

TTNP01 – Problem of STEFAN with lumpés elements - QUAD9

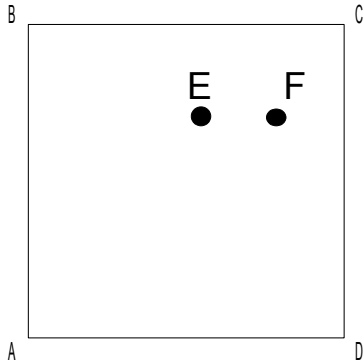
Summary:

This case test validates modeling `PLAN_DIAG` in non-linear thermics in the case of a thermal shock.

The got results are compared with an analytical solution.

1 Problem of reference

1.1 Geometry



The square is in space $[0., 4.] \times [0., 4.]$.

Coordinates of the points (m) :

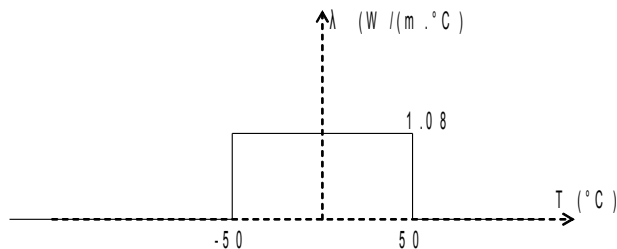
$A : (0., 0.)$
 $B : (0., 4.)$
 $C : (4., 4.)$
 $D : (4., 0.)$
 $E : (2., 3.)$
 $F : (3., 3.)$

Group of e-mail:

LAB : segment AB
 LBC : segment BC
 LCD : segment CD
 LDA : segment AD

1.2 Properties of material

- Conduction



- Enthalpy

Temperature ($^{\circ}C$)	Enthalpy (J)
-50.	0
-0.25	49.75
-0.15	120,010

50.	169,860
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1.3 Boundary conditions and loadings

$T = -45^{\circ}C$ of $t = 0 \text{ sec}$ with $t = 10 \text{ sec}$

1.4 Initial conditions

$T = 0^{\circ}C$ with $t = 0 \text{ sec}$

2 Reference solution

2.1 Reference variables

The solution is deduced from the following publication (chapter 4, "Numerical examples"):
Solidification problems by the boundary element method. Nicholas ZABARAS and S MUKHERJEE.
Int Newspaper of Solids Structures. Pergamon. Vol. 31, No 12/13, pp. 1829-1846, 1994

2.2 Result of reference

$t(s)$	Points	Size ($^{\circ}C$)	Reference
1	<i>F</i>	<i>TEMP</i>	-11.8
2	<i>F</i>	<i>TEMP</i>	-29.9
3	<i>F</i>	<i>TEMP</i>	-34.7
4	<i>F</i>	<i>TEMP</i>	-36.7

1	<i>E</i>	<i>TEMP</i>	0
2	<i>E</i>	<i>TEMP</i>	-18.1
3	<i>E</i>	<i>TEMP</i>	-25.2
4	<i>E</i>	<i>TEMP</i>	-29.3

4 Summary of the results

Results got in the case of a thermal modeling `PLAN_DIAG` are satisfactory.