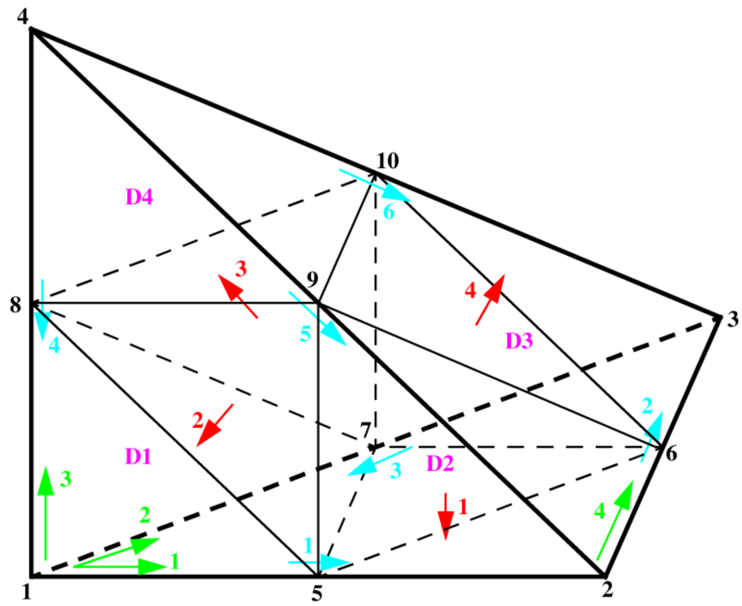
European Commission

JRC TECHNICAL REPORTS

Adaptivity with Simplex Elements in EUROPLEXUS

Folco Casadei
Martin Larcher
George Valsamos

Report EUR 26630 EN



EUROPLEXUS Software

Joint Research Centre

European Commission
Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information
Martin Larcher
Address: Joint Research Centre, Via Enrico Fermi 2749, TP 480, 21027 Ispra (VA), Italy
E-mail: martin.larcher@jrc.ec.europa.eu
Tel.: +39 0332 78 9563
Fax: +39 0332 78 9049

http://ipsc.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

This publication is a Technical Report by the Joint Research Centre of the European Commission.

JRC89894
ISBN 978-92-79-37966-6
ISSN 1831-9424
DOI 10.2788/70220

Luxembourg: Publications Office of the European Union, 20xx

Printed in Italy

Contents

List of Figures

List of Tables

1. Introduction

This report is a sequel to reports and publications [1-12] on mesh adaptivity in fast transient dynamics and presents the formulation and implementation of mesh adaptivity for simplex elements (triangles in 2D, tetrahedra in 3D) in fast transient dynamics. The algorithms are implemented in the EUROPLEXUS code.

EUROPLEXUS [13] is a computer code for fast explicit transient dynamic analysis of fluid-structure systems jointly developed by the French Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA Saclay) and by the Joint Research Centre of the European Commission (JRC Ispra).

Reference [1] presented the first implementation in EUROPLEXUS of an adaptive mesh refinement and un-refinement procedure, in two space dimensions (element shape QUA4) for solid mechanics. The procedure was extended to fluid mechanics (FE formulation) in 2D in reference [2]. Then, reference [3] applied a similar refinement and un-refinement procedure in three space dimensions to the CUB8 element shape, both in solids mechanics and in fluid mechanics (FE formulation).

All numerical examples presented in references [1-3] with a variable mesh used a so-called "manual" mesh adaptation directive, the `WAVE` directive (see the code manual in reference [13]), first introduced in reference [1]. This directive refines the mesh along "wavefronts" that are specified by the user, e.g. according to a known analytical solution to the problem considered. This technique was used with success to simulate a bar problem (in solid mechanics) and a shock tube problem (in fluid mechanics) both in 2D and in 3D [1-3].

However, those solutions cannot be qualified as "true" adaptive solutions, because in (true) adaptivity mesh refinement and un-refinement should be completely automatic, based upon suitable *error estimators* or *error indicators*. The formulation of error estimators in fast transient dynamics is challenging and is still a subject of research. The use of so-called error indicators, however, is much simpler. For this reason, subsequent work in EUROPLEXUS focused on error indicators. References [4] and [5] document a first prototype implementation of adaptivity based upon error indicators in EUROPLEXUS, limited to 2D problems in continuum and fluid mechanics. An extension of the indicator technique to 3D is under development but has not been completed and documented yet.

Publications [6-7] focus on the natural quantities of interest in goal-oriented error assessment and adaptivity, but limited to the case of linear elasto-dynamics.

The adaptive technique was then applied to Cell-Centred Finite Volumes (CCFV) for the description of the fluid domain, first in 2D (see [8]) and then also in 3D [9]. More recently, the technique has also been extended for use with the CDEM combustion model which makes use of the CCFV formulation [10]. A complete description of the element refinement and un-refinement techniques used in mesh adaptation has been published in a paper [11]. Finally, reference [12] shows the combination of mesh adaptivity with Fluid-Structure Interaction, i.e. the automatic fluid mesh refinement and un-refinement near a moving and deforming structure.

The present work extends mesh adaptivity to simplex element shapes, i.e. the 3-node triangle (TRI3) in 2D and the 4-node tetrahedron (TET4) in 3D. These elements are useful in fully general unstructured meshing of complex geometries.

This document is organized as follows:

- Section 2 presents the geometrical aspects of adaptivity with TRI3 element shapes in 2D.
- Section 3 presents the geometrical aspects of adaptivity with TET4 element shapes in 3D.
- Section 4 presents some numerical examples in order to validate the proposed formulations.
- Some conclusions are given in Section 5.

The Appendix contains a listing of all the input files mentioned in the present report.

2. Adaptivity for the TRI3

The geometrical aspects of mesh adaptivity for the TRI3 element shape, i.e. the 3-node triangle in 2D, have been developed in close analogy to what had been done in reference [1] for the QUA4 element (4-node quadrilateral).

The refinement (one level only) of a generic triangle is shown in Figure 1 and compared with that of a quadrilateral.

In both cases, four descendents are generated upon refinement of a parent element (indicated as element 0 in the Figure). For the triangle, up to three new nodes are generated (all on the boundary), while for the quadrilateral up to 5 new nodes are generated (four on the boundary and one internal).

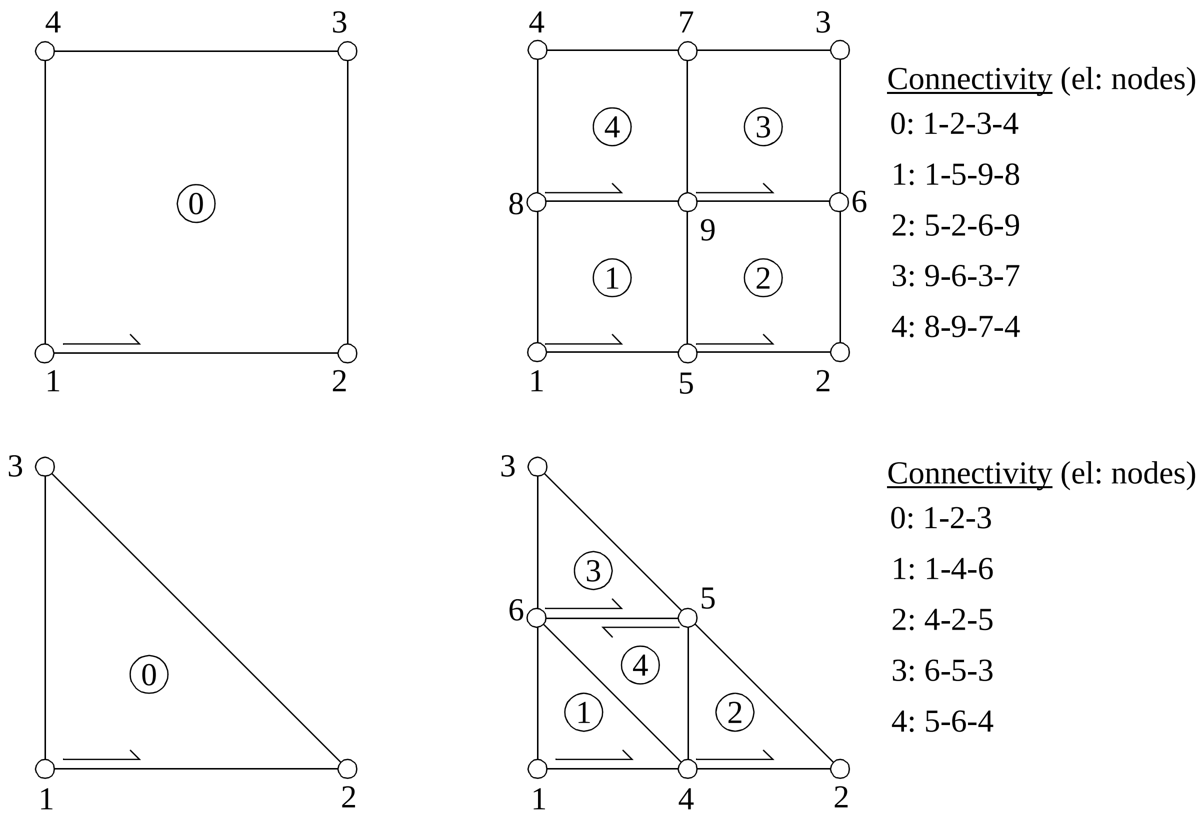


Figure 1 - Adaptive refinement of a QUA4 and of a TRI3

As concerns Cell-Centred Finite Volumes, for the quadrilateral four new internal interfaces are always generated, for the triangle three new internal interfaces are always generated. These are indicated by arrows in Figure 2 and numbered in red.

Then for the quadrilateral up to 8 new external interfaces are generated, for the triangle up to 6 new new external interfaces are generated (two interfaces for each external face of these elements).

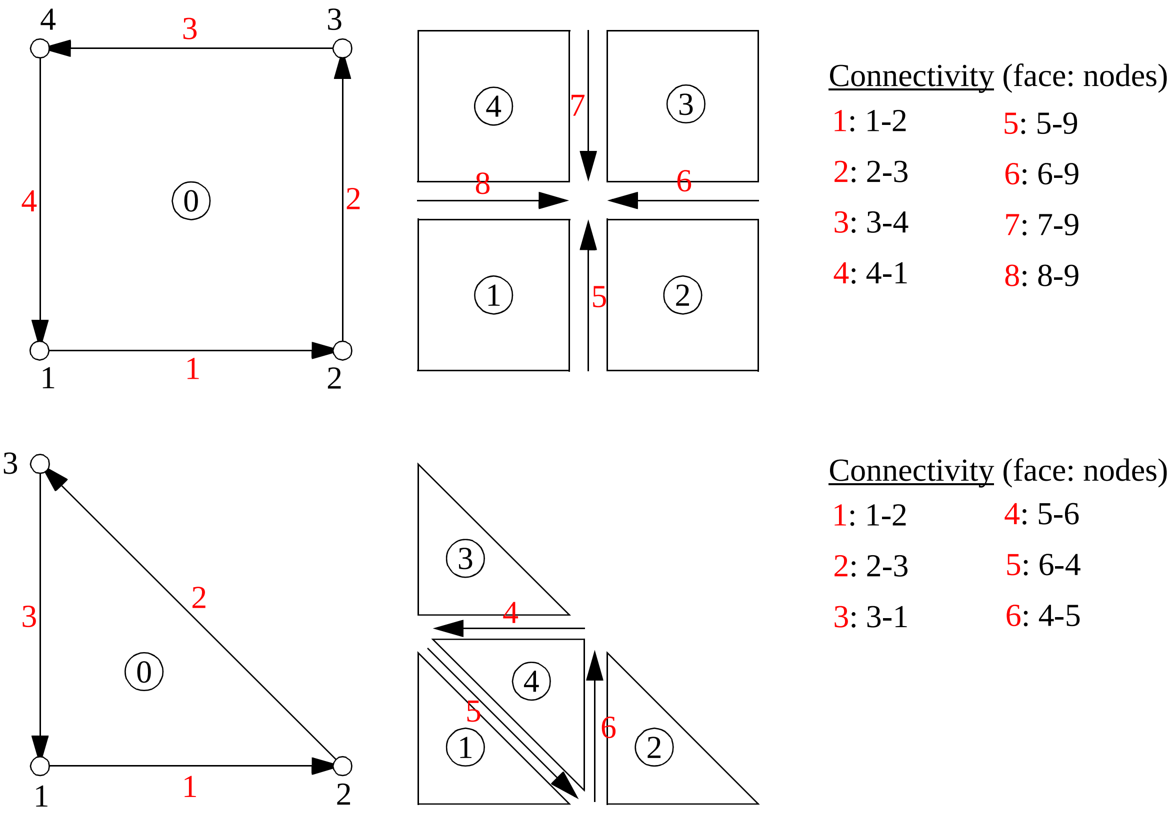


Figure 2 - Adaptive refinement of a QUA4 and of a TRI3: new internal VFCC interfaces (in red)

3. Adaptivity for the TET4

The geometrical aspects of mesh adaptivity for the TET4 element shape, i.e. the 4-node tetrahedron in 3D, have been developed in close analogy to what had been done in reference [3] for the CUB8 element (8-node hexahedron).

The refinement (one level only) of a (linear) cube is shown in Figure 3 (from reference [3]) and can be compared with that of the (linear) tetrahedron, which is shown in Figure 4.

In both cases, eight descendents are generated upon refinement of a parent element. For the tetrahedron, up to six new nodes are generated (all on the boundary), while for the hexahedron up to 19 new nodes are generated (eighteen on the boundary and one internal).

Linear tetrahedra in 3D have four nodes, four faces and six corners. The splitting process occurs as shown in Figure 5.

In a first phase, the 0-level element A is split into four sub-tetrahedra, one for each "corner" of the original tetrahedron, plus an octahedron. With the numbering shown in Figure 5, the sub-tetrahedra are: D_1(1,5,7,8), D_2(5,2,6,9), D_3(7,6,3,10) and D_4(8,9,10,4). The octahedron is numbered (5,6,7,8,9,10) and may be viewed as the union of two pyramids: (5,7,10,9,6) and (5,9,10,7,8). The first-step splitting is shown in an "exploded" view in the lower part of Figure 5, where the octahedron is colored in red for clarity. Then, we must obtain more tetrahedra from the octahedron. There are two alternatives: splitting the octahedron in 8 or in 4 tetrahedra. While the first alternative is unique, the second one can be realized in three different ways.

With the first alternative, the second and last phase is as follows. First, the centroid of the quadrilateral (5,7,10,9), i.e the base of the two pyramids that form the octahedron, is computed. Let this be point 11 in the upper part of Figure 6. This may be obtained as the mid-point of segment a-b or, equivalently, as the mid-point of segment c-d, where a, b, c, d are the mid-points of the four sides of the quadrilateral (5,7,10,9), as indicated in the Figure. Finally, from each of the two mentioned pyramids plus the newly computed point 11, we get the eight desired tetrahedra. These are: D_5(5,8,9,11), D_6(6,9,10,11), D_7(5,6,7,11), D_8(7,10,8,11), D_9(8,10,9,11), D_{10}(5,6,9,11), D_{11}(5,7,8,11) and D_{12}(6,10,7,11). These tetrahedra are represented in "exploded" view in the lower part of Figure 6. Thus, with this first strategy altogether the splitting of a linear tetrahedron generates twelve sub-tetrahedra, the four shown in Figure 5 plus the eight shown in Figure 6.

With the second alternative, the second and last phase is as follows. The octahedron is split in four tetrahedra only, instead of eight tetrahedra. First, the three diagonals of the octahedron, 9-7, 5-10 and 6-8 are evaluated and the *shortest* one is considered (in order to obtain final tetrahedra with the best aspect ratios, i.e. to avoid the appearance of *slivers*). If the shortest diagonal is 9-7, then the splitting is as shown in Figure 7 (left). If the shortest diagonal is 5-10, then the splitting is as shown in Figure 7 (right). If the shortest diagonal is 6-8, then the splitting is as shown in Figure 8. Thus, with this strategy altogether the splitting of a linear tetrahedron generates eight sub-tetrahedra, the four shown in Figure 5 plus the four shown in Figure 7 or Figure 8.

