ZZZZ175 - Coupling Aster-Homard on a Summarized

STAT_NON_LINE computation:

This series of benchmark validates by means of computer the mesh adaptation with HOMARD with use of STAT_NON_LINE. On a simple mesh, either in 2D , or in 3D , a nonlinear computation of mechanics is launched, with production of an error indicator. From there, a call to the software HOMARD will involve a modification of the mesh. On this new mesh, a new computation is activated, corresponding to the same physical problem.

These benchmarks are not examples of the interest of the mesh adaptation and do not have any physical meaning. They are used only as tests of NON-regression of the functionality in the various possible configurations.

1 General information

1.1 Context

the purpose is only to test the NON-regression of the future evolutions of *Code_Aster* and HOMARD. Even if the benchmarks are realistic from the physical point of view for representing real studies well, one should not attach importance to the value of the results.
In particular, one should not anything deduce some as for the performance indicating couple from mesh adaptation error.

These benchmarks validate the operation of two macro commands MACR_INFO_MAIL and MACR_ADAP_MAIL which control the group of the process.

More precisely, the features tested are the following ones:

- readings and writings of mesh and fields to med format . They are commands IMPR_RESU, LIRE_CHAMP and LIRE_MAILLAGE with the key word MED like format,
- writing of the data file for HOMARD,
- launching of the procedure managing the HOMARD execution. It is command EXEC_LOGICIEL ; it calls a script with a variable number of arguments,
- control of the group of the process by the python: macr_adap_mail_ops.py.

The process is a priori insensitive with the modelization considered. The important points which cause different processing in the data exchange between HOMARD and Code_Aster *are* element types, the control of the adaptation and the update of fields on the new mesh.

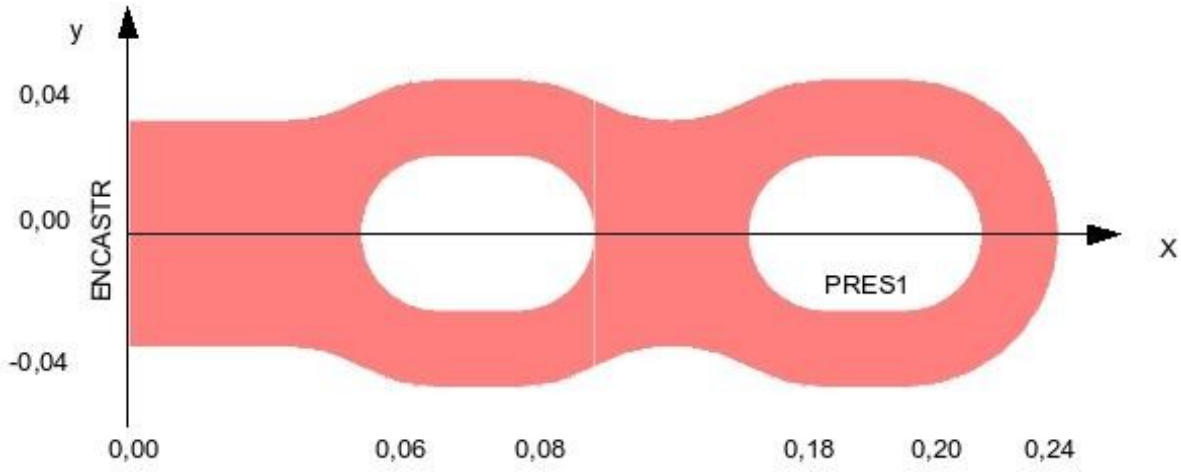
The non-regression is tested on the value of the field of displacement, stress or temperature in a free node. The test takes place for several resolutions, those with the meshes resulting from the first and at least another adaptation. Indeed, the HOMARD data transmissions and control are not the same ones for the first adaptation and the following. At least two transitions thus should be tested. Method of calculating

1.2 used for the reference solution These

benchmarks are benchmarks of non regression. The reference solution is that obtained with a computation Code_Aster . *Modelization*

2 A Geometry

2.1 Properties



2.2 of the material Material

to elastoplastic behavior with a linear hardening: Elasticity

: Young

- $E=2.1\,x\,10^{5}\,Pa$ modulus Poisson's ratio
- $\nu=0.3$ Plasticity

: Slope

- of curve of tension in the plastic range Yield stress $\frac{\partial\sigma}{\partial\varepsilon}=2.\times10^{3}\ Pa$
- Boundary conditions $\sigma_{e}=235.\,Pa$

