

TPLV304 - Distribution of the temperature in a bar of square section

Summarized:

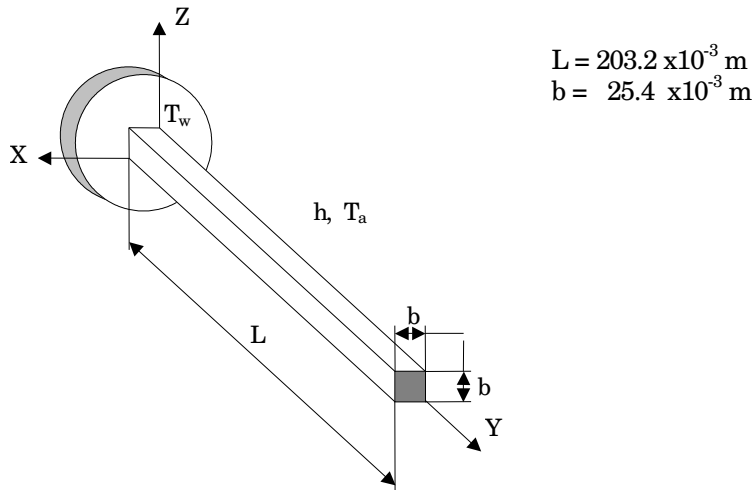
This test is resulting from the validation independent of version 3 in linear steady thermal.

It aims to validate the voluminal thermal elements under conditions of convection and imposed temperature.

The reference solution is based on an analytical approach.

1 Problem of reference

1.1 Geometry



1.2 Properties of the thermal

$\lambda = 43.2675 \text{ W/m} \cdot ^\circ\text{C}$ material Conductivity

1.3 Boundary conditions and loadings

- temperature imposed on the face $y=0$ $T_w = 37.78^\circ\text{C}$,
- $\varphi=0$ the face $y=L$,
- convection on the other sides:
 - $h = 5.678 \text{ W/m}^2 \cdot ^\circ\text{C}$
 - $T_a = -17.780^\circ\text{C}$.

1.4 Initial conditions

Without object.

2 Reference solution

2.1 Method of calculating used for the reference solution

the original reference solution given in the book [bib1] is based on an analytical approach. This reference is quoted in the handbook of checking of ANSYS [bib2]

2.2 Results of reference

Temperature on the face $y=l$

2.3 Uncertainty on the Unknown

solution, it was not possible to get the original reference (delivers old, more published).

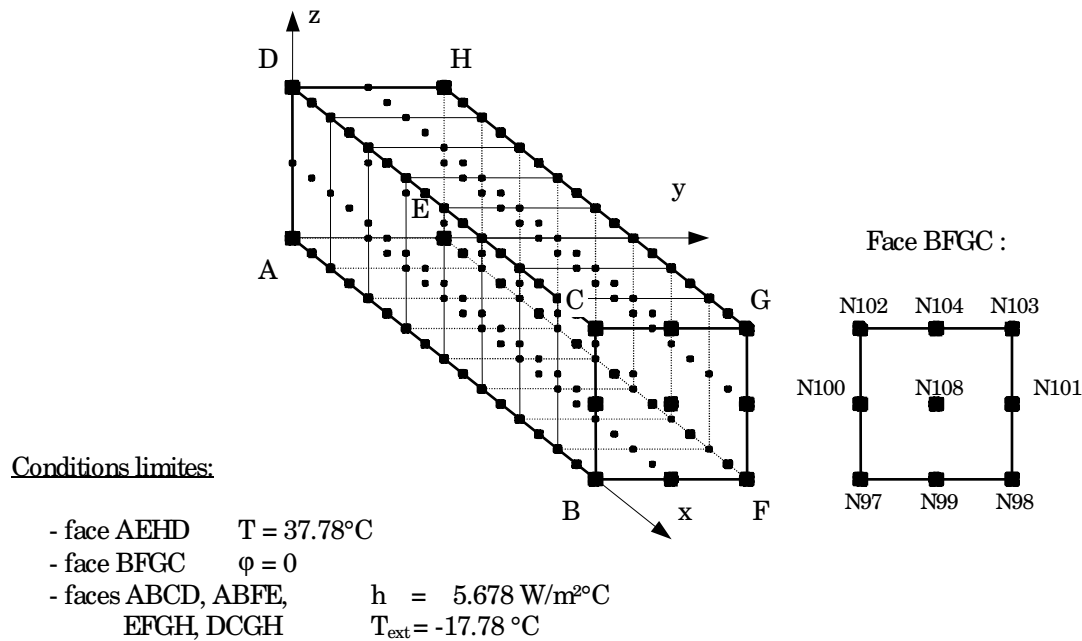
2.4 Bibliographical references

- [1] ANSYS: "Checking manual", 1st edition, June 1,1976
- [2] Kreith, F., "Principles of heat transfer", International Textbook Co., Scranton, Pennsylvania, 2nd Printing, 1959.

3 Modelization A

3.1 Characteristic of the modelization

3D (HEXA27)



3.2 Characteristic of the mesh

Many nodes: 153
Number of meshes and types: 8 HEXA27 (and 32 QUAD9)

3.3 Quantities tested and results

Identification	Reference	Aster	Variation relative (%)		absolute Deviation ($^{\circ}\text{C}$)		
			difference	tolerance	difference	tolerance	
Temperature ($^{\circ}\text{C}$)							
at the end of the bar							
$Y = L$	20.329						
B	N97	20.329	20.295	0.166	1%	0.0338	0.5
medium BF	N99	20.329	20.327	0.010	1%	0.0021	0.5
F	N98	20.329	20.295	0.166	1%	0.0338	0.5
medium FG	N101	20.329	20.327	0.010	1%	0.0021	0.5
G	N103	20.329	20.295	0.166	1%	0.0338	0.5
medium GC	N104	20.329	20.327	0.010	1%	0.0021	0.5
C	N102	20.329	20.295	0.166	1%	0.0338	0.5
medium CB	N100	20.329	20.327	0.010	1%	0.0021	0.5
medium of the face	N108	20.329	20.359	0.146	1%	0.0297	0.5

3.4 Remarks

Warning : The translation process used on this website is a "Machine Translation". It may be imprecise and inaccurate in whole or in part and is provided as a convenience.

voluminal heat ρC_p does not intervene in this test, but must be declared for *Code_Aster*. One takes $\rho C_p = 1.0 \text{ J/m}^3 \text{ }^\circ\text{C}$.

The limiting condition $\varphi = 0$ is implicit on free edges.

The small differences which remain correspond to a variation in temperature in the section observed. What is in conformity with the modelled physical phenomenon.

4 Summary of the results

the got results are very satisfactory, the maximum change is of -0.166% . The principal interest of this test is to check mesh HEXA27.