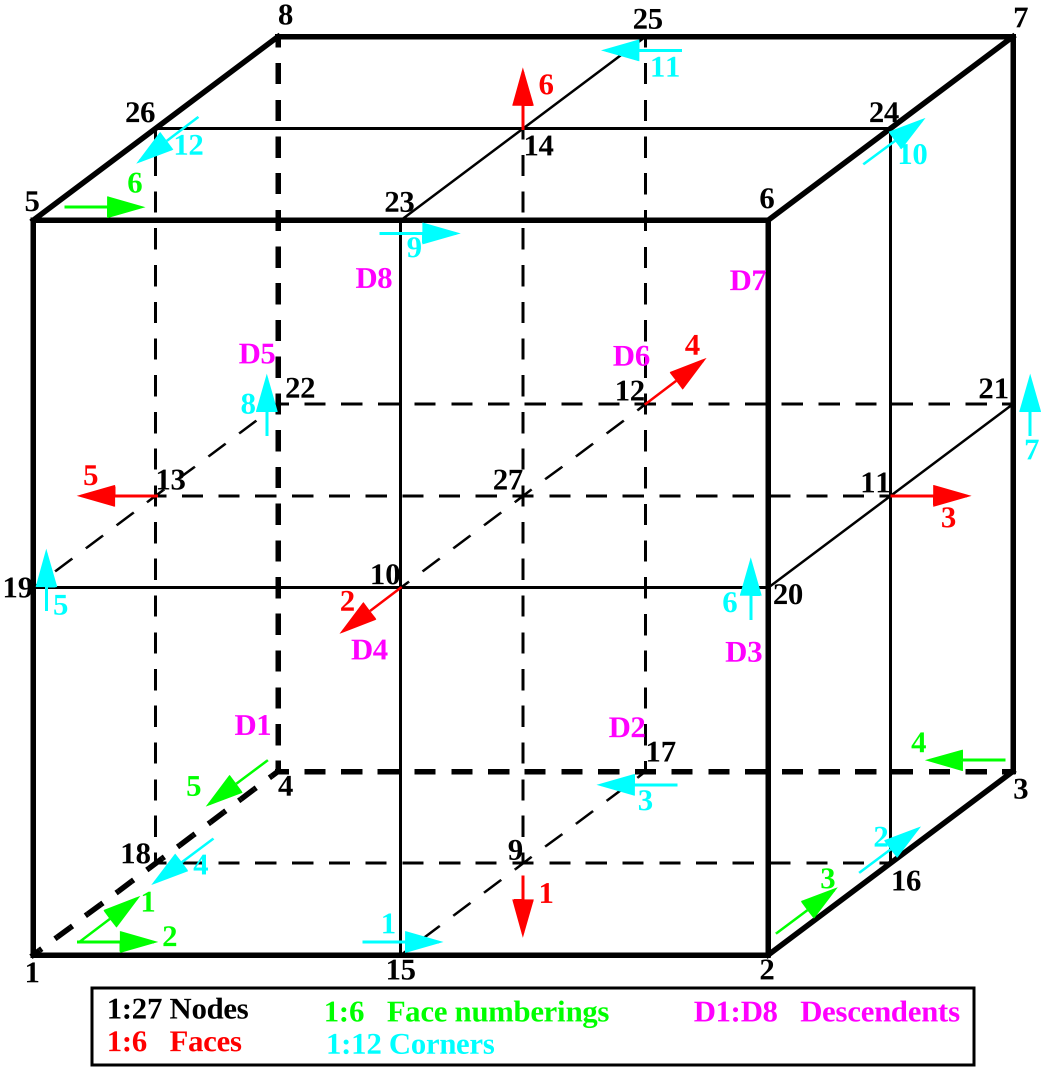
The second strategy is preferred because it is likely to lead to better-shaped descendents, although the presence of three alternatives could in principle make the programming more complicated.

However, by noting that each of the four "internal" tetrahedra (originating from the octahedron) has one and only one "external" face (lying on the surface of the parent tetrahedron), it is possible to simplify the programming (by making it as similar as possible to that of the CUB8 element) if one numbers and arranges the internal tetrahedra in such a way that the two following conditions are always met (irrespective of the particular case, A, B or C, of the octahedron splitting):

I *The (local) index of the descendent must be equal to the local index of the corresponding parent's face, plus 4.*

II *The (local) number of the "external" face of the descendent must be equal to the (local) number of the corresponding parent's face.*

With the local numbering shown in Figures 7 and 8 for the three alternative cases (A, B, C) both of the above conditions are satisfied.



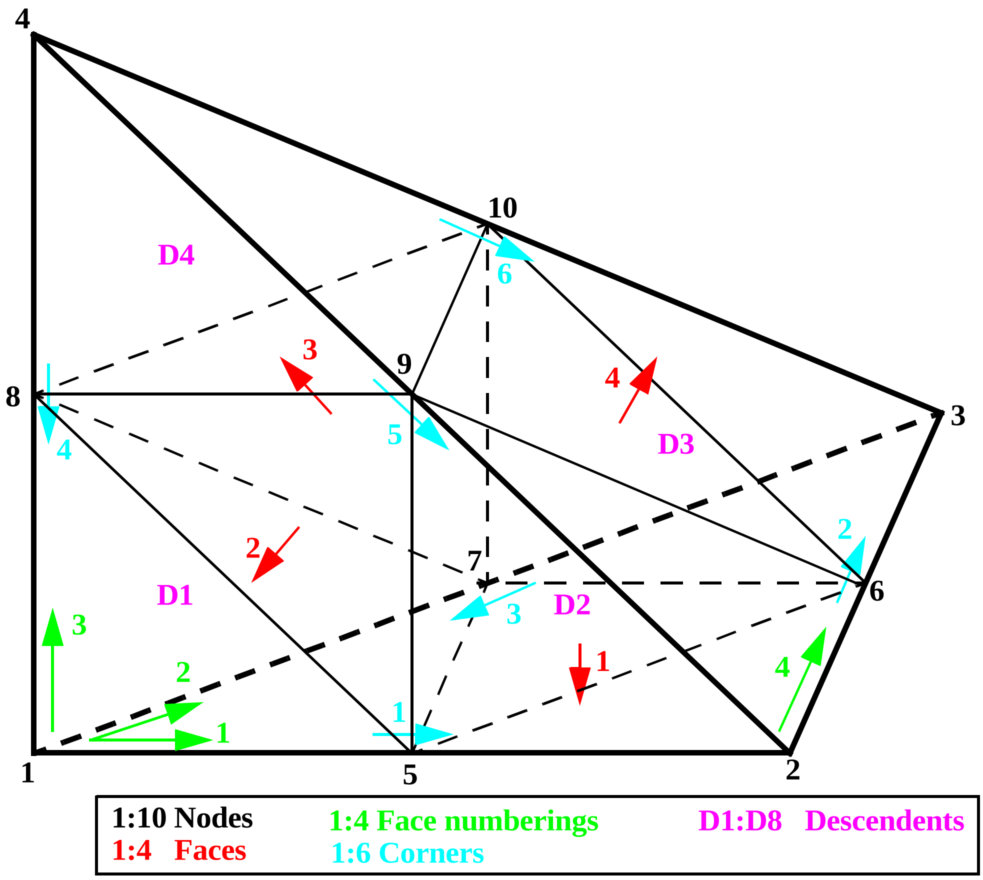
<u>Constants</u>

Parent element: 1-2-3-4-5-6-7-8.
Faces: 1-4-3-2 ; 1-2-6-5 ; 2-3-7-6 ; 3-4-8-7 ; 4-1-5-8 ; 5-6-7-8.
Corners: 1-2 ; 2-3 ; 3-4 ; 4-1 ; 1-5 ; 2-6 ; 3-7 ; 4-8 ; 5-6 ; 6-7 ; 7-8 ; 8-5 = **COR2NOD**(1:2,1:12).
Faces to corners: 4-3-2-1 ; 1-6-9-5 ; 2-7-10-6 ; 3-8-11-7 ; 4-5-12-8 ; 9-10-11-12 = **FAC2COR**(1:4,1:6).
Corners to faces: 1-2 ; 1-3 ; 1-4 ; 1-5 ; 2-5 ; 3-2 ; 4-3 ; 5-4 ; 2-6 ; 3-6 ; 4-6 ; 5-6 = **COR2FAC**(1:2,1:12).
Corners to mid-side nodes: 1-2 ; 2-3 ; 3-4 ; 4-1 ; 1-5 ; 2-6 ; 3-7 ; 4-8 ; 5-6 ; 6-7 ; 7-8 ; 8-5 = **COR2DN**(1:2,1:12)
(1st entry is descendent index, 2nd entry is descendent's node).
Faces to mid-face nodes: 1-3 ; 1-6 ; 2-7 ; 3-8 ; 4-5 ; 5-7 = **FAC2DN**(1:2,1:6) (1st entry = descendent, 2nd = node).
Corners to descendents: 1-2 ; 2-3 ; 3-4 ; 4-1 ; 1-5 ; 2-6 ; 3-7 ; 4-8 ; 5-6 ; 6-7 ; 7-8 ; 8-5 = **COR2DES**(1:2,1:12).

<u>Variables</u>

Nodes: 1:8 parent element (8) always reused,
9:14 face centres (6) new or reused,
15:26 corners (12) new or reused,
27 element centre (1) always new = **NN**(1:27).
Small neighbors: "descendent" neighbors (0=none) for each face, in the same order as face nodes=**SNEI**(1:4,1:6).
Small neighbours' faces: SNEI's face adjacent to this element's descendent (same org. as SNEI)=**SFAC**(1:4,1:6).
Descendents D1:D8 are the smaller cubes containing nodes 1:8, respectively, numbered "consistently" with parent.

Figure 3 - Adaptive refinement of a 8-node hexahedron (CUB8 element shape), from [3]



<u>Constants</u>

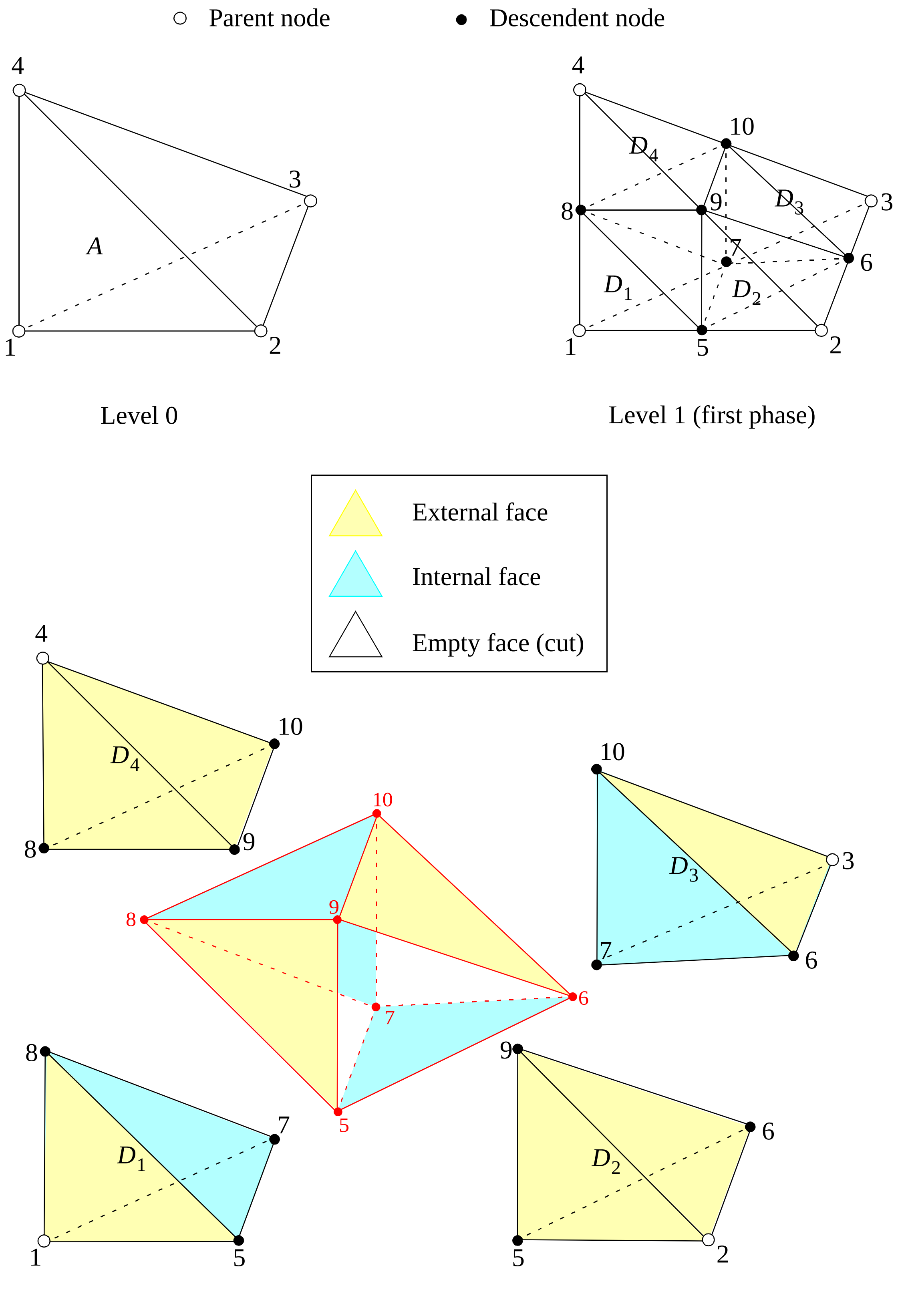
Parent element: 1-2-3-4.
Faces: 1-3-2 ; 1-2-4 ; 1-4-3 ; 2-3-4.
Corners: 1-2 ; 2-3 ; 3-1 ; 4-1 ; 4-2 ; 4-3 = **COR2NOD**(1:2,1:6).
Faces to corners: 3-2-1 ; 1-5-4 ; 4-6-3 ; 2-6-5 = **FAC2COR**(1:3,1:4).
Corners to faces: 1-2 ; 1-4 ; 1-3 ; 2-3 ; 4-2 ; 3-4 = **COR2FAC**(1:2,1:6).
Corners to mid-side nodes: 1-2 ; 2-3 ; 3-1 ; 4-1 ; 4-2 ; 4-3 = **COR2DN**(1:2,1:6)
(1st entry is descendent index, 2nd entry is descendent's node).
Faces to mid-face nodes: N/A to tetrahedron.
Corners to descendents: 1-2 ; 2-3 ; 3-1 ; 4-1 ; 4-2 ; 4-3 = **COR2DES**(1:2,1:6).
Note that, with the above numbering of the tetrahedron, **COR2NOD = COR2DN = COR2DES.**

<u>Variables</u>

Nodes: 1:4 parent element (4) always reused,
5:10 corners (6) new or reused = **NN**(1:10).
Small neighbours: "descendent" neighbours (0=none) for each face, first three in the same order as face nodes, fourth one is "central" neighbor=**SNEI**(1:4,1:4).
Small neighbours' faces: SNEI's face adjacent to this element's descendent (same org. as SNEI)=**SFAC**(1:4,1:4).
Descendents D1:D4 are the smaller tetrahedra containing nodes 1:4, respectively. D5:D8 are built from the remaining octahedron. There are three possibilities (A, B, C) depending on the shortest diagonal (9-7, 5-10, 6-8 respectively).

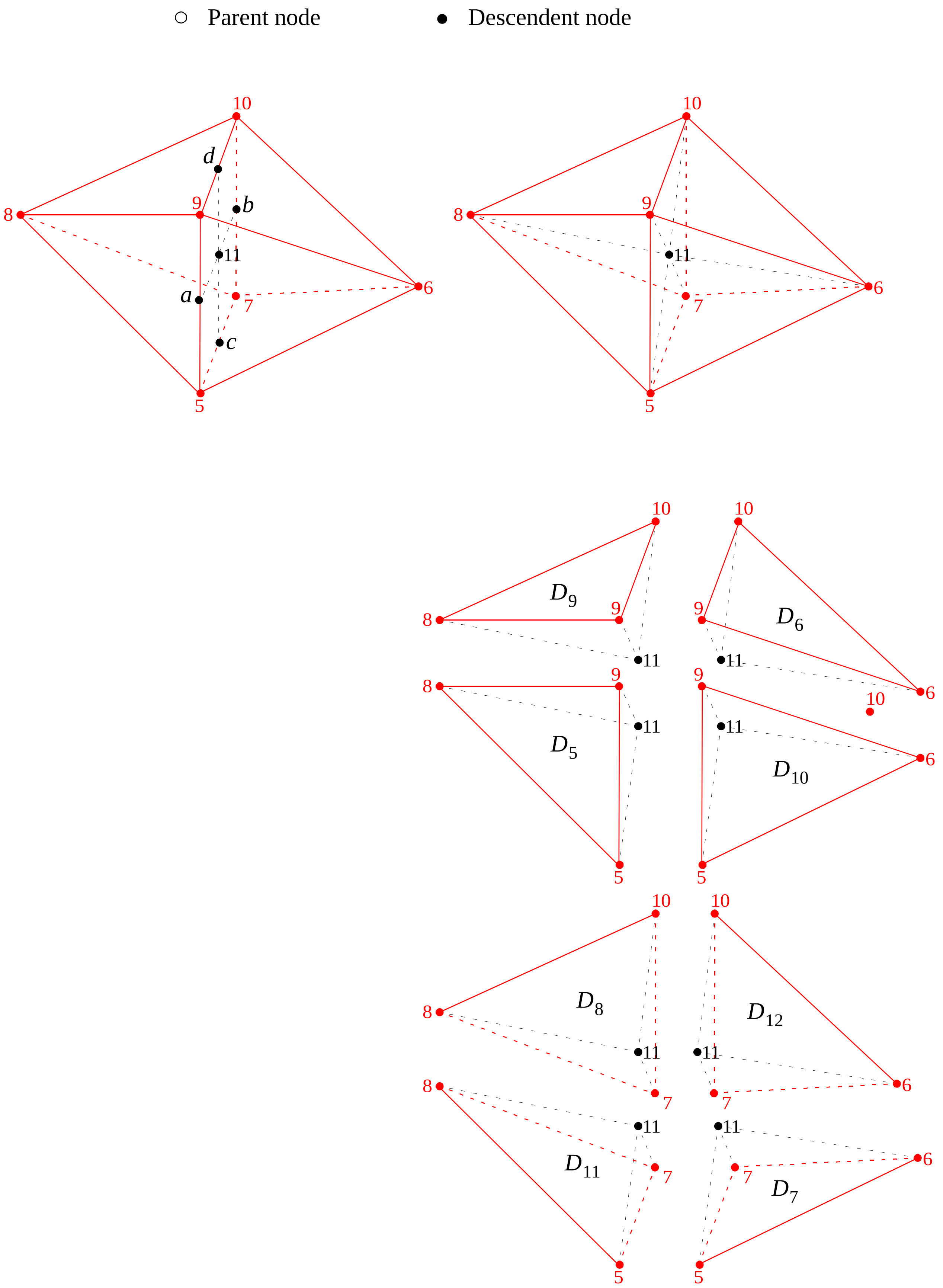
	A	B	C
D1 = 1-5-7-8	D5 = 5-6-7-9	D5 = 5-6-7-10	D5 = 5-6-7-8
D2 = 5-2-6-9	D6 = 8-5-7-9	D6 = 8-5-10-9	D6 = 8-5-6-9
D3 = 7-6-3-10	D7 = 8-9-7-10	D7 = 8-5-7-10	D7 = 8-6-7-10
D4 = 8-9-10-4	D8 = 7-9-6-10	D8 = 5-9-6-10	D8 = 8-9-6-10.