2.3 and loadings The computation

is in nonlinear mechanics. The part is embedded on its left face. Pressure is put on the low horizontal part of the second hole (zone on $PRES1$ the sketch). This pressure varies in time. One will look at the evolution of displacement on a node of the base. Edge

: $ENCASTR$ blocking of displacements by blocking of the degrees of freedom: DX = DY = 0. Edge

loading $PRES1$ pressure

- imposed according to times: Time

() Pressure s	() 0 $N.m^{-2}$.
0.	60
. 15	. 120

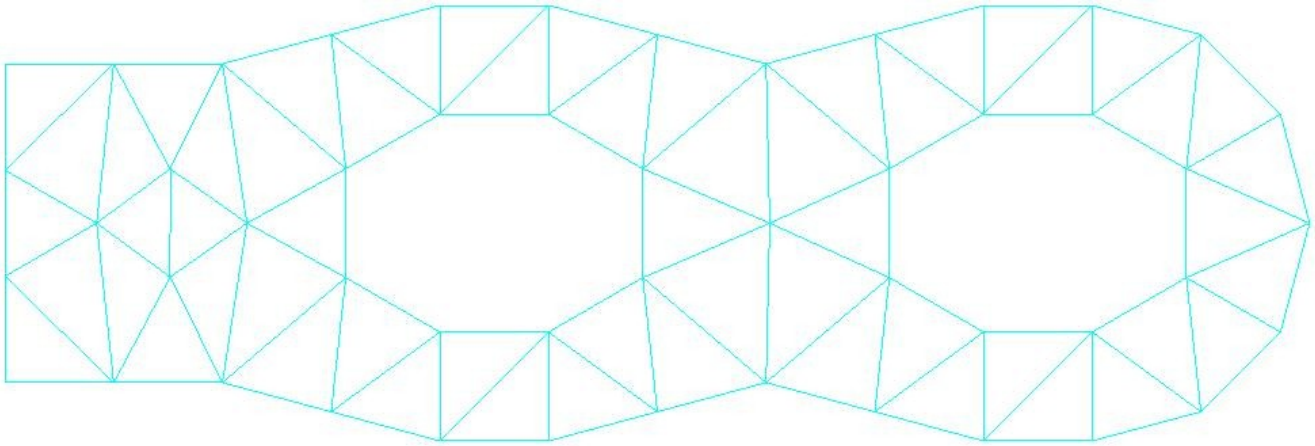
. 20	. 180
. 20	. 240
. 30	. 300
. 30	. 360
. 20	. 420
. 15	. 480
. 10	.

