sigma=\sigma_Y+E_T\left(\frac{U}{L}-\frac{\sigma}{E}\right)=190\,\text{MPa}$$

$$\varepsilon=\frac{U}{L}=0,01$$

2.2   Results of reference

- Constraint with the node B : $\sigma_B=190\,\text{MPa}$
- Deformation with the node B : $\varepsilon_B=0,01$

2.3   Uncertainty on the solution

Analytical solution. However, with the method IMPLEX who is an approached method, a small error is possible. One admits a tolerance of $0,1\%$.

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Version
default

Date : 06/10/2011 Page : 3/4
Clé : V6.02.137 Révision :
173d3dba7e13

3 Modeling A

3.1 Characteristics of modeling
The bar is modelled by elements of bar.

3.2 Characteristics of the grid
Four meshs SEG2.

3.3 Sizes tested and results
The sizes tested are indexed in the table below.

Size tested	Type of reference	Value of reference	Allowed tolerance
σ_B	Analytical	$190\,MPa$	0,10%
ε_B	Analytical	0,01	0,10%

Table 3.1 : Results of modeling A

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Date : 06/10/2011 Page : 4/4
Clé : V6.02.137   Révision   :
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4   Summary of the results

The results being exact, it is deduced that the method IMPLEX is correctly programmed for the elements of bar with the relation VMIS_ISOT_LINE.