

## HSSL100 – Bi--embedded beam multifibre subjected to a field of temperature

---

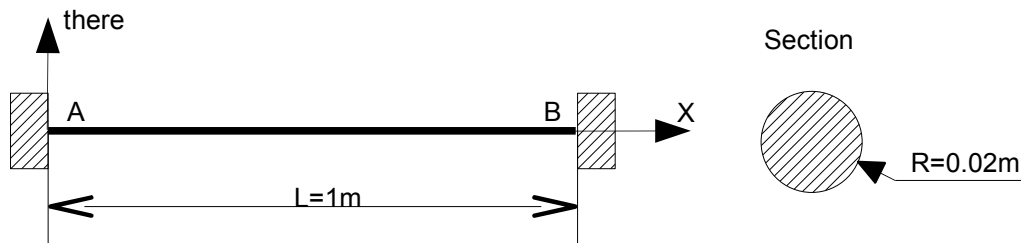
### Summarized

This test makes it possible to validate the good taking into account of the temperature for constitutive law `ELAS` in the multifibre case of a beam. This test makes it possible to check that thermal thermal expansion is well calculated.

## 1 General characteristics

### 1.1 Geometry

It acts of a beam fixed at its two ends.



### 1.2 Properties of the materials

$$E = 2.0 \text{ E}+11 \text{ Pa}$$

Modulus Young

$$\nu = 0.3$$

Poisson's ratio

$$\alpha = 15.0 \text{ E}-06 / ^\circ \text{C}$$

Coefficient of thermal expansion

$$D\_SIGM\_EPSI = 2.0 \text{ E}+09 \text{ Pa}$$

Slope of curve of tension

$$SY = 150.0 \text{ E}+10 \text{ Pa}$$

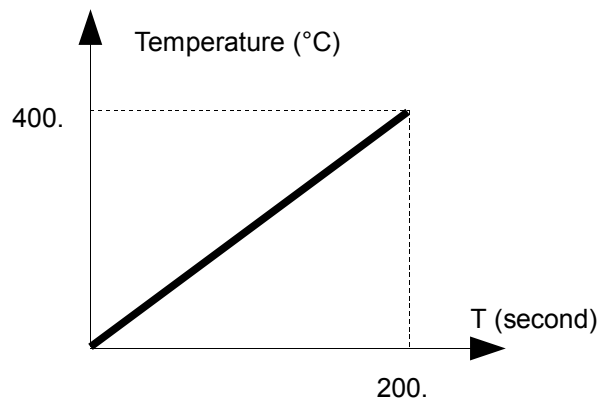
Elastic limit

### 1.3 Boundary conditions and loadings

Fixed support at the points  $A$  and  $B$  :  $DX = DY = DZ = DRX = DRY = DRZ = 0$

Imposed temperature:  $T = 400^\circ \text{C}$

The imposed temperature is increasing linearly according to time.



### 1.4 Initial conditions

Reference temperature:  $0^\circ \text{C}$

## 2 Reference solution

---

### 2.1 Method of calculating used for the reference solution

the fixed support to the points  $A$  and  $B$  makes it possible to block the strains according to  $x$  :  
 $\varepsilon_{xx} = 0$ .

This blocking associated with the imposed temperature creates an axial stress of compression along the axis  $x$ . This stress has as a statement:

$$\sigma_{xx} = E \alpha (T_{reference} - T)$$

### 2.2 Variables reference

Forced  $SIXX$

### 2.3 Result of reference

For  $T = 200^\circ C$  one obtains  $SIXX = -0.6E+09 Pa$

For  $T = 400^\circ C$  one A  $SIXX = -1.20E+09 Pa$

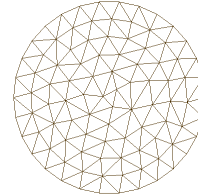
### 2.4 obtains Uncertainty on

the solution analytical

## 3 Solution Modelization

### 3.1 Characteristic of the modelization

Modelization POU\_D\_EM  
Behavior model of ELAS



Mesh of the beam

Many nodes 11  
Number of meshes 10  
Is: SEG2 10

Mesh of the section of the beam

Many nodes 96  
Number of meshes 160  
Is: TRIA3 160

### 3.2 Results

Behavior ELAS.

Quantity	Does not net		urgent	Subpoint	Behavior	Reference Tolerance (%)
SIXX	M4	1	120	50.	0.60 E+09 Pa	0.1
SIXX	M9	2	40	100.	1.2 E+09 Pa	0.1

) VMIS\_ISOT\_LINE.

Quantity	Does not net		urgent	Subpoint	during	Reference Tolerance (%)
SIXX	M4	1	120	50.	0.60 E+09 Pa	0.1
SIXX	M9	2	40	100.	1.20 E+09 Pa	0.1

) the behavior of the beam computations with constitutive law VMIS\_ISOT\_LINE remains elastic.

## 4 Summary of the results

---

the results are in conformity with the analytical solution.