

SSNL137 - draw Bars in elastoplasticity with Summarized method

IMPLEX:

This test allows a simple checking of computations with model `VMIS_ISOT_LINE` for the elements of bar.

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

1 Problem of reference

1.1 Geometry

a bar 1cm length, cut out in 4 elements of 2,5 mm . It is embedded at an end and undergoes a displacement imposed U on the other.

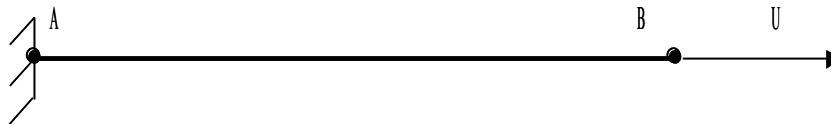


Illustration 1 : Diagram of the geometry of the bar in tension

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

1.2 Material properties

One considers an elastoplastic material with linear isotropic 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

Fixed support in A ($DZ=DY=DX=0$) .

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

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

2 Reference solution

2.1 Method of calculating used for the reference solution

tension simple armature of the uniform fields of stresses and strain. 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

Forced to the node is outside the field of definition with a right profile of the EXCLU type node: B

$$\sigma_B = 190\text{ MPa}$$

Strain with the node is outside the field of definition with a right profile of the EXCLU type node:

$$B \quad \varepsilon_B = 0,01$$

2.3 Uncertainty on the analytical

solution Solution. However, with the method `IMPLEX` which is an approached method, a small error is possible. One admits a tolerance of 0,1% .

3 Modelization A

3.1 Characteristic of the modelization

the bar is modelled by elements of bar.

3.2 Characteristics of the mesh

Four meshes SEG2.

3.3 Quantities tested and results

the quantities tested are indexed in the table below.

Quantity tested	Standard of reference	Value of reference	allowed Tolerance
σ_B	Analytical	190 MPa	0.10%
ε_B	0,10%	0.01	0.10%

Table 3.1 : Results of the modelization A

4 Summary of the results

the results being exact, one deduces that method `IMPLEX` is correctly programmed for the elements of bar with relation `VMIS_ISOT_LINE`.