The other edges are with stress null. Characteristics

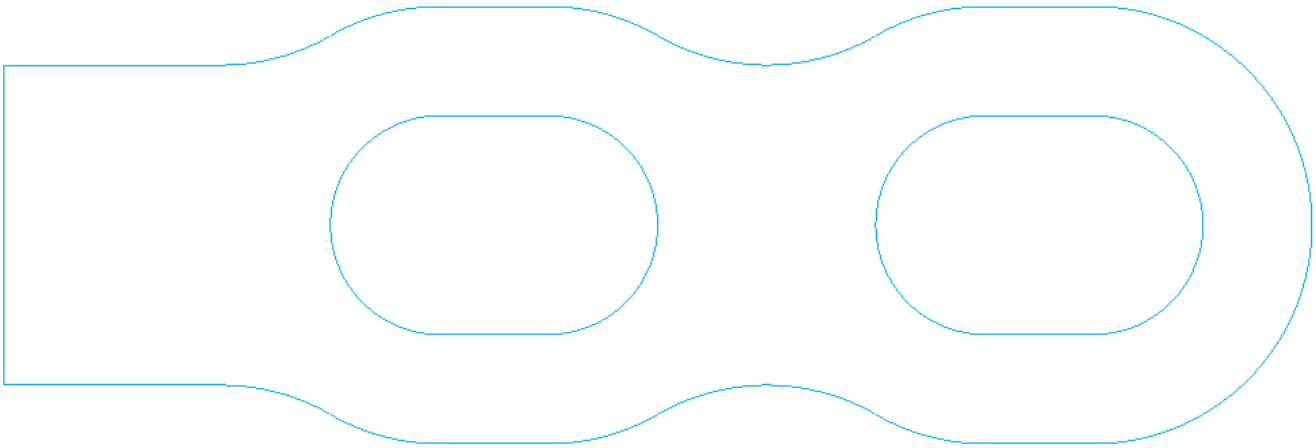
2.4 of the mesh The mesh

initial before refinement. Nodes

: 158 SEG3
: 45 SORTED
6: 57



the border is made of 4643 nodes and as many segments. Results



2.5 of reference DX

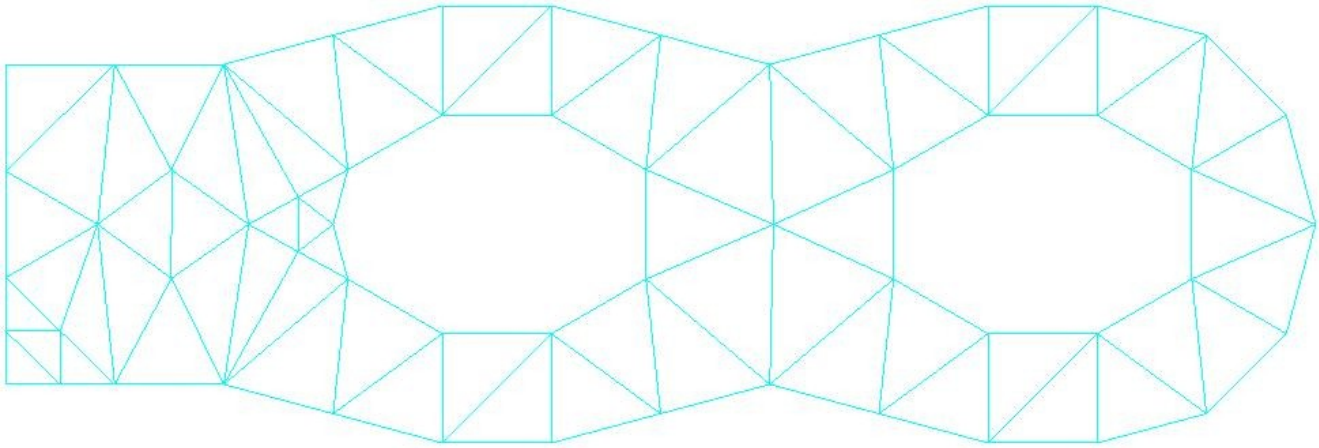
Displacements and DY for the group of node A1 , made up of only one node, after the 3rd adaptation : DX

= -3,891854x10-5 DY
= -1,394744x10-4 adapted

2.6 Meshes

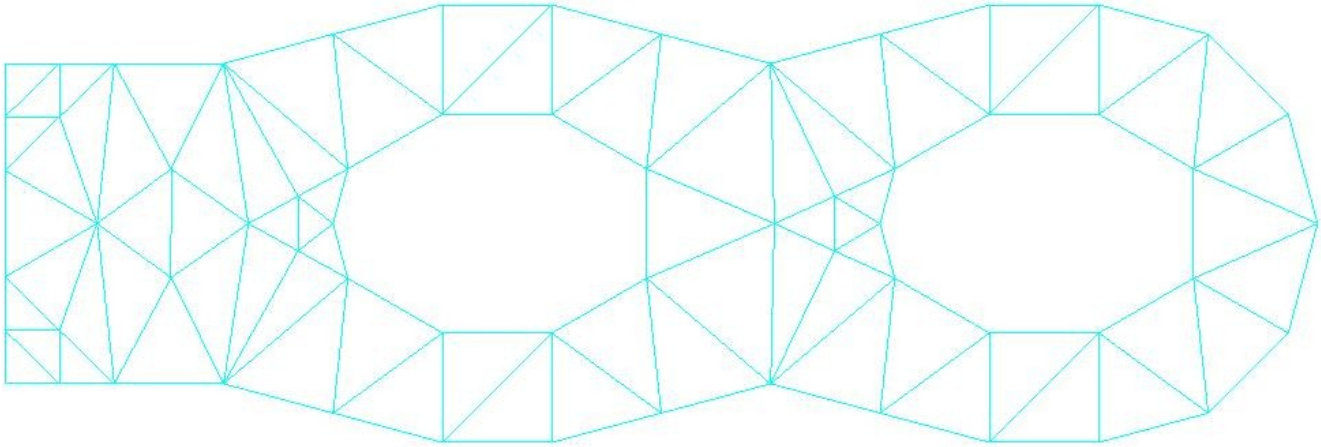
the loop python of refinement of mesh comprises 3 iterations from error indicator (ERME_ELEM). For each iteration, one describes the characteristics of each mesh produced by macro-command MACR _ADAP_MAIL. Refined

