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## TPLS100 - Infinite plate subjected to Summarized skew-symmetric

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### flux:

The purpose of this test is the model testing linear thermal shell at three fields (`MODELISATION`: "COQUE" or "COQUE\_PLAN") by comparison with an analytical solution, for an infinite plate subjected to a steady skew-symmetric heat flux couple on its two half-sides, in steady mode.

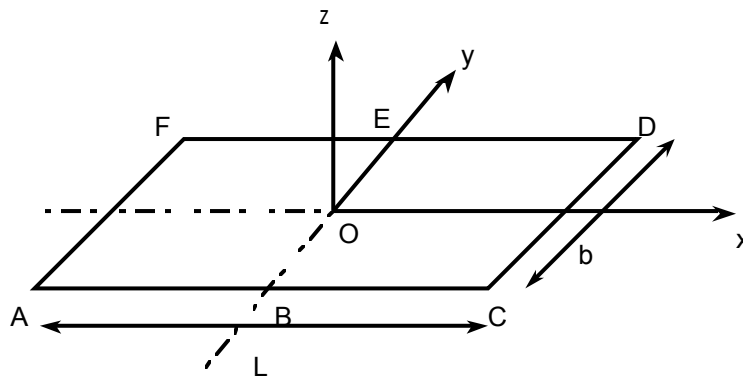
The equation of heat is solved in hover, with a linear, isotropic, homogeneous conduction.

Two modelizations: A for the finite elements of surface shell (triangles) and B for the linear elements (segments).

One simultaneously tests in each modelization the elementary commands and global command `THER_LINEAIRE`.

## 1 Problem of reference

### 1.1 Geometry



Length:  $L = 20\text{mm}$   
Width:  $b = 2\text{mm}$   
Thickness:  $h = 4\text{mm}$

### 1.2 Material properties

voluminal  $\lambda = 4.5 \text{ W/mm/}^\circ\text{C}$

Conductivity Heat:  $\rho C_p = 0. \text{ J/}^\circ\text{C} \cdot \text{mm}^3$

### 1.3 Boundary conditions and loadings

Temperature null on the average average of the plate:

$$TEMP = 0.$$

Flux imposed on the upper surface  $(ABEF)^+$

$$flux^+ = 30. \text{ W/mm}^2/\text{ }^\circ\text{C}$$

Flux imposed on the surface upper  $(ABEF)^-$

$$flux^- = -30. \text{ W/mm}^2/\text{ }^\circ\text{C}$$

## 2 Reference solution

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

For more details to refer to the document [R3.11.01] and the note [bib1].

### 2.2 Results of reference

- Temperature in higher skin,
- Flux into cubes nodes placed on the axis  $Ox$  in higher skin.

### 2.3 Uncertainty on the analytical

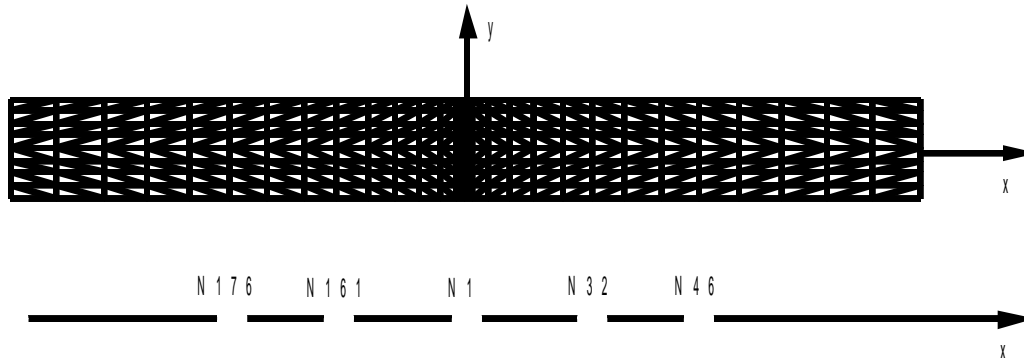
solution Solution.

### 2.4 Bibliographical references

- S. ANDRIEUX, F. VOLDOIRE HI-71/7131 - Formulation of a model of thermal for the thin shells (12/7/90).

## 3 Modelization A

### 3.1 Characteristic of the modelization



Cutting: 28 elements in length,  
8 elements in width.

Boundary conditions - loading:

```
TEMP_IMPO (TOUT = ' oui', TEMP=0.)
FLUX_REP (GROUP_MA =GRSD2, FLUN_INF=-30.
          FLUN_SUP=30.)
```

### 3.2 Characteristics of the mesh

Many nodes: 969

Number of meshes and types: 448 meshes TRIA6

### 3.3 Quantities tested and results

Identification	Reference
TEMP_SUP :	
node N201 (-10.,0)	13.3321
node N176 (-5.15,0)	13.2565
node N161 (-2.8,0)	12.7462
node N1 (0.,0.)	6.6666
node N32 (28,0.25)	0.5870
node N46 (5.15,0)	0.07679
Flux component X :	
node N176	
nets M297	0.2992
mesh M289	0.2992
nets M290	0.2992
mean value	0.2992
node N161	
nets M265	2.287
mesh M266	2.287
nets M273	2.287
mean value	2.287
node N1	
nets M1	25.98
mesh M225	25.98

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nets M337	25.98
mean value	25.98

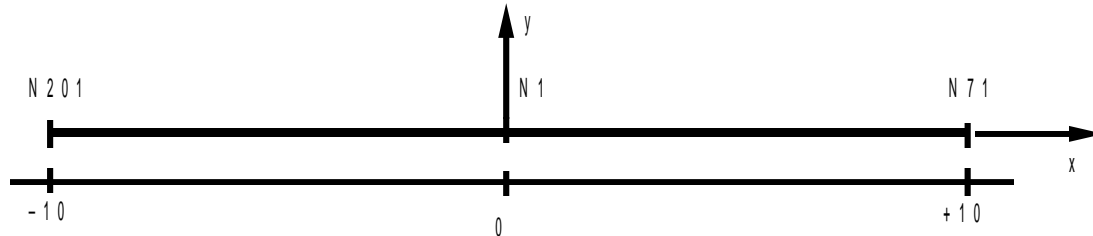
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## Contents of the file Temperatures

- results to the nodes,
- heat flux with the nodes out of higher wall,
- values tested deferred above.

## 4 Modelization B

### 4.1 Characteristic of the modelization



Cutting: 28 linear elements in length, (even progression of meshes that in the mesh of the modelization A).

Boundary conditions - loading:

```
TEMP_IMPO (TOUT = ' oui', TEMP=0.)
FLUX_REP (GROUP_MA = GRSD2, FLUX_INF=-30.
          FLUX_SUP=30.)
```

### 4.2 Characteristics of the mesh

Many nodes: 57

Number of meshes and types: 28 meshes SEG3

### 4.3 Quantities tested and results

Identification	Reference
TEMP_SUP:	
node <i>N201</i> (-10.,0)	13.3321
node <i>N176</i> (-5.15,0)	13.2565
node <i>N161</i> (-2.8,0)	12.7462
node <i>N1</i> (0.,0.)	6.6666
node <i>N46</i> (5.15,0)	0.07679

#### Contents of results files

- the Temperatures to the nodes on the upper surface,
- values tested deferred above.

## 5 Summary of the results

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In the modelization A with meshes TRIA6, one notes that the variations on flux are lower than 1%, except in the zones where those are very weak.