Figure 4 - Adaptive refinement of a 3D 4-node tetrahedron (TET4 element shape)



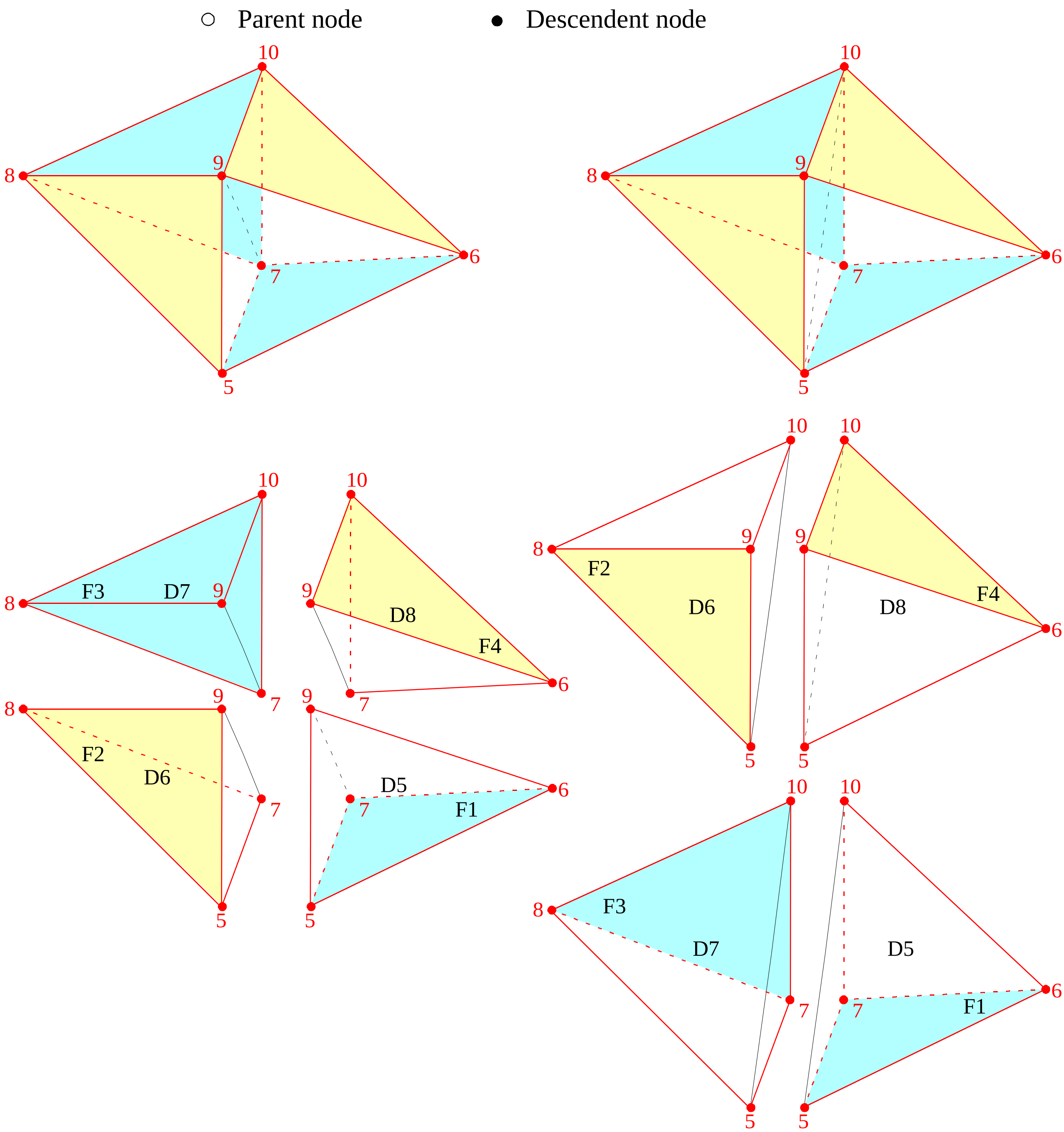
Exploded view of level 1, first phase

Figure 5 - Splitting of a TET4 element shape, first phase



Exploded view of level 1, second phase

Figure 6 - Splitting of a TET4 element shape, first strategy, second and last phase



A

D1 = 1-5-7-8	D5 = 5-6-7-9
D2 = 5-2-6-9	D6 = 8-5-7-9
D3 = 7-6-3-10	D7 = 8-9-7-10
D4 = 8-9-10-4	D8 = 7-9-6-10.

Alternative A : diagonal 9-7 shorter than 5-10 and 6-8

B

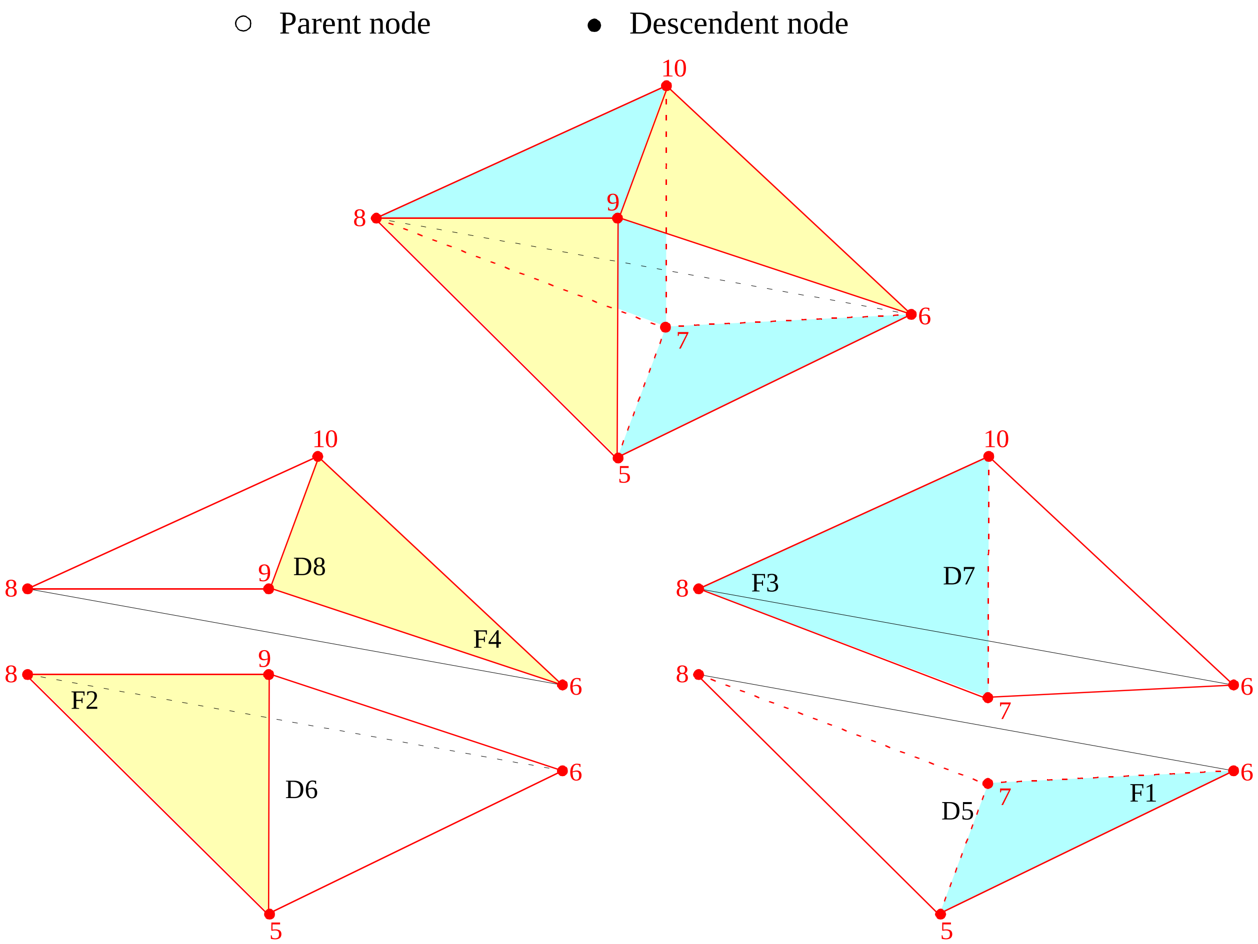
D1 = 1-5-7-8	D5 = 5-6-7-10
D2 = 5-2-6-9	D6 = 8-5-10-9
D3 = 7-6-3-10	D7 = 8-5-7-10
D4 = 8-9-10-4	D8 = 5-9-6-10.

Alternative B : diagonal 5-10 shorter than 9-7 and 6-8

Parent element: 1-2-3-4.
Faces: 1-3-2 ; 1-2-4 ; 1-4-3 ; 2-3-4.

Exploded view of level 1, second phase

Figure 7 - Splitting of a TET4 element shape, second strategy, second and last phase



C

D1 = 1-5-7-8	D5 = 5-6-7-8
D2 = 5-2-6-9	D6 = 8-5-6-9
D3 = 7-6-3-10	D7 = 8-6-7-10
D4 = 8-9-10-4	D8 = 8-9-6-10.

Alternative C: diagonal 6-8
shorter than 5-10 and 9-7

Parent element: 1-2-3-4.
Faces: 1-3-2 ; 1-2-4 ; 1-4-3 ; 2-3-4.

Exploded view of level 1, second phase

Figure 8 - Splitting of a TET4 element shape, second strategy, second and last phase (cont'd)

As concerns Cell-Centred Finite Volumes, for the hexahedron twelve new internal interfaces are always generated, for the tetrahedron eight new internal interfaces are always generated. The latter are shown in Figures 9, 10, 11 for the three different splittings of the octahedron (case A, B, C, respectively).

Then for the hexahedron up to 24 new external interfaces are generated, for the tetrahedron up to 16 new external interfaces are generated (four interfaces for each external face of these elements).

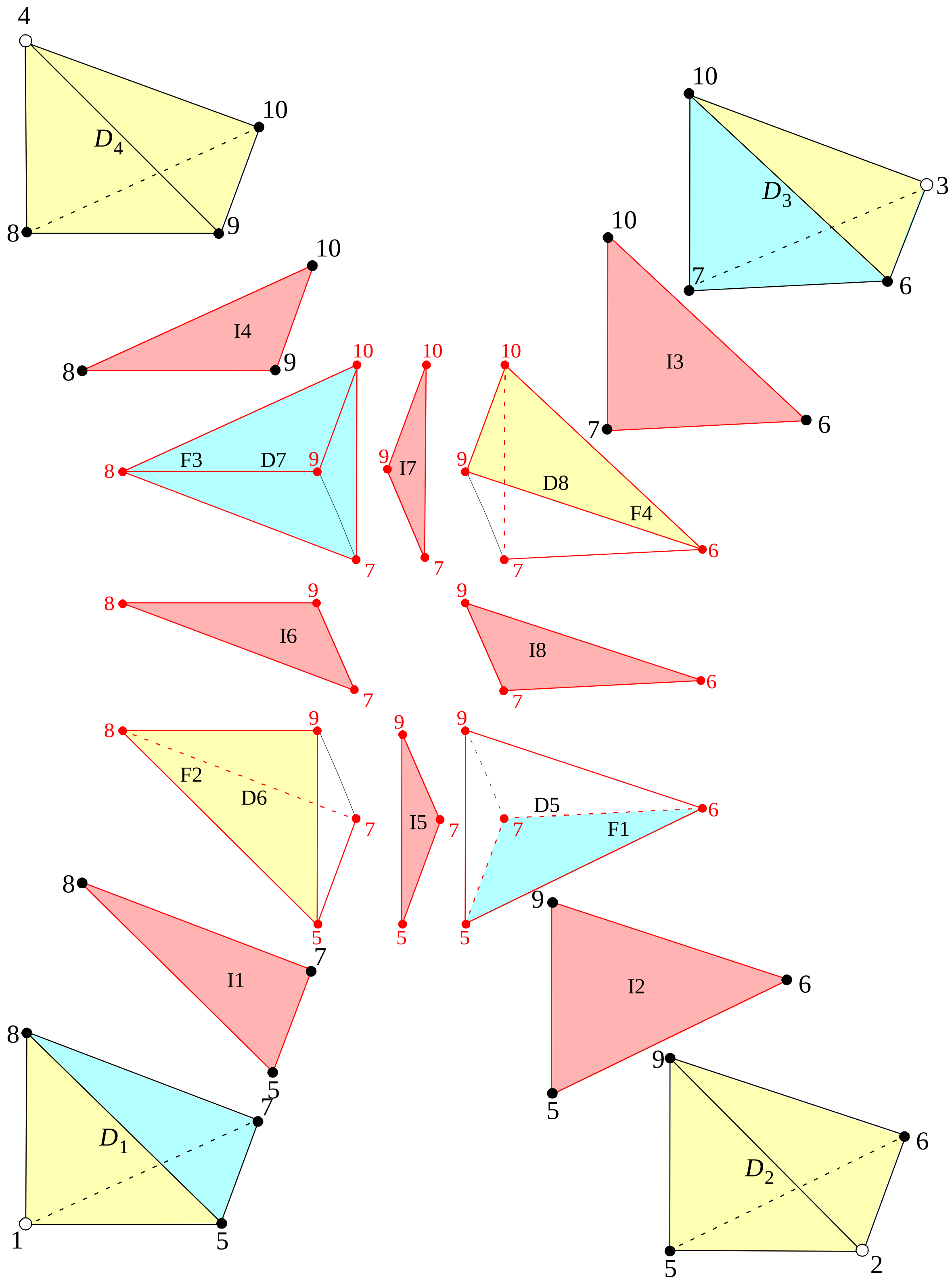


Figure 9 - Adaptive refinement of a TET4: new internal VFCC interfaces in case A

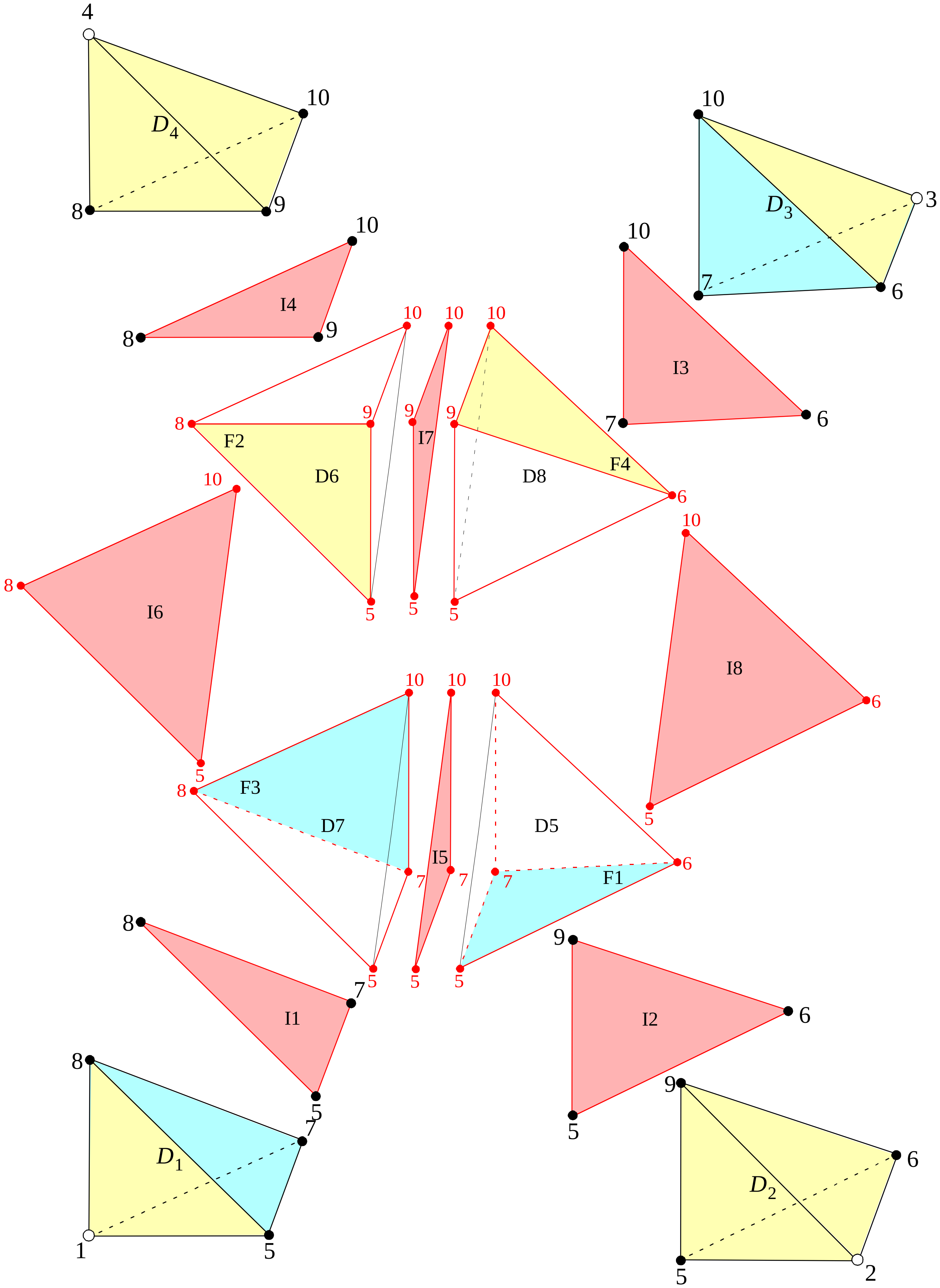


Figure 10 - Adaptive refinement of a TET4: new internal VFCC interfaces in case B