2.6.1 mesh: iteration 1 Nodes



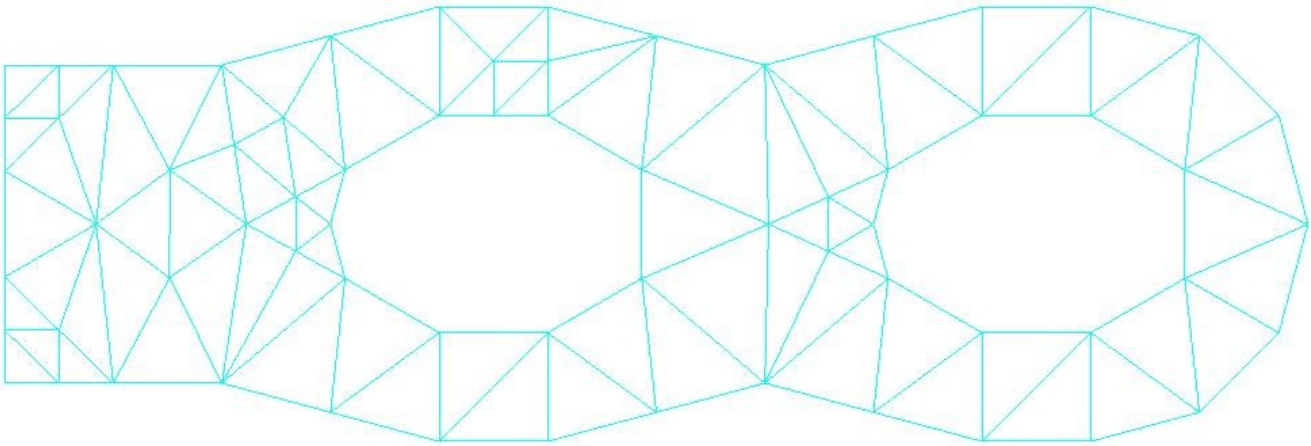
: 179 SEG3
: 48 SORTED
6: 66 refined

2.6.2 Mesh: iteration 2 Nodes



: 200 SEG3
: 51 SORTED
6: 75 refined

2.6.3 Mesh: iteration 3 Nodes



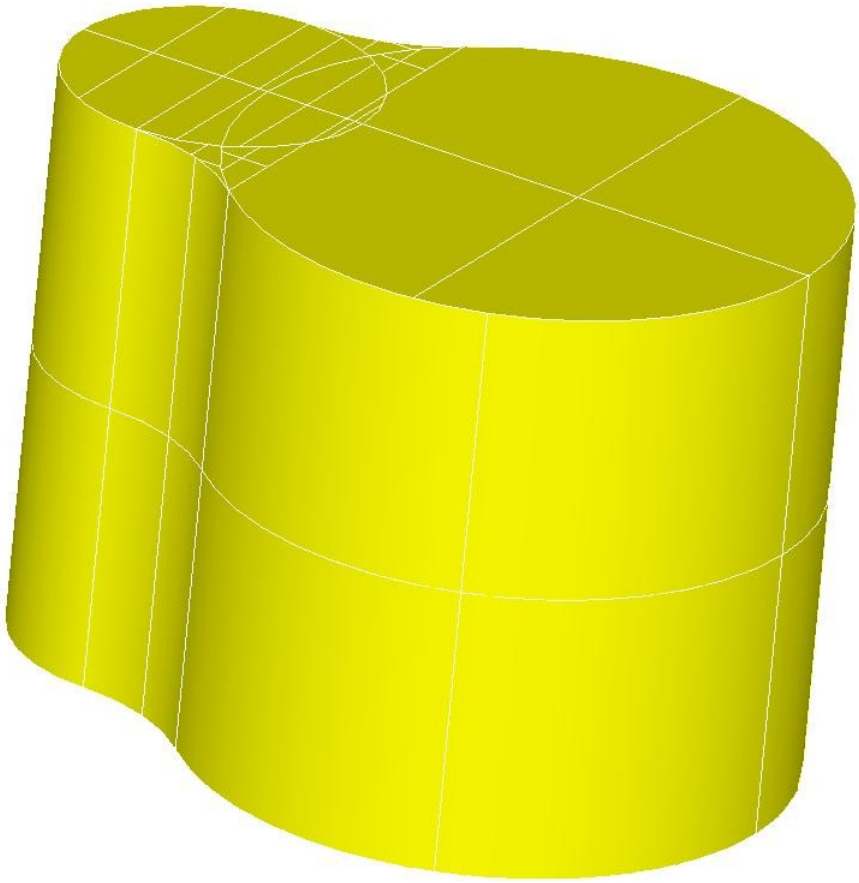
: 219 SEG3
: 52 SORTED
6: 84 Remarks

2.7 One

can note that the nodes resulting from the segment divisions on the border will be placed on the fine description of the border. Modelization

3 B Geometry

3.1 Properties



3.2 of the material

the material is that definite in the case of wtnl THM 100a Boundary conditions

3.3 and loadings The computation

