

TTLP303 - Heat transfer in an orthotropic plate: imposed temperatures

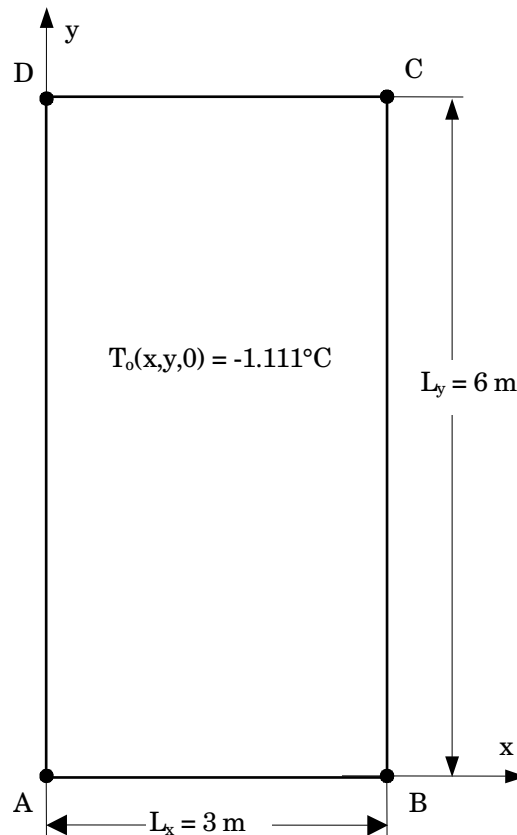
Summarized:

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

Analyzes:	Linear transient thermal
Problem:	2D plane
Functionalities tested:	<ul style="list-style-type: none">•thermal element shell•thermal element plane•orthotropic material•algorithm of transient thermal•limiting conditions: imposed temperatures
Interest of the test:	<ul style="list-style-type: none">•orthotropic material•analytical solution
Many modelizations:	<ul style="list-style-type: none">•1 modelization shell•1 modelization planes

1 Problem of reference

1.1 Geometry



1.2 Properties of the thermal

$\lambda_x = 1.319 \text{ W/m}^\circ\text{C}$	material conductivity along the thermal x
$\lambda_y = 0.659 \text{ W/m}^\circ\text{C}$	axis conductivity along the voluminal y
$\rho C = 1899.1 \text{ J/m}^3^\circ\text{C}$	axis heat

1.3 Boundary conditions and loadings

Contour $ABCD$: $T = -17.778^\circ\text{C}$

1.4 Initial conditions

$$T_0(t=0) = -1.111^\circ\text{C}$$

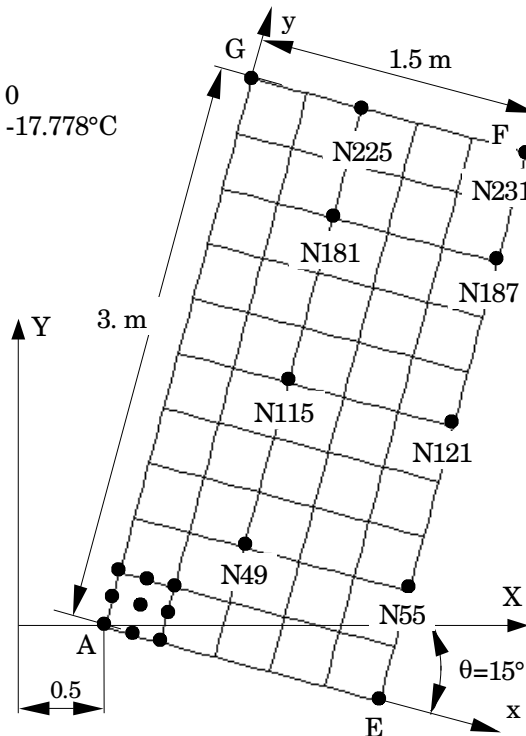
3 Modelization C

3.1 Characteristic of the modelization

PLANE (QUAD9)

Conditions limites

- cotés EF, FG: $\varphi = 0$
- cotés AE, AG: $T = -17.778^{\circ}\text{C}$



3.2 Characteristic of the mesh

Many nodes: 231
Number of meshes and types: 50 QUAD9

3.3 Remarks

the discretization in time step are the following one:
240 steps for $[0., 4320.D0]$ are $\Delta t = 18.D0$

4 Results of the modelization C

4.1 Values tested

Identification	Reference	Aster	relative Variation %		Absolute Deviation	
			difference	tolerance	difference	tolerance
Temperature in °C						
<i>x</i> = 0.6						
<i>N49</i> (<i>y</i> = 0.6)	-17.6526	-17.6515	-0.006	1%	0.001	0.05
<i>N115</i> (<i>y</i> = 1.5)	-17.4970	-17.4942	-0.016	1%	0.003	0.05
<i>N181</i> (<i>y</i> = 2.4)	-17.4077	-17.4040	-0.021	1%	0.004	0.05
<i>N225</i> (<i>y</i> = 3.0)	-17.3905	-17.3867	-0.022	1%	0.004	0.05
<i>x</i> = 1.5						
<i>T</i> (<i>y</i> = 0.6)	-17.5649	-17.5627	-0.012	1%	0.002	0.05
<i>T</i> (<i>y</i> = 1.5)	-17.3002	-17.2952	-0.029	1%	0.005	0.05
<i>T</i> (<i>y</i> = 2.4)	-17.1482	-17.1418	-0.037	1%	0.006	0.06
<i>T</i> (<i>y</i> = 3.0)	-17.1189	-17.1123	-0.039	1%	0.007	0.05

5 Summary of the results

The modelization PLANE, made with meshes QUAD9, give satisfactory results, the maximum change obtained is of 0.039%.