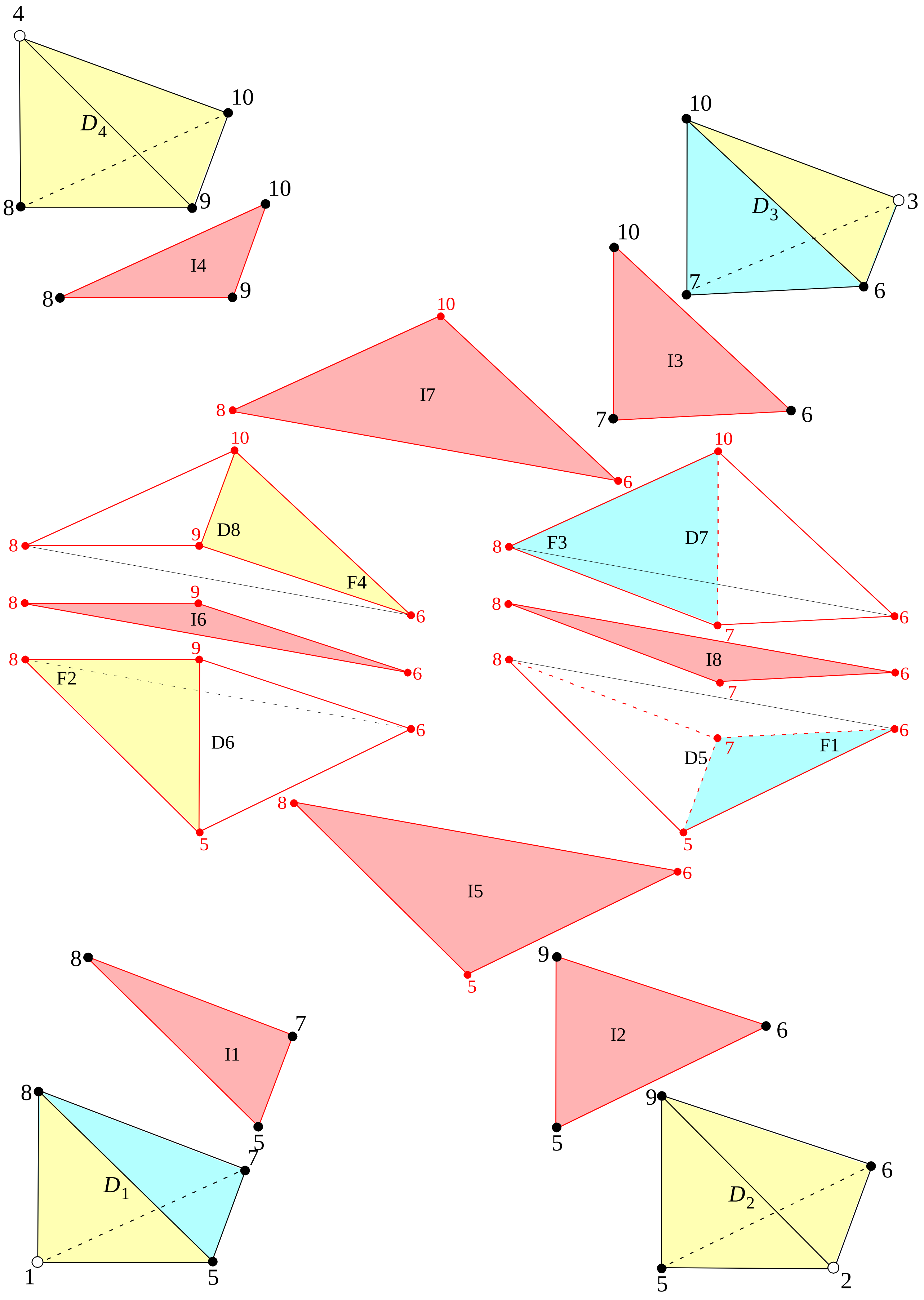


Figure 11 - Adaptive refinement of a TET4: new internal VFCC interfaces in case C

4. Numerical examples

We present some numerical examples in order to test the algorithms described in the previous Sections.

4.1 Wave propagation in 2D

The first example is that of the propagation of two spherical waves in a 2D quadrangular region by means of the `WAVE` directive, see Figure 12 and reference [1]. This test verifies only the geometric aspects of adaptivity because no real stress wave is generated in the model.

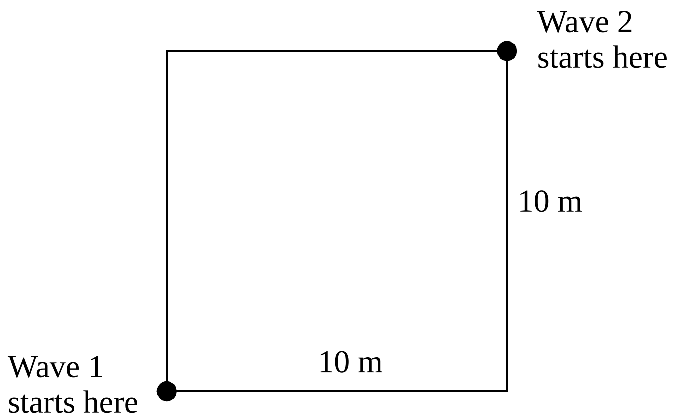


Figure 12 - Definition of the wave propagation problem

First, a reference solution is obtained by means of quadrilaterals, see reference [1]. Then, an adaptive solution with triangles is obtained. All performed calculations are summarized in Table 1.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
TEST10QUA	100 FL24	WAVE 2 SPHE MAXL 4	114	1.92	183,634
TEST10TRI	200 FL23	WAVE 2 SPHE MAXL 4	182	4.02	587,214

Table 1 - Calculations for the wave propagation problem

TEST10QUA

This test uses a very coarse base fluid mesh, of just 10×10 FL24 quadrilateral fluid elements. The evolution of the adapted mesh is shown in Figure 13.

TEST10TRI

This test uses a very coarse base fluid mesh, of just 200 FL23 triangular fluid elements. The evolution of the adapted mesh is shown in Figure 14 and is very similar to the case with quadrilaterals. However, this solution was slightly unstable and a safety coefficient `CSTA 0.5` had to be used here.

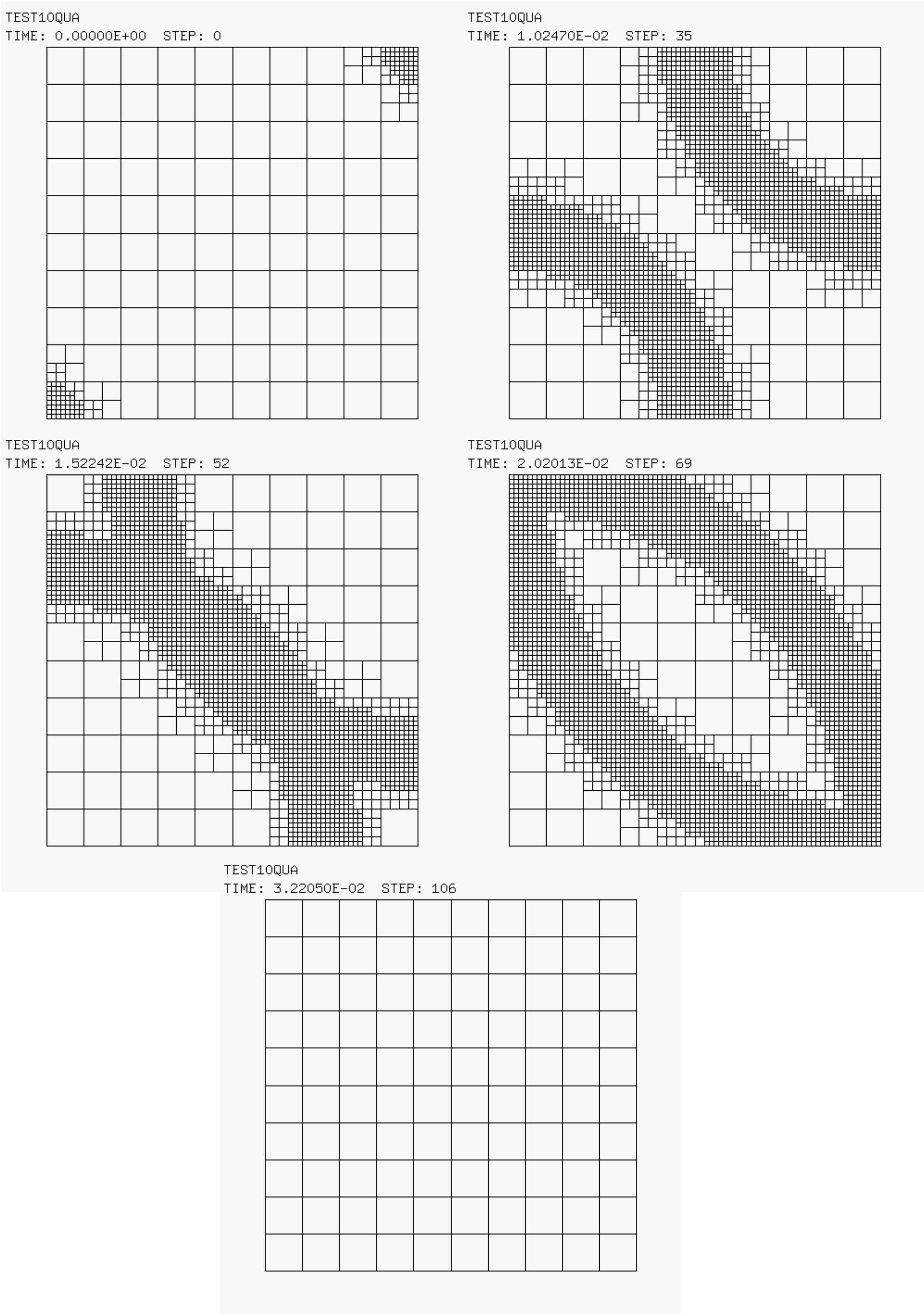


Figure 13 - Evolution of the adapted mesh for case TEST10QUA

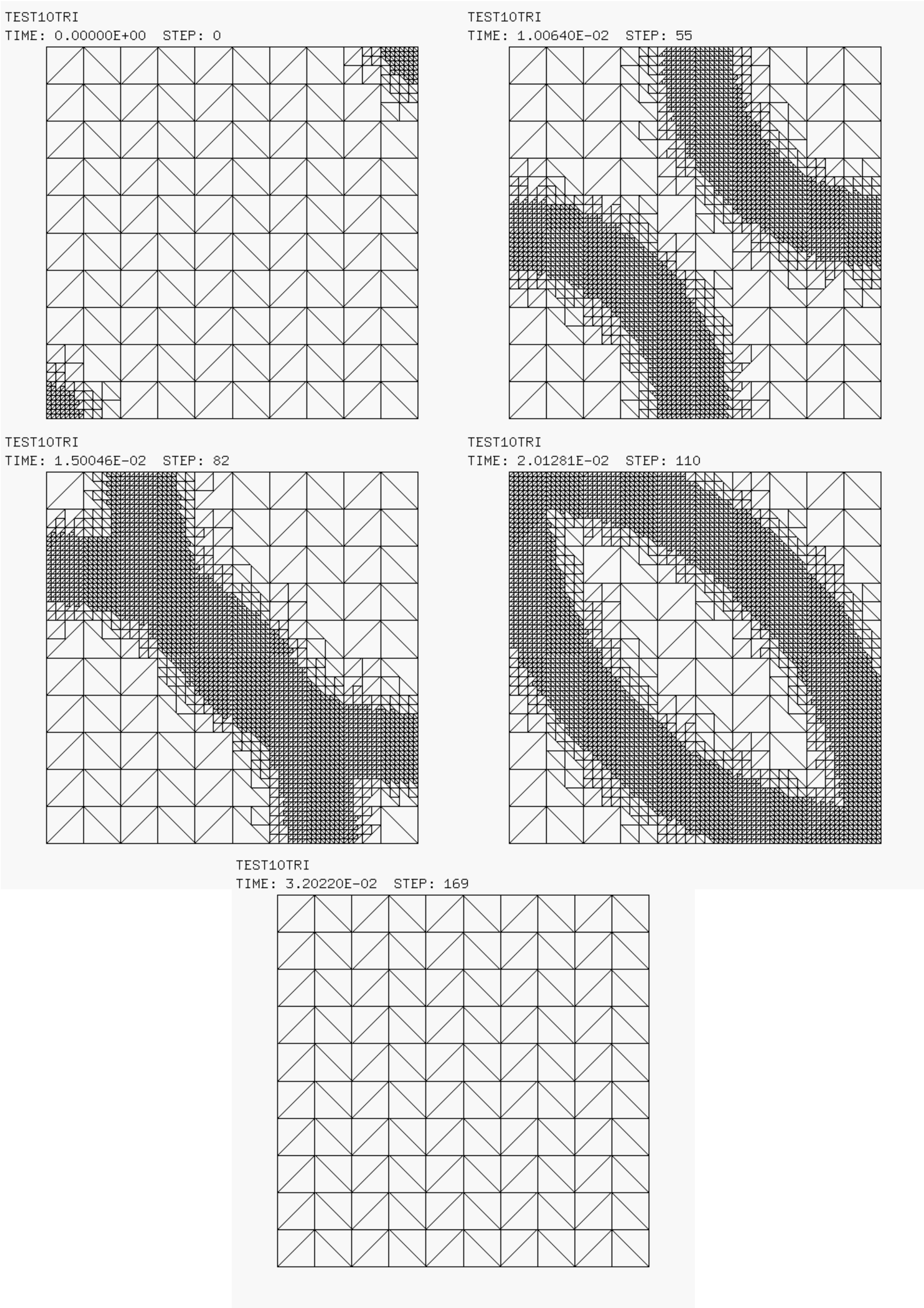


Figure 14 - Evolution of the adapted mesh for case TEST10QUA

4.2 Bar impact in 2D

The next example is that of the impact of an elastic bar on a rigid obstacle. An elastic bar of square unit cross-section and length 100 units impacts at an initial velocity of 100 m/s on a rigid wall. The material is steel-like. The calculation is performed until 40 ms, when rebound of the bar starts.

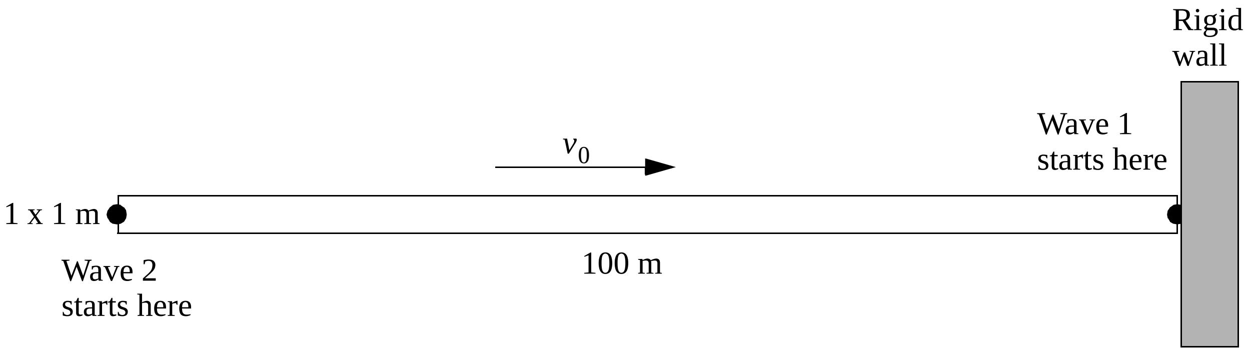


Figure 15 - Definition of the bar impact problem in 2D

First, a reference solutions (without adaptivity) are obtained by means of triangles (TRIA element). Then, equivalent solutions with adaptivity are obtained. All performed calculations are summarized in Table 2.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
BITR01	200 TRIA	No adaptivity			
BITR02	200 TRIA	WAVE 2 PLAN MAXL 2			
BITT03	200 TRIA	WAVE 2 PLAN MAXL 3			

Table 2 - Calculations for the bar impact problem in 2D

BITR01

This test uses a mesh of just 200 TRIA triangular elements. The solutions is considered as a (rough, because of the coarse mesh) reference, since no adaptivity is used. Figure 16 shows the spatial distribution of the velocity every 10 ms.