is in saturated nonlinear mechanics HM . After each adaptation, computation is initialized by the results of computation the preceding one, interpolated on the new mesh. One will look at the evolution of displacement on a node of the upper surface. Higher

Hydraulics	face	
Forced	imposed null	Flux Lower
null	Displacement null	Flux Side
Stress	null imposed	Pressure mechanical

Problem:

The part is blocked on the lower face: Face
Z_ MIN: DX = DY = DZ = 0 One

applies a pressure to the upper face: Face
: Z_MAX NEAR = the 1.0.105

other edges are with stress null. Hydraulic

problem: One

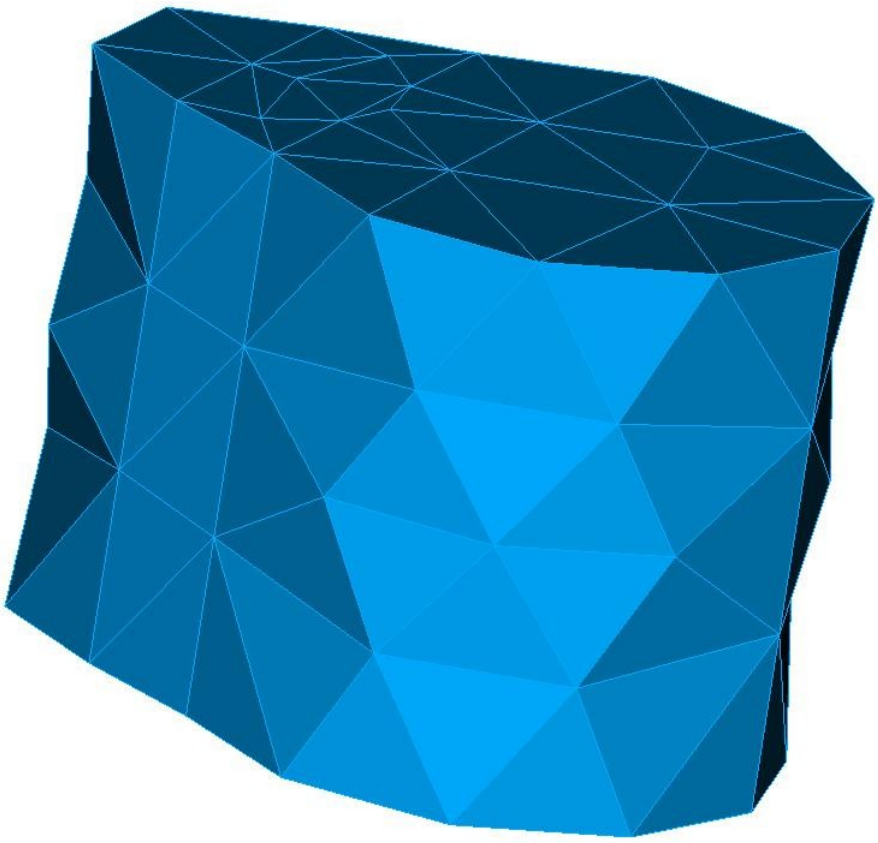
applies a pressure to the side sides: Sides
COTE_0 COTE_1 COTE_2 : COTE_3 PRE1 = the 1.0.105

