

## SSLV324 - Elliptic crack in a 3D body subject to tensile loading

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### Abstract:

This test case models a planar elliptic crack within a 3D body subject to a tensile loading. The purpose is to study the idealised behaviour of a crack using linear-elastic-fracture mechanics.

## 1 Reference problem

### 1.1 Geometry

The specimen configuration is presented in half symmetry, as shown in figure 1. It represents a cube with dimensions ( $h=w=t=16$ ) containing a planar, elliptic crack with dimensions  $c=a=1$ . The specimen is subjected to a tensile load perpendicular to the plane of the crack and represents pure mode 1 crack opening.

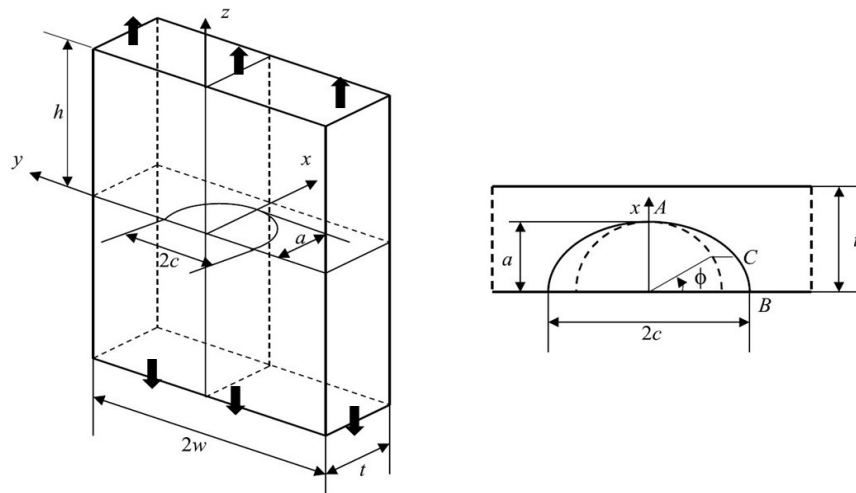


Fig.1 Specimen geometry

### 1.2 Material properties

The material of the specimen is assumed to be homogeneous isotropic linear elastic with the following parameters:

- Young modulus  $E = 200\,000\text{ Mpa}$  ,
- poisson's ratio  $\nu = 0,3$  .

### 1.3 Boundary conditions and loading

The structure is subjected to a tensile stress ( $\sigma = 1\text{ MPa}$  ). Due to symmetry, only one quarter of the elliptical crack is considered and symmetric conditions are implemented on two faces `FACE_LAT` and `FACE_AV` .

## 2 Reference solution

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### 2.1 Method used for the reference solution

For a circular crack of radius  $a$  in an infinite medium, subjected to a uniform tension  $\sigma_0$  according to the normal to the plane of the crack lips, T-stress is independent of the curvilinear abscisse along the crack front  $s$  and is expressed in the following way [1]:

$$T(s) = -\sigma_0$$

### 2.2 Reference results

By considering the numerical values of the statement, we get:  $T = -1 \text{ MPa}$ .

### 2.3 Bibliographical references

- 1 X . Wang , Elastic T\_stress solutions for semi-elliptical surface cracks in finite thickness plates Engineering Fracture Mechanics , 70 (2003) 731-756

## 3 Model A

### 3.1 Mesh

The quadratic mesh of structure is provided as a MED format . Due to symmetry, only one quarter of the structure is represented, as shown in figure 2.

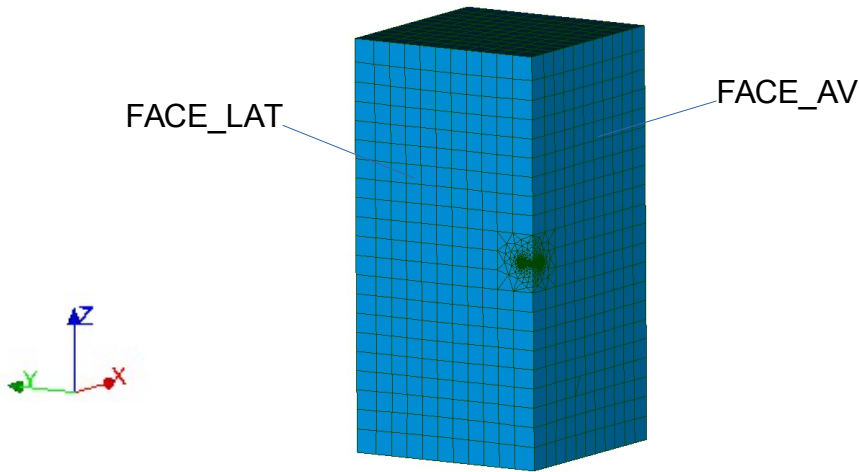
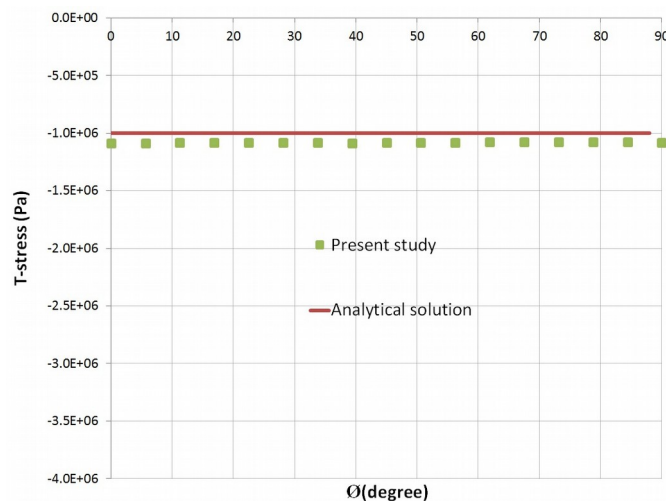


Fig.2 Mesh

### 3.2 Quantities tested and results

Identification	Type de Référence	Référence	% tolérance
$T$ - MAX	ANALYTIQUE	-1.E6	5.0
$T$ - MIN	ANALYTIQUE	-1.E6	5.0



## 4 Conclusion

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Results are in good agreement with the theory.