BITE02

This test is similar to BITR01 but uses adaptivity. Two `WAVE` directives are specified, the first starting at the right end of the bar and at time 0 (incident wave), when impact occurs, the second starting at the left end of the bar at time 20 ms (reflected wave). A maximum refinement level of `MAXL 2` is prescribed (recall that level 1 is the base mesh), so elements are refined just once. Figure 17 shows the spatial distribution of the velocity every 10 ms.

BITR03

This test is similar to BITR02 but uses `MAXL 3`. Figure 18 shows the spatial distribution of the velocity every 10 ms. Figures 19 and 20 compare the three solutions with triangles at 10 ms (incident wave) and at 30 ms (reflected wave), respectively. As the mesh is progressively refined, the solution becomes steeper and the oscillations amplitude diminishes.

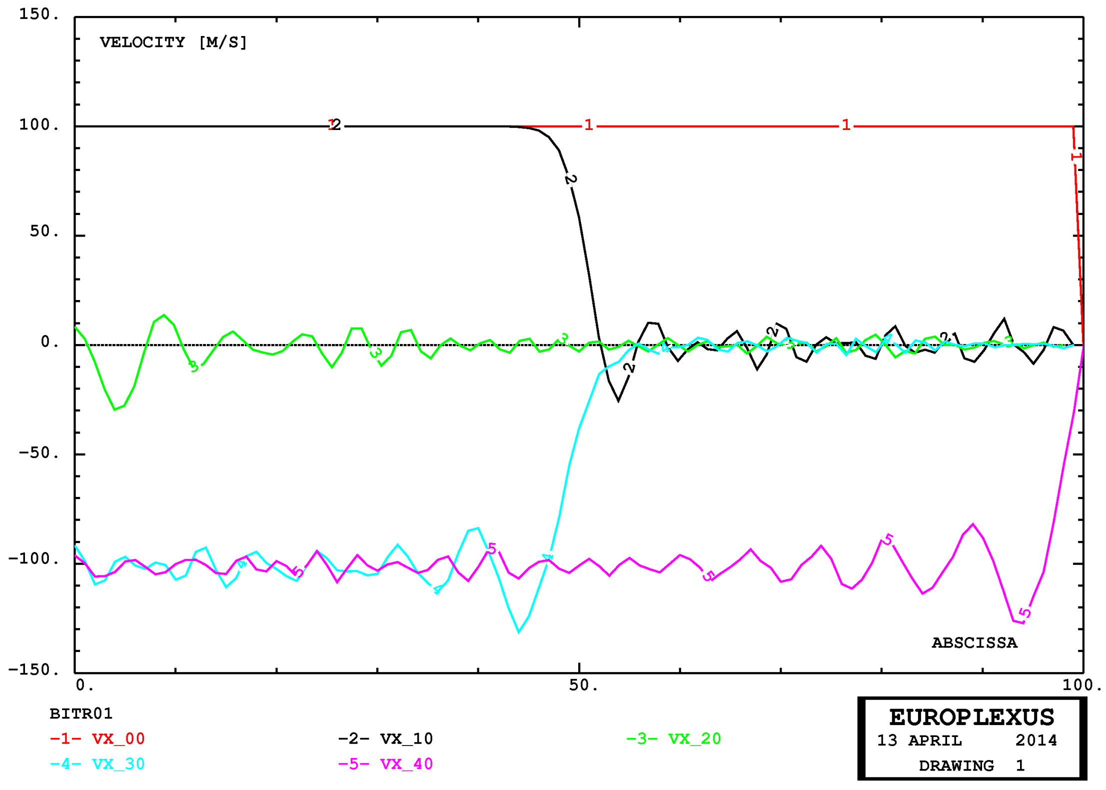


Figure 16 - Spatial distribution of the velocity every 10 ms in case BITR01

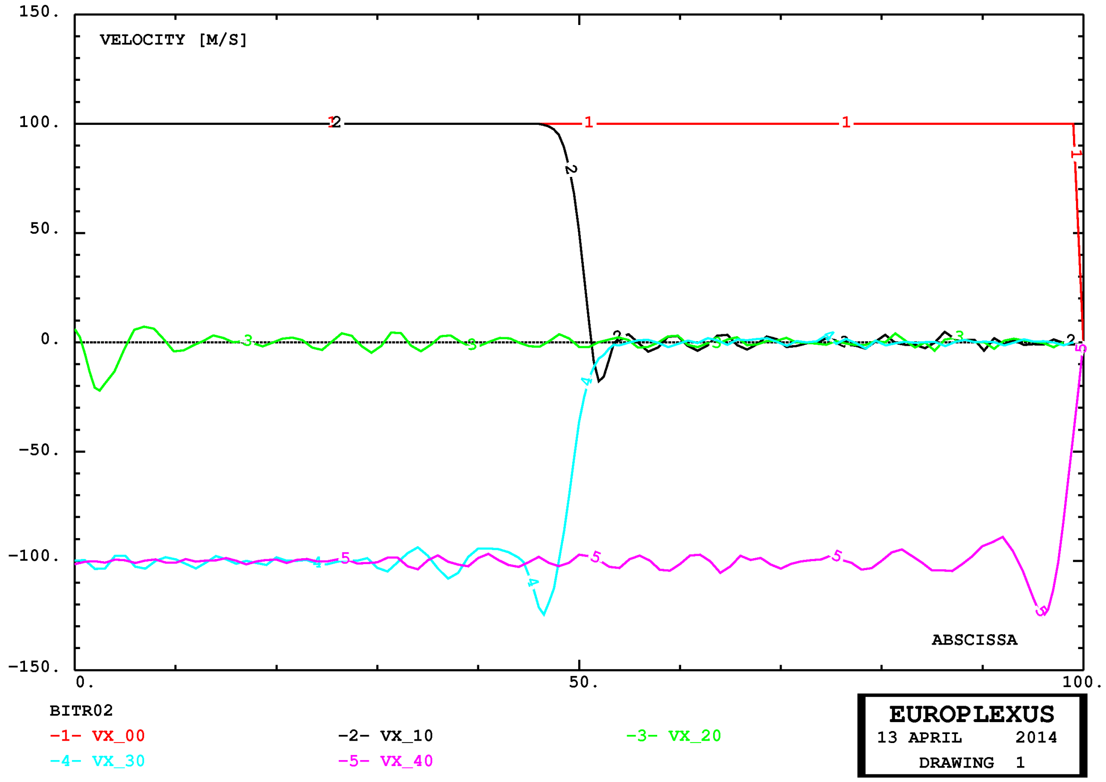


Figure 17 - Spatial distribution of the velocity every 10 ms in case BITR02

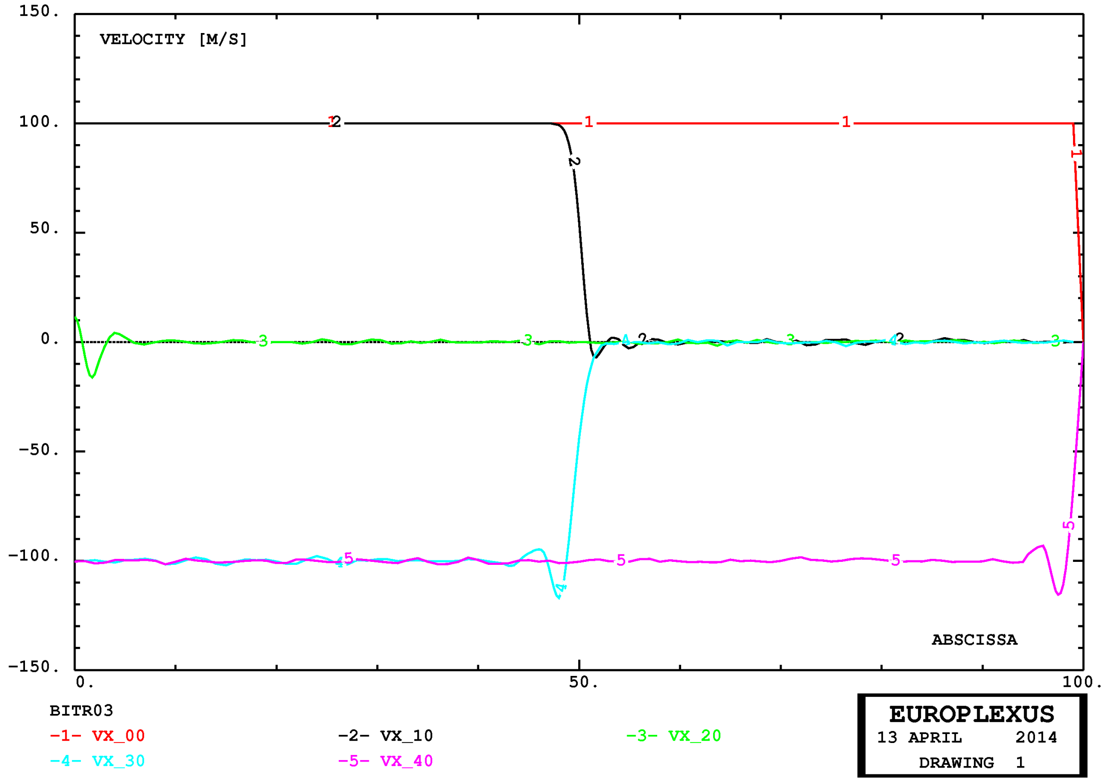


Figure 18 - Spatial distribution of the velocity every 10 ms in case BITR03

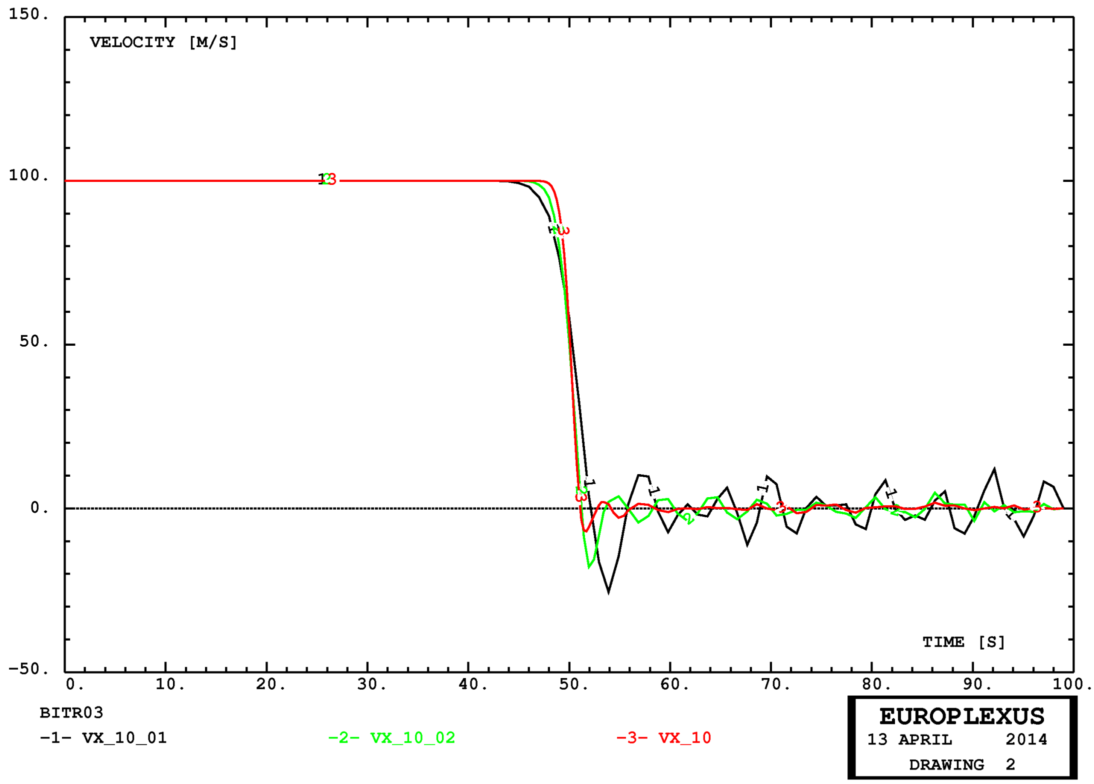


Figure 19 - Comparison of three solutions at 10 ms (incident wave) with triangles

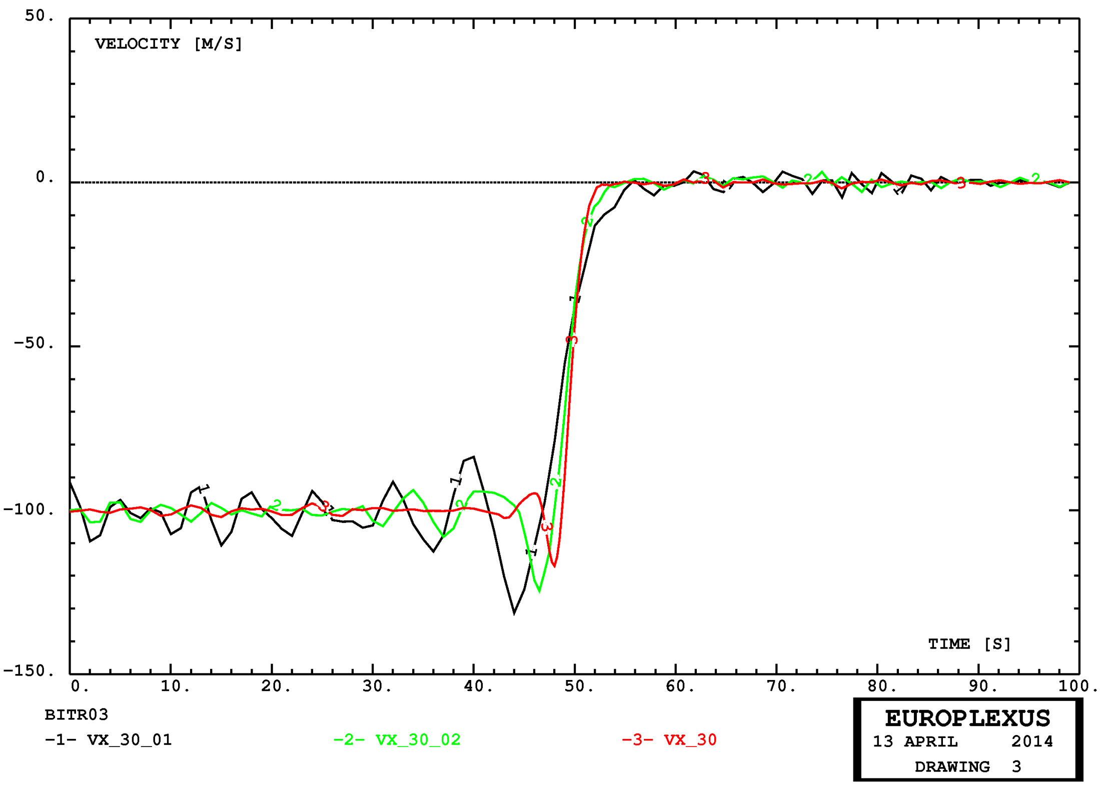


Figure 20 - Comparison of three solutions at 30 ms (reflected wave) with triangles

4.3 Shock tube in 2D with Finite Elements

The next example is a classical shock tube, similar to those considered in reference [2]. The adaptive mesh refinement is once again piloted by the `WAVE` directive.

First, a reference solution is obtained by means of a fine mesh of (non-adaptive) triangles. Then, an adaptive solution with triangles is obtained. All performed calculations are summarized in Table 1.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
SHOT00	12,800 FL23	Non-adaptive fine mesh	1,053	19.1	13,491,200
SHOT01	200 FL23	WAVE 4 PLAN MAXL 4	1,051	3.12	1,286,716

Table 3 - Calculations for the shock tube problem with Finite Elements

SHOT00

This test uses a very fine non-adaptive fluid mesh, of $800 \times 8 \times 2 = 12800$ triangular fluid elements FL23. The solution is not particularly good (i.e. not as regular as with quadrilaterals, but this may happen with triangles since the solution is mesh-sensitive) and is shown in Figures 21 (pressure), 22 (density), 23 (specific internal energy) and 24 (velocity). This is taken as a reference for the subsequent adaptive solution.

SHOT01

This solution is adaptive and uses a very coarse base fluid mesh, of just 200 triangular fluid elements FL23. The solution is shown in Figures 21 (pressure), 22 (density), 23 (specific internal energy) and 24 (velocity) and is in relatively good agreement with the reference.