other edges are with null flux. Characteristics

3.4 of the mesh The mesh

initial before refinement. Nodes

: 622 SORTED
6: 148 SMALL FIRECLAY CUP
10: 339 Results



3.5 of reference Displacement

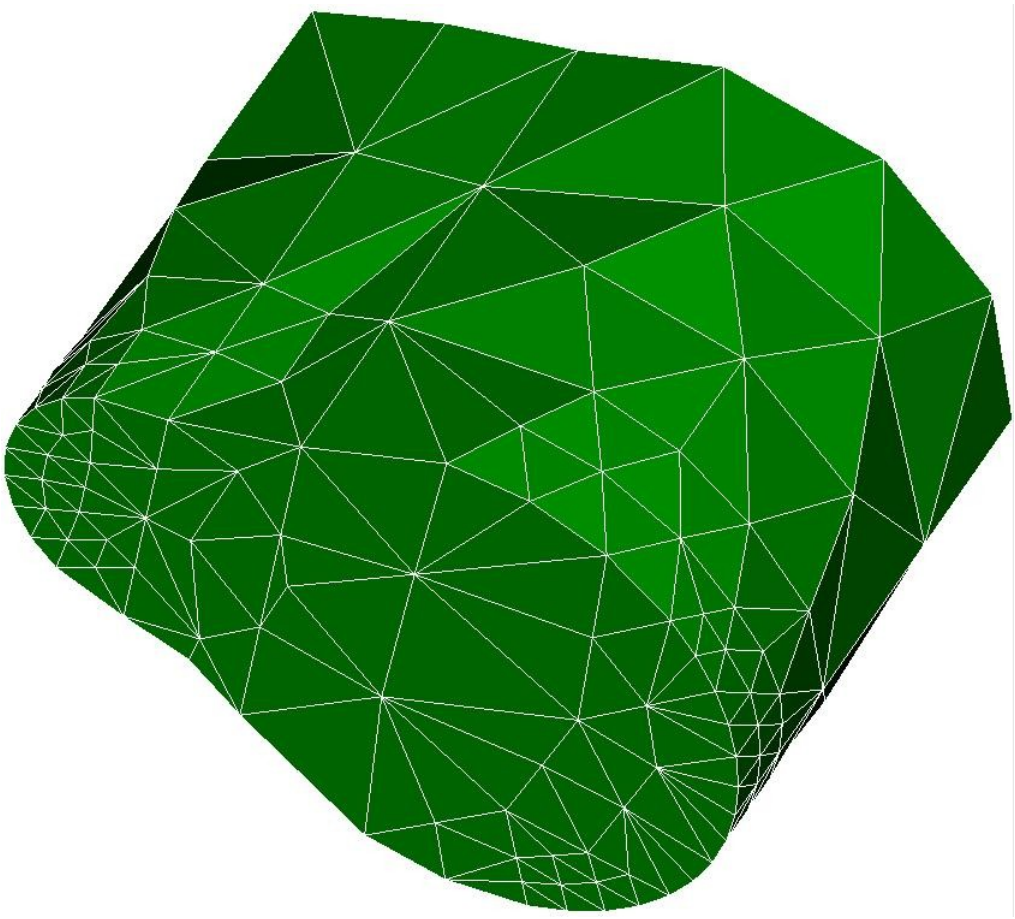
DZ for the group of node made up A, of only one node, after the 3rd adaptation : DZ

= -6,0386667168703 x10-2 adapted

3.6 Meshes

the loop python of refinement of mesh comprises 3 iterations starting from the jump of the mechanical field of displacement of a node to her neighbor. For each iteration, one describes the characteristics of each mesh produced by macro-command MACR _ADAP_MAIL. Nodes

: 1611 SORTED
6: 362 SMALL FIRECLAY CUP
10: 901 Remarks



3.7 One

can note that the nodes resulting from the segment divisions on the border will be placed on the analytical description of the border. One
will look with attention the mechanism used to read again the fields with Gauss points. Summary

4 of the results This

benchmark shows the good performance of macro-command MACR _ADAP_MAIL to refine a mesh with HOMARD with follow-up of a curved border or 1D . 2D