

TPLP300 - Rectangular plate: convection, imposed temperature

Summarized:

This test is resulting from the validation independent of version 3 in linear steady thermal.

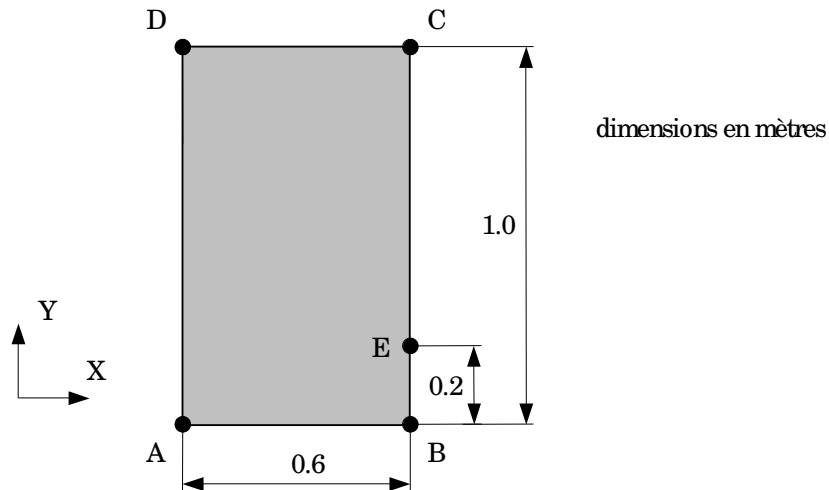
It is about a problem 2D plane represented by only one modelization (plane).

The features tested are the use of plane thermal elements under limiting conditions of imposed temperature and convection.

The results are compared with those provided by NAFEMS.

1 Problem of reference

1.1 Geometry



1.2 Properties of the material

$\lambda = 52 \text{ W/m} \cdot ^\circ\text{C}$ thermal Conductivity

1.3 Boundary conditions and loadings

- imposed temperature with dimensions $[AB]$: $T_p = 100^\circ\text{C}$,
- density flux $= 0$ on with dimensions one $[DA]$,
- convection on dimensioned $[BC]$ and $[CD]$
 - $h = 750 \text{ W/m}^2 \cdot ^\circ\text{C}$
 - $T_{ext} = 0^\circ\text{C}$.

1.4 Initial conditions

Without object.

2 Reference solution

2.1 Méthode de calcul used for the reference solution

the reference solution is that given in file "TEST n° T4" of the tests of reference published by NAFEMS.

2.2 Results of reference

Temperature to the point E: $T = 18.3^{\circ}C$

2.3 Uncertainty on the solution

Nonavailable on bibliographical file

2.4 NAFEMS References

[1] NAFEMS (the National Agency for Finite Element Methods Standard and (the U.K.)): "Standard The NAFEMS Benchmarcks", TNSB rév 3, October 1990.

3 Modelization A

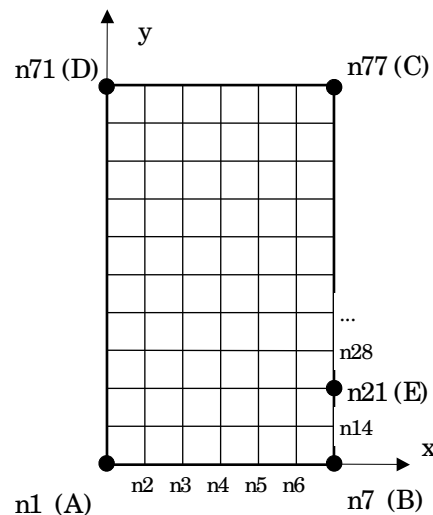
3.1 Characteristic of the modelization

PLANE (QUAD4)

Conditions aux limites:

- Coté AB: $T = 100^{\circ}\text{C}$
- Coté BA: $\varphi = 0$.
- Coté BC,CD: $T_{\text{ext}} = 0^{\circ}\text{C}$
 $h = 750\text{W/m}^2\text{ }^{\circ}\text{C}$

Points	X	Y	Noeuds
E	0.6	0.2	N21
A	0.0	0.0	N1
B	0.6	0.0	N7
C	0.6	1.0	N77
D	0.0	1.0	N71



3.2 Characteristic of the mesh

Many nodes: 77
Number of meshes and types: 60 QUAD4 (16 SEG2)

3.3 Quantities tested and results

Identification	Reference	Aster	difference	tolerance
Temperature ($^{\circ}\text{C}$)				
To the item <i>E : N21</i>	18.3	17.954	-1.89	1%

4 Summary of the results

The modelization give result which exceed the tolerance fixed initially. The maximum change obtained is of 1.9%, to compare with the tolerance of 1%.

In this test, the heat gradients are more important close to the point B (imposed temperature and convection), a finer mesh in this zone would improve quality of the results.

The results are regarded as acceptable taking into account the type of mesh (QUAD4) and of the density of the mesh used

the interest of this test is its origin NAFEMS.