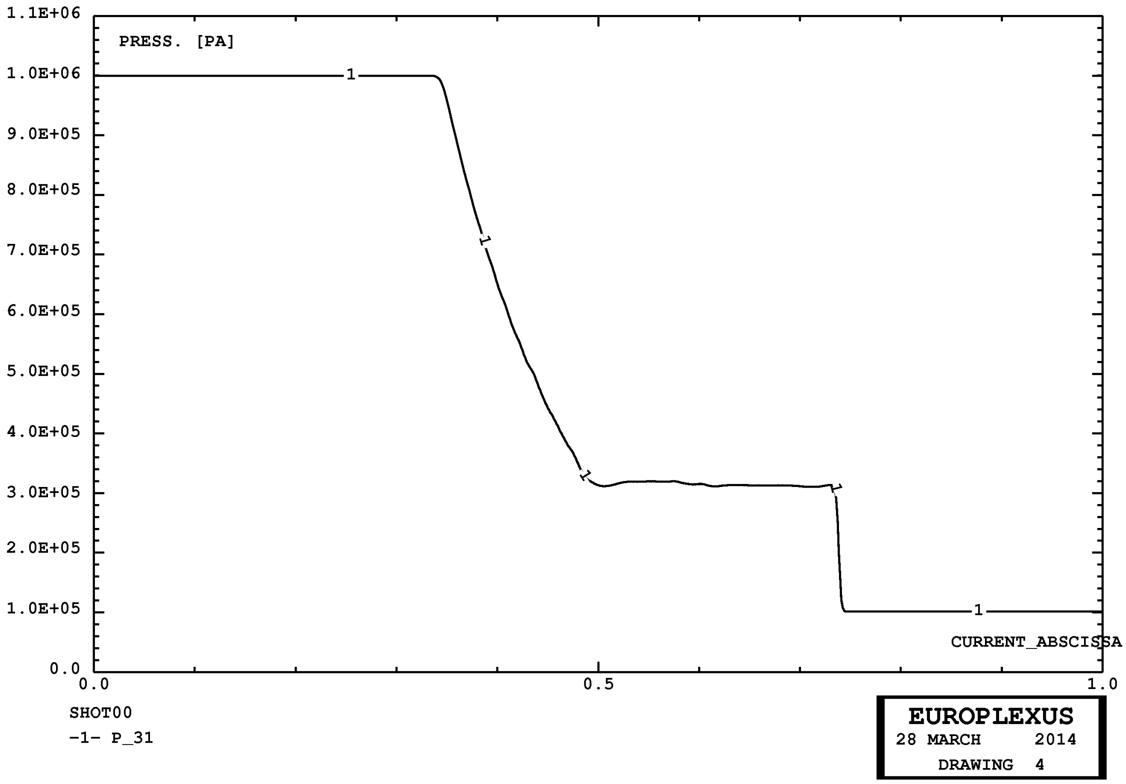


Figure 21 - Pressure in case SHOT00

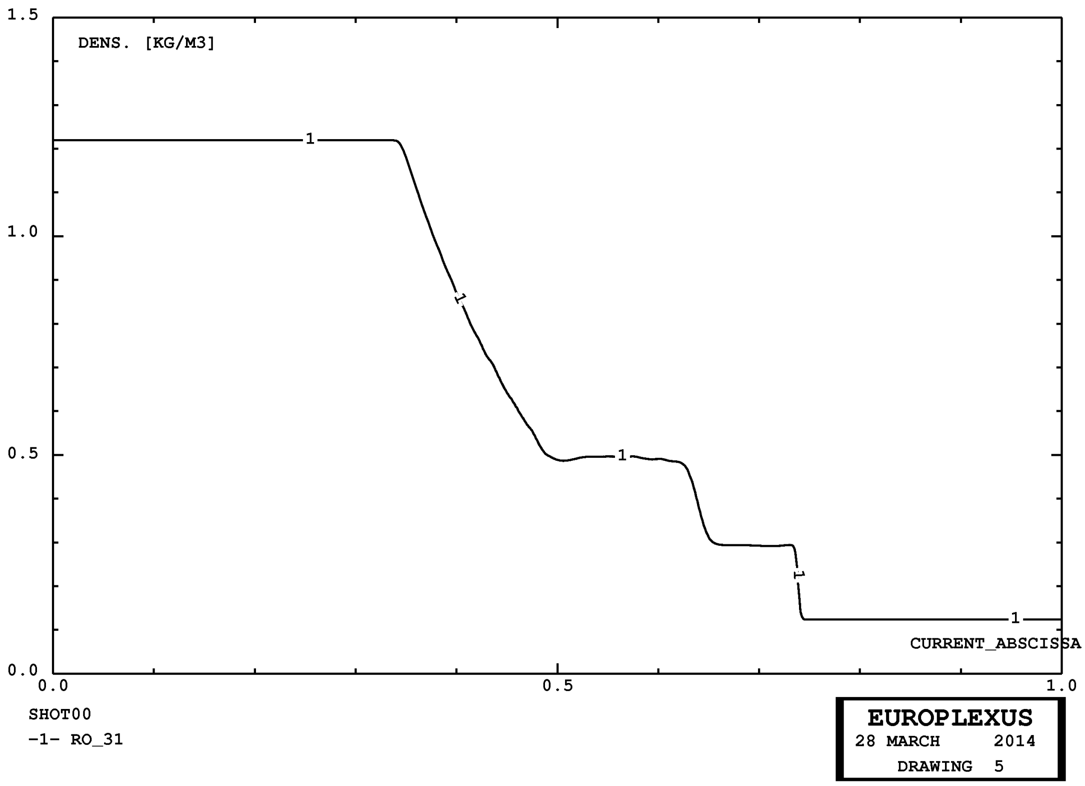


Figure 22 - Density in case SHOT00

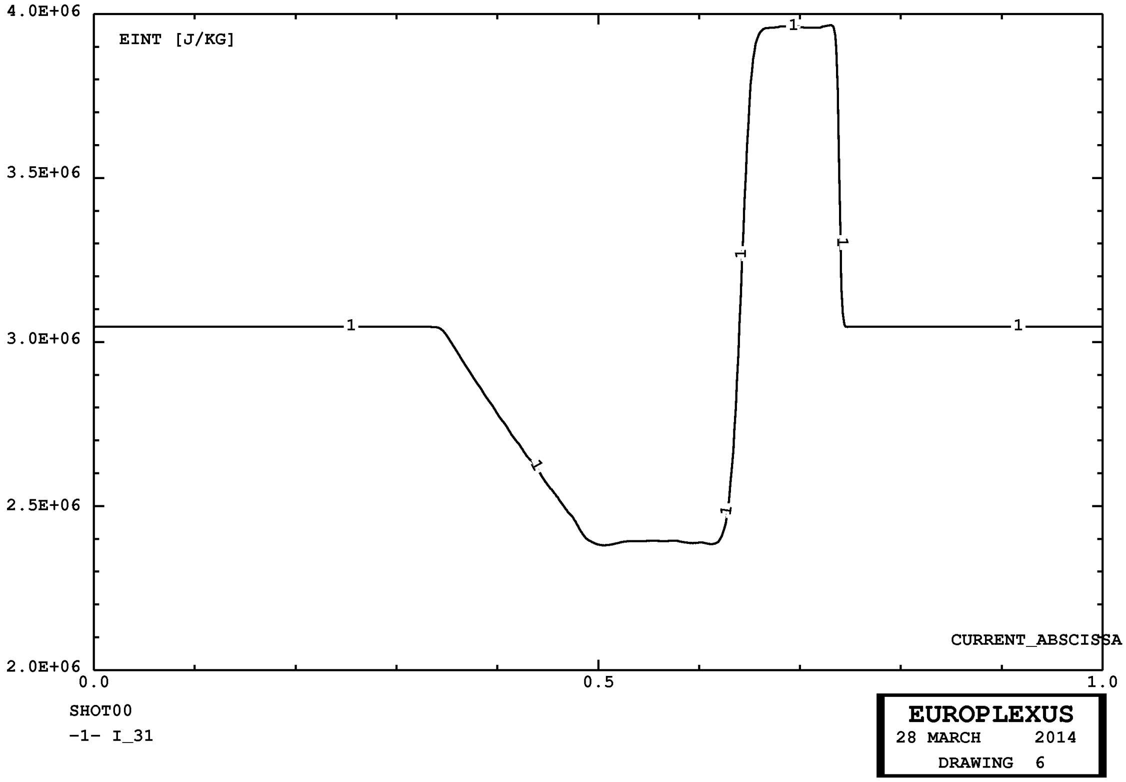


Figure 23 - Specific internal energy in case SHOT00

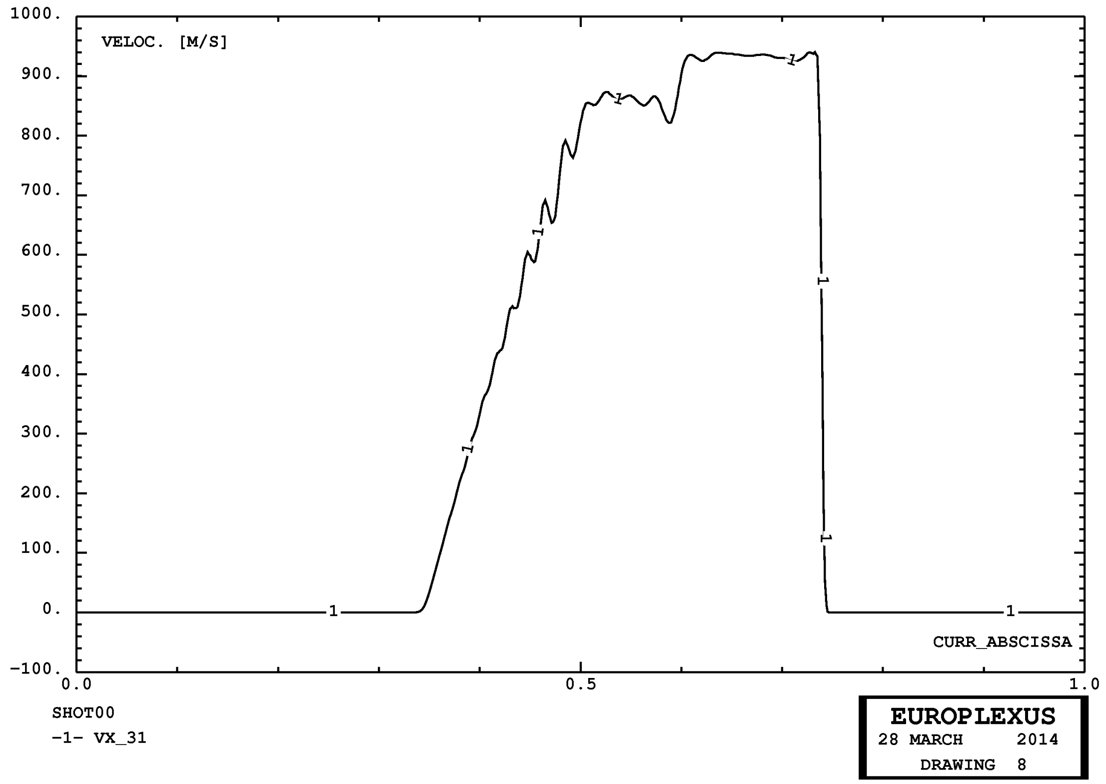


Figure 24 - Velocity in case SHOT00

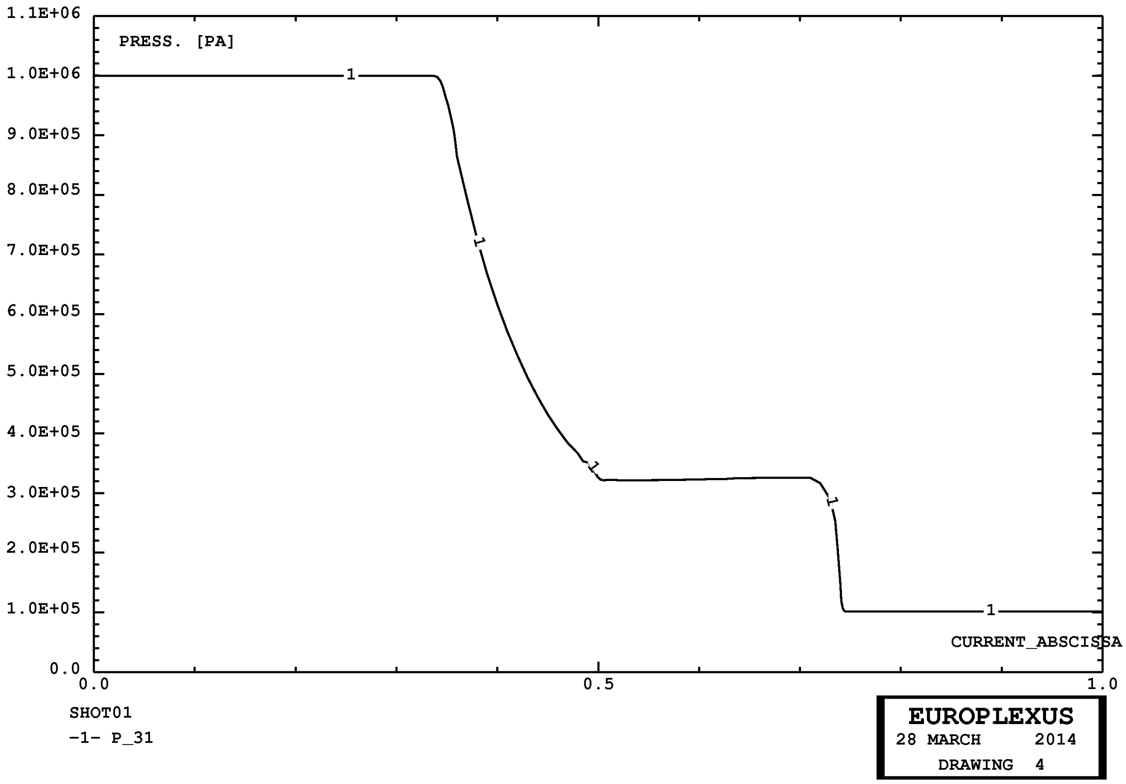


Figure 25 - Pressure in case SHOT01

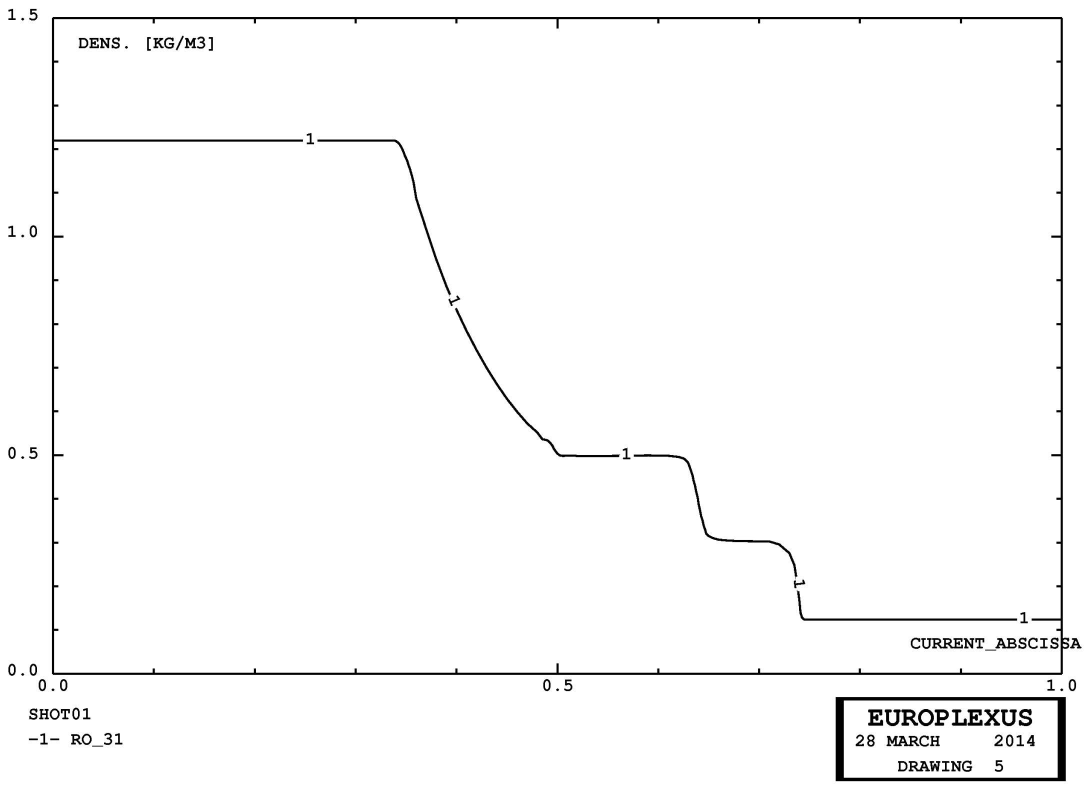


Figure 26 - Density in case SHOT01

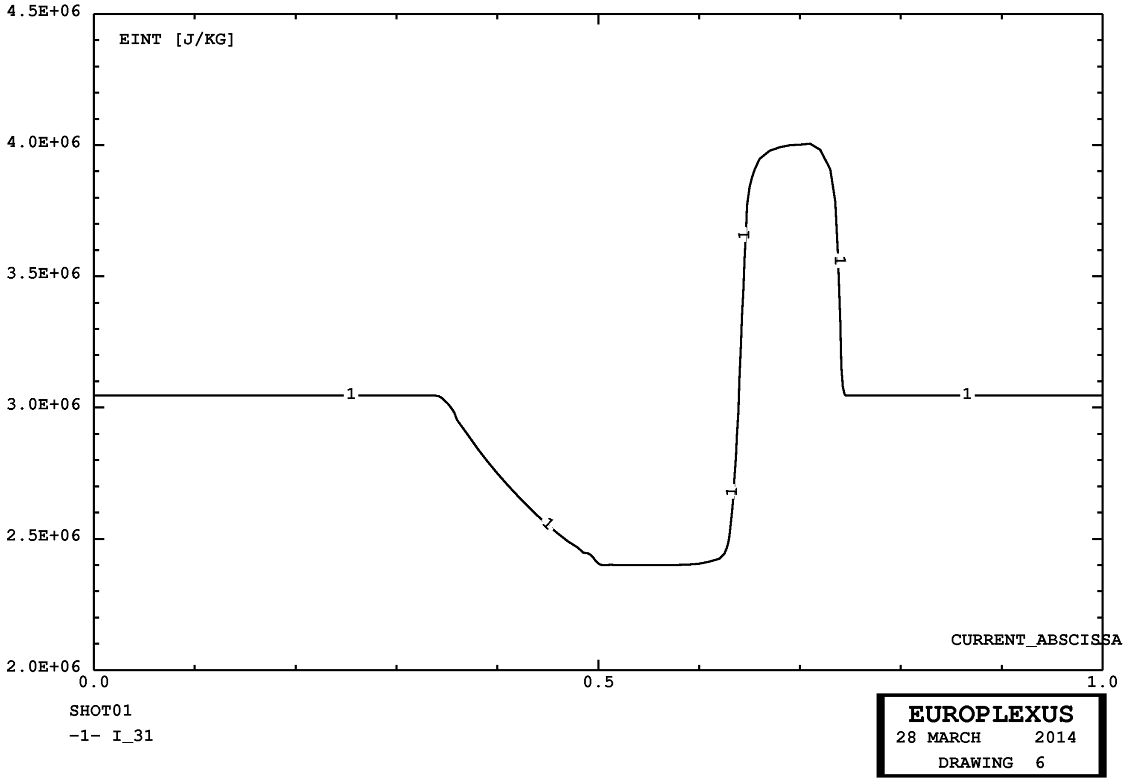


Figure 27 - Specific internal energy in case SHOT01

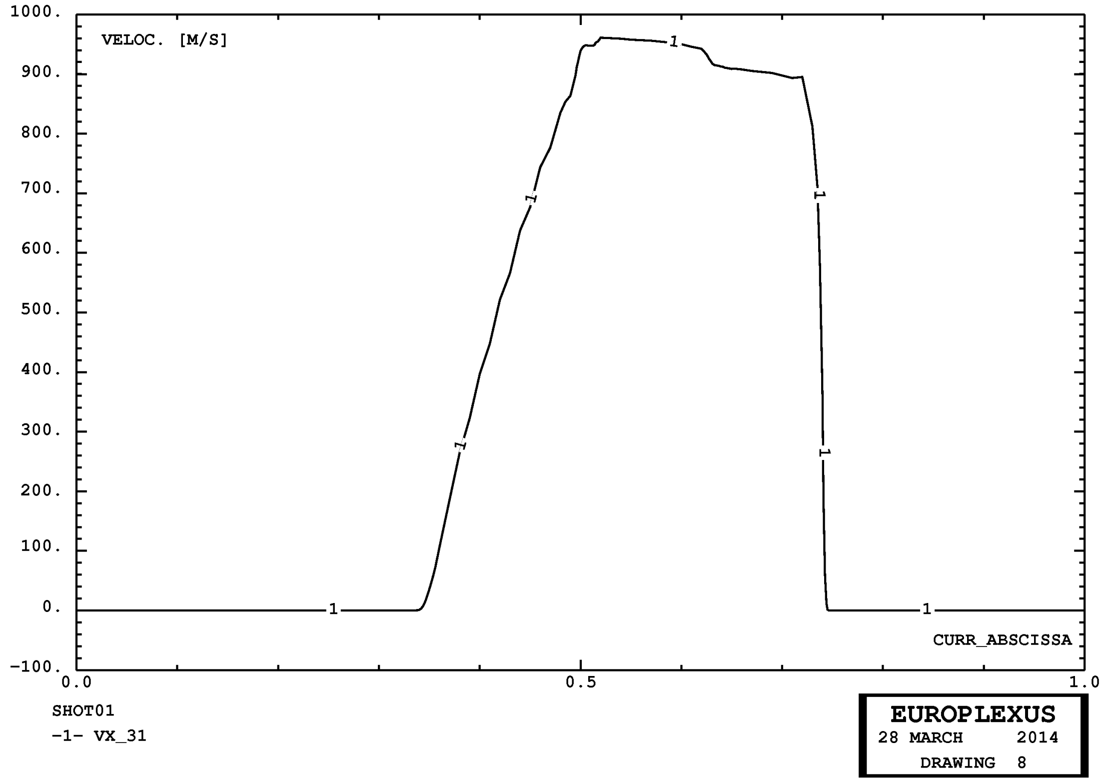


Figure 28 - Velocity in case SHOT01

4.4 Shock tube in 2D with Finite Volumes

The next example is the same shock tube problem considered in Section 4.3, but now solved with the Cell-Centred Finite Volume method, using element T3VF.

First, a reference solution is obtained by means of a fine mesh of (non-adaptive) triangles. Then, an adaptive solution with triangles is obtained. All performed calculations are summarized in Table 4.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
FVTU00	1,600 T3VF	Non-adaptive fine mesh	1,495	3.65	2,393,600
FVTU01	200 T3VF	WAVE 4 PLAN MAXL 4	1,492	4.38	1,876,681

Table 4 - Calculations for the shock tube problem with Finite Volumes

FVTU00

This test uses a fine non-adaptive fluid mesh, of 1,600 triangular fluid volumes T3VF. The solution is shown in Figures 21 (pressure), 22 (density), 23 (specific internal energy) and 24 (velocity), compared with the analytical solution (in red), with which it is in very good agreement. This is taken as a reference for the subsequent adaptive solution.

FVTU01

This solution is adaptive and uses a very coarse base fluid mesh, of just 200 triangular fluid volumes T3VF. The solution is shown in Figures 21 (pressure), 22 (density), 23 (specific internal energy) and 24 (velocity) and is in relatively good agreement with the reference (not shown) and with the analytical solution (in red).

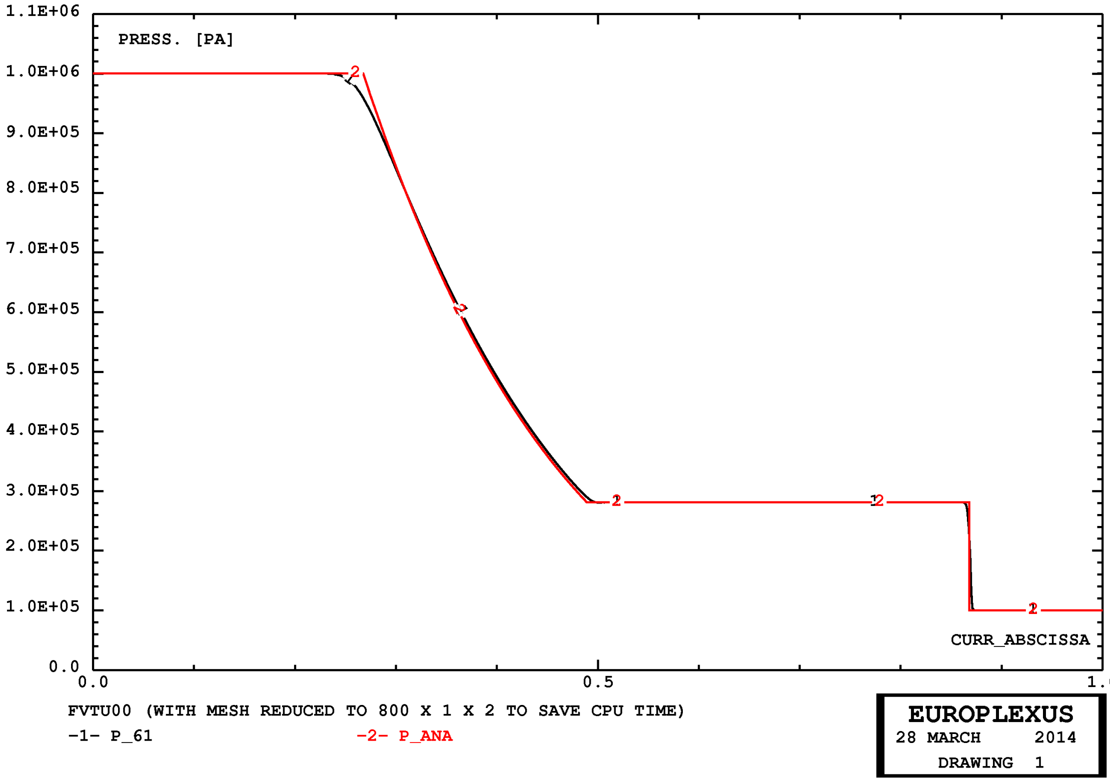


Figure 29 - Pressure in case FVTU00

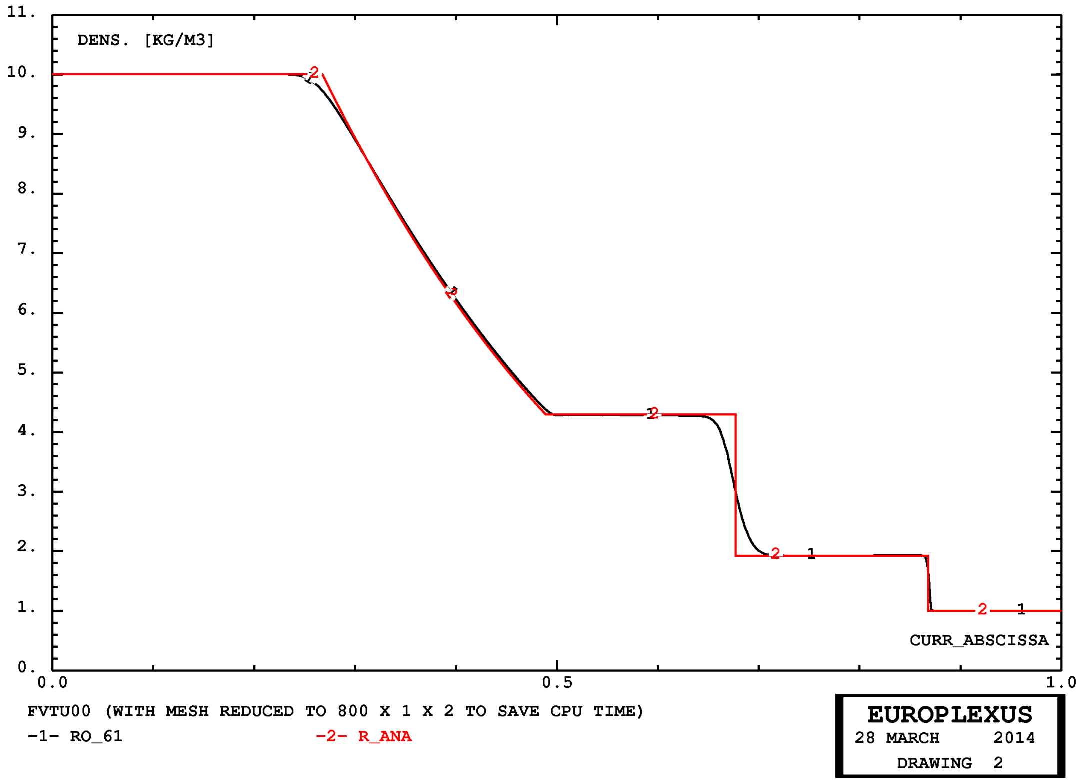


Figure 30 - Density in case FVTU00

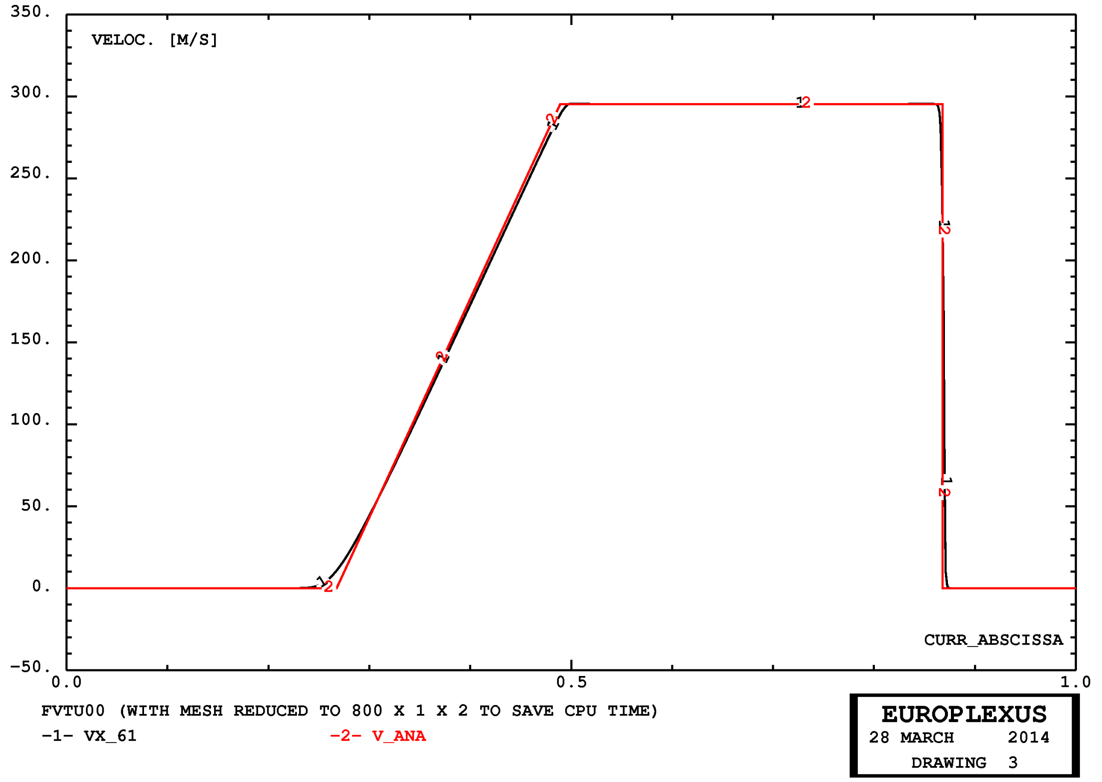


Figure 31 - Velocity in case FVTU00

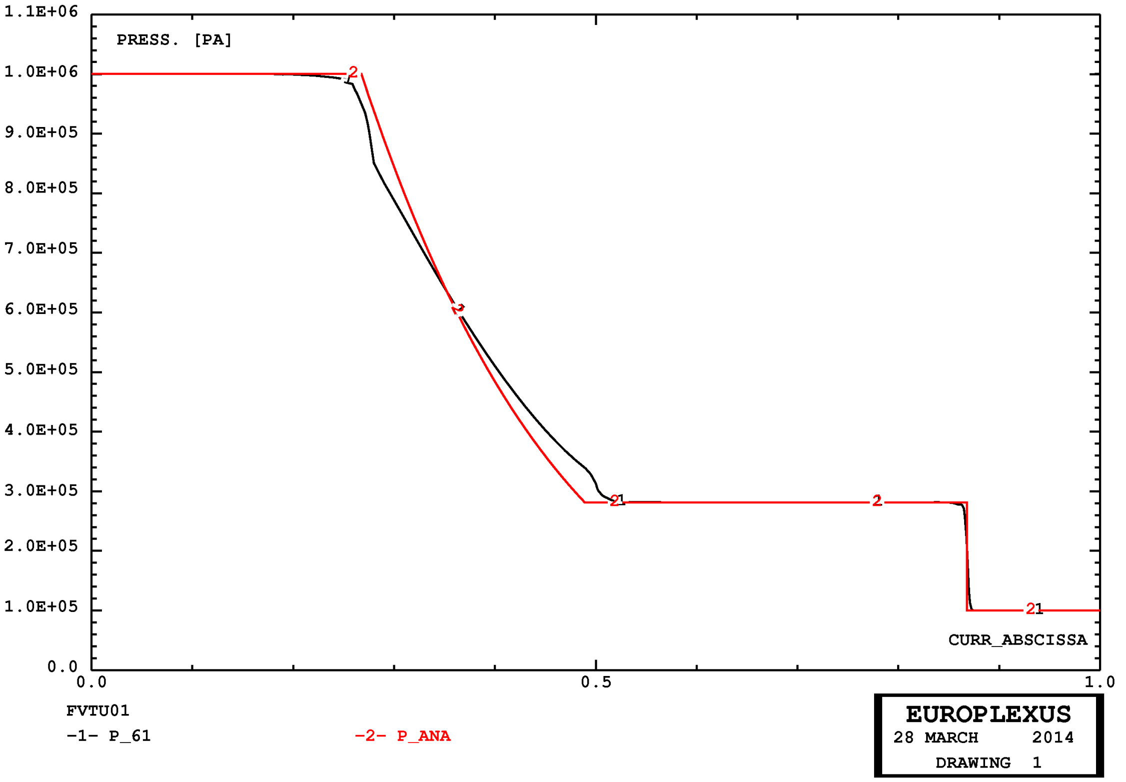


Figure 32 - Pressure in case FVTU01

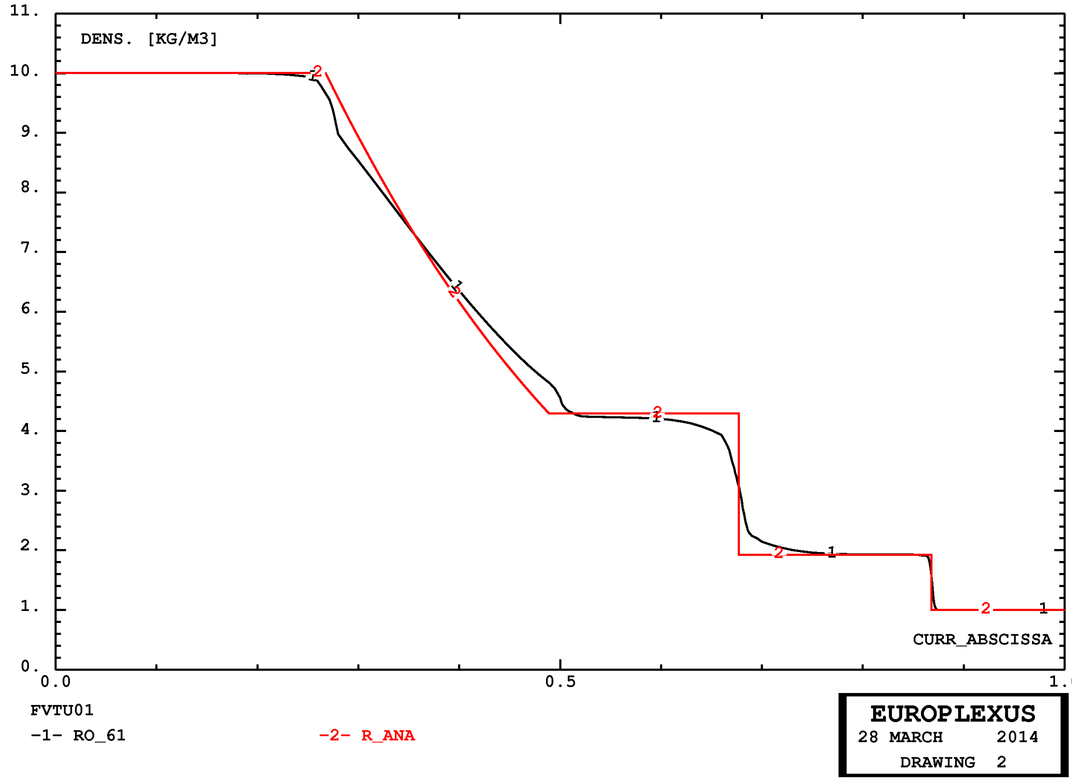


Figure 33 - Density in case FVTU01

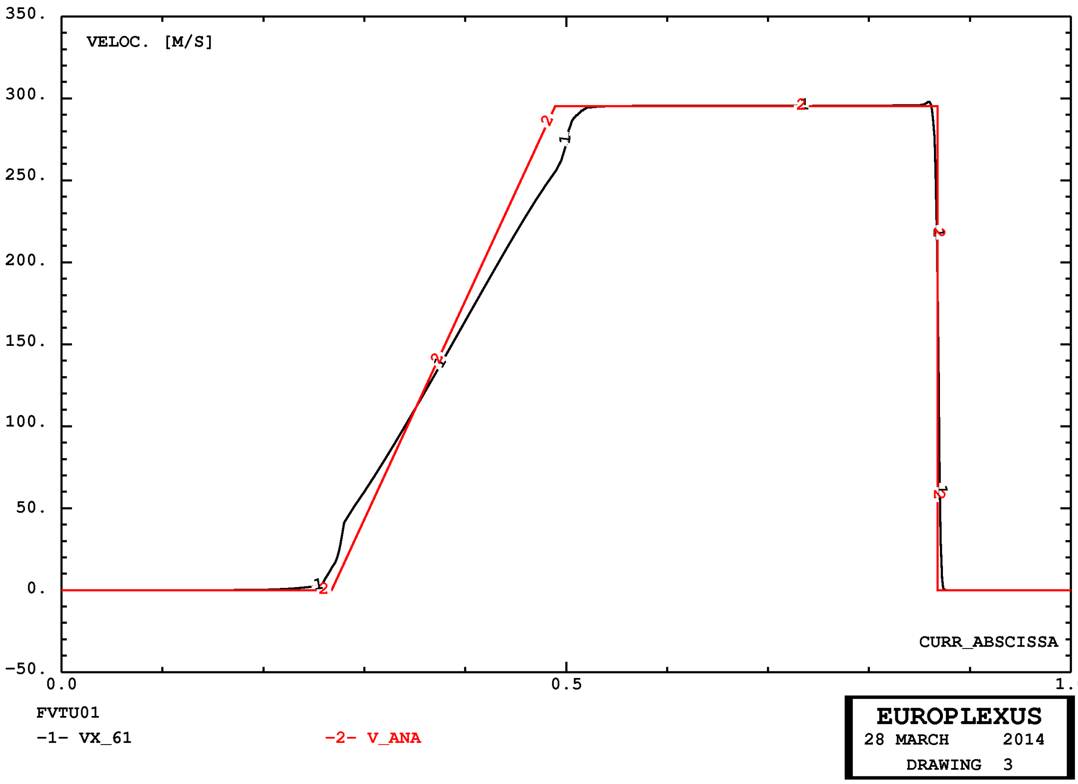


Figure 34 - Velocity in case FVTU01

4.5 Testing CLxx boundary conditions in 2D

The next example verifies the use of natural boundary conditions by means of CLxx elements in 2D. The test is similar to case TWAD11 of reference [1]. A bar of constant cross section is loaded at the left end by an applied pressure, represented by a CL22 element with an IMPE PIMP material. The pressure is constant in time, and generates a stress wave in the bar.

All performed calculations are summarized in Table 5.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
TWAD21	20 TRIA 1 CL22	WAVE 1 PLAN MAXL 4	228	0.8	42,990
TWAD22	40 TRIA 1 CL22	WAVE 1 PLAN MAXL 4	323	1.4	121,002

Table 5 - Calculations for the pressure-loaded bar in 2D

TWAD21

This test uses a very coarse base mesh, of only 20 triangular elements TRIA, obtained by splitting along a diagonal a mesh of 10 regular quadrangles (thus the triangles mesh is not symmetric). The solution is shown in Figures 35 (displacements), 36 (velocity) and 37 (velocities of two symmetric points in time). The two curves in the last Figure should be superposed, but they show a small lack of symmetry instead. This is thought to be due to the fact that the triangular mesh is not symmetric.

TWAD22

This solution identical to the previous one, but uses a symmetric base mesh of 40 triangles, obtained from a uniform mesh of 10 quadrilaterals by subdividing each quadrilateral into four (rather than just two) triangles, by inserting a central node, by means of the Cast3m procedure `pxq42t34.proc`. The solution is shown in Figures 38 (displacements), 39 (velocities) and 40 (velocities of two symmetric points in time) and is now perfectly symmetric.

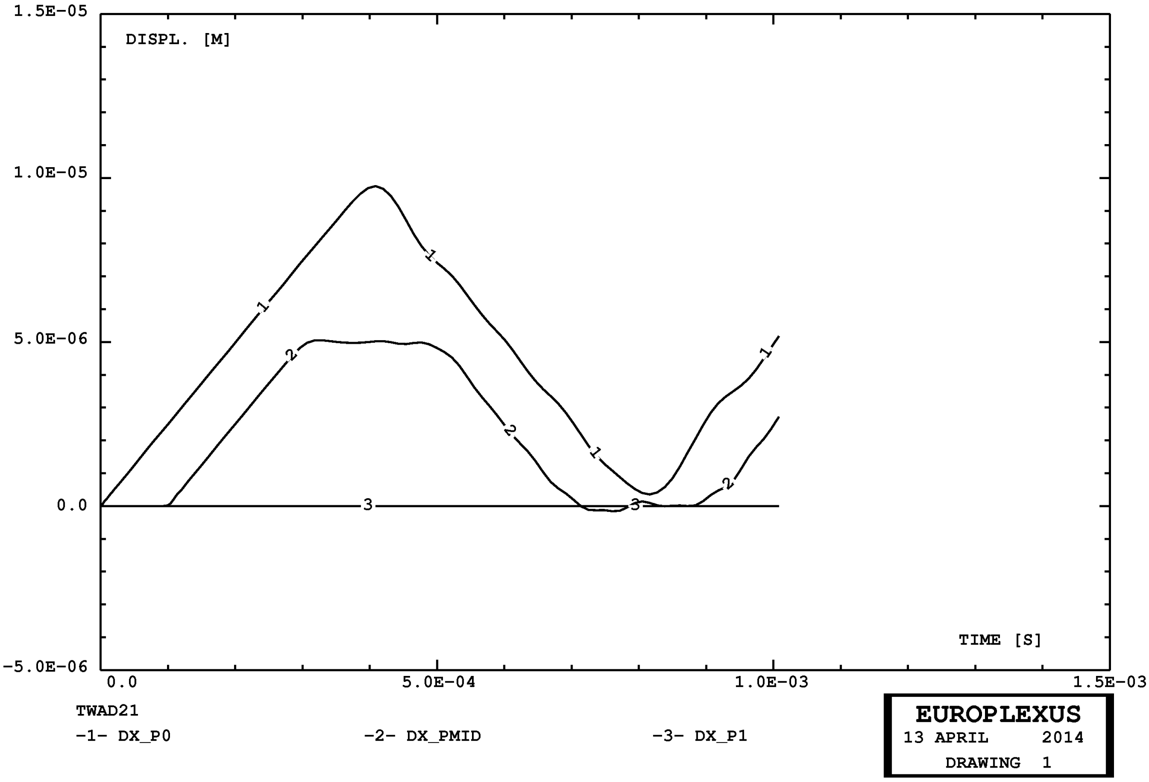


Figure 35 - Displacements in case TWAD21

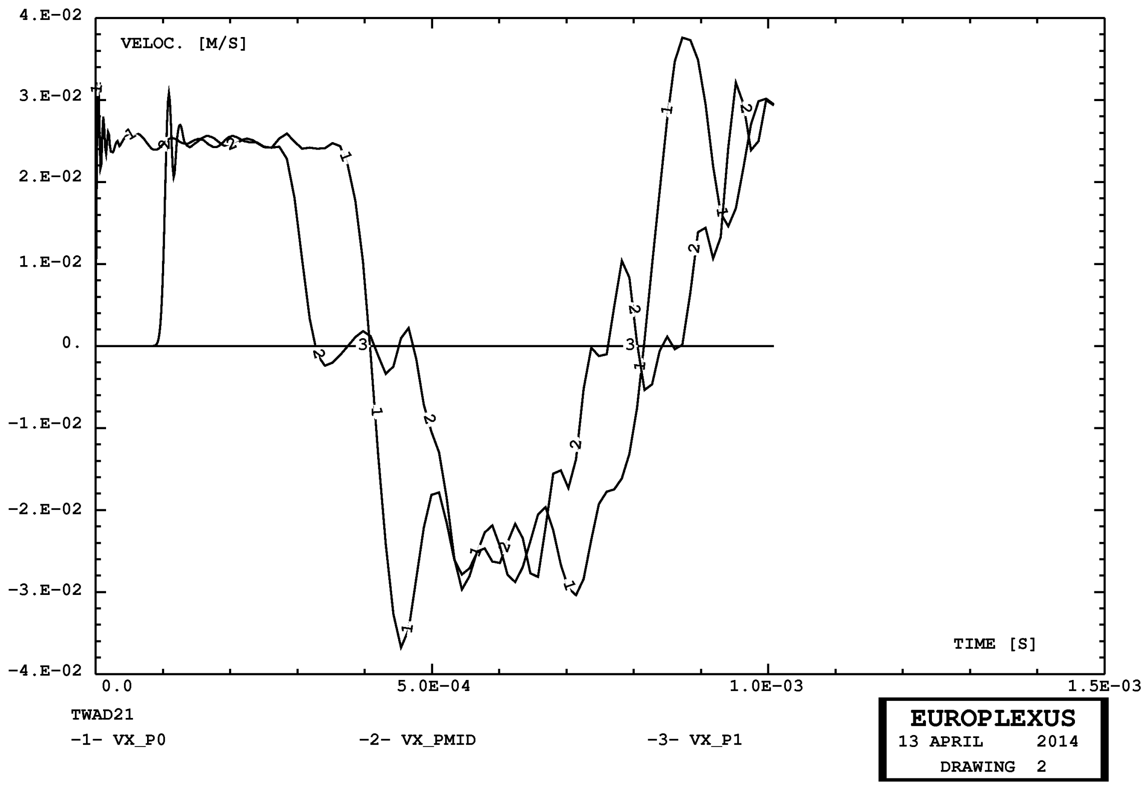


Figure 36 - Velocities in case TWAD21

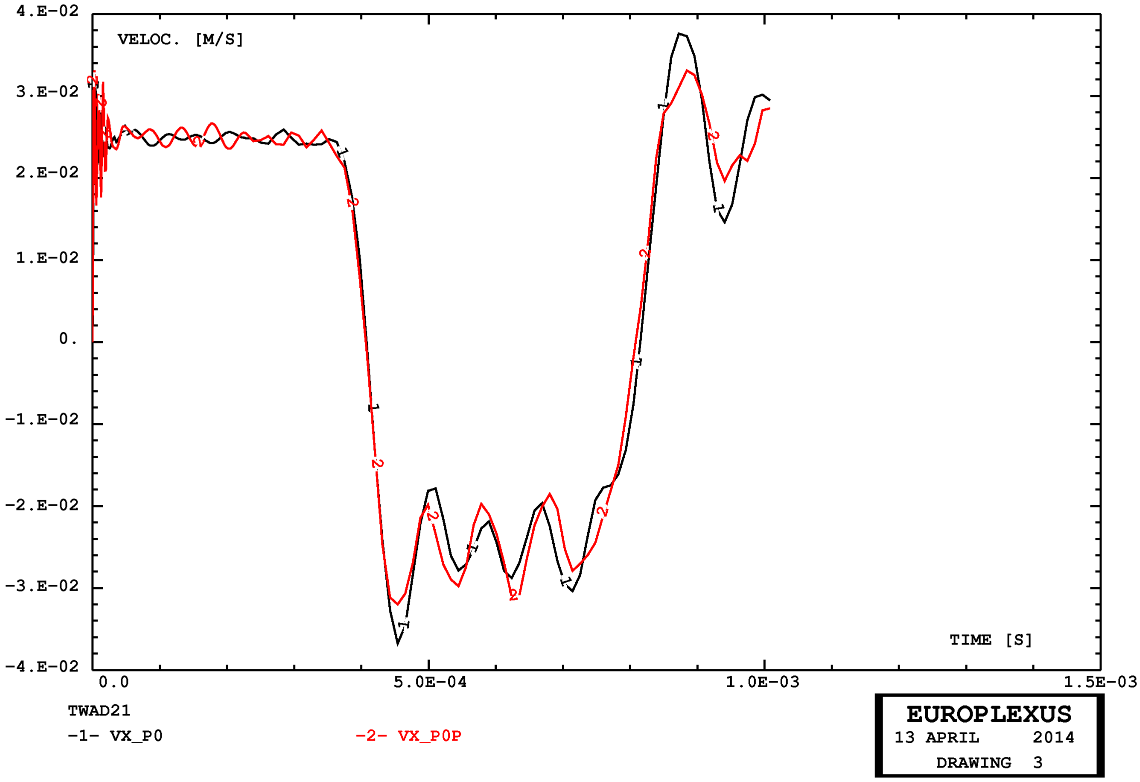


Figure 37 - Velocity of two symmetric points in case TWAD21

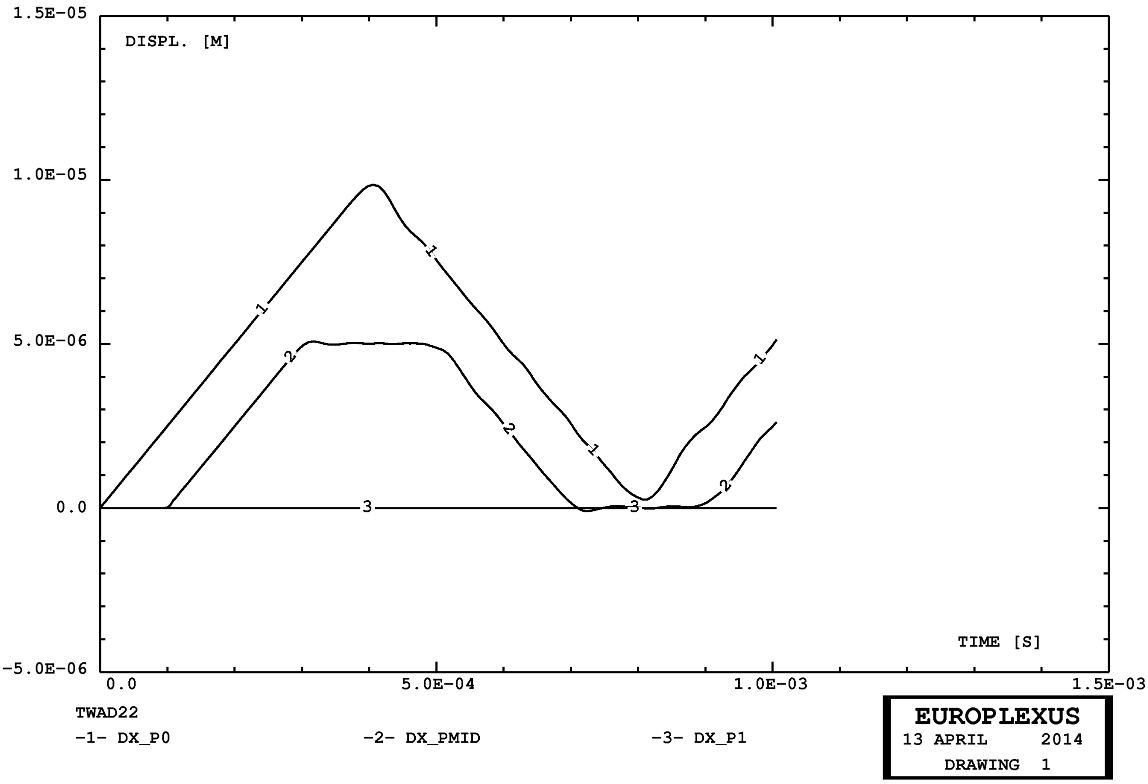


Figure 38 - Displacements in case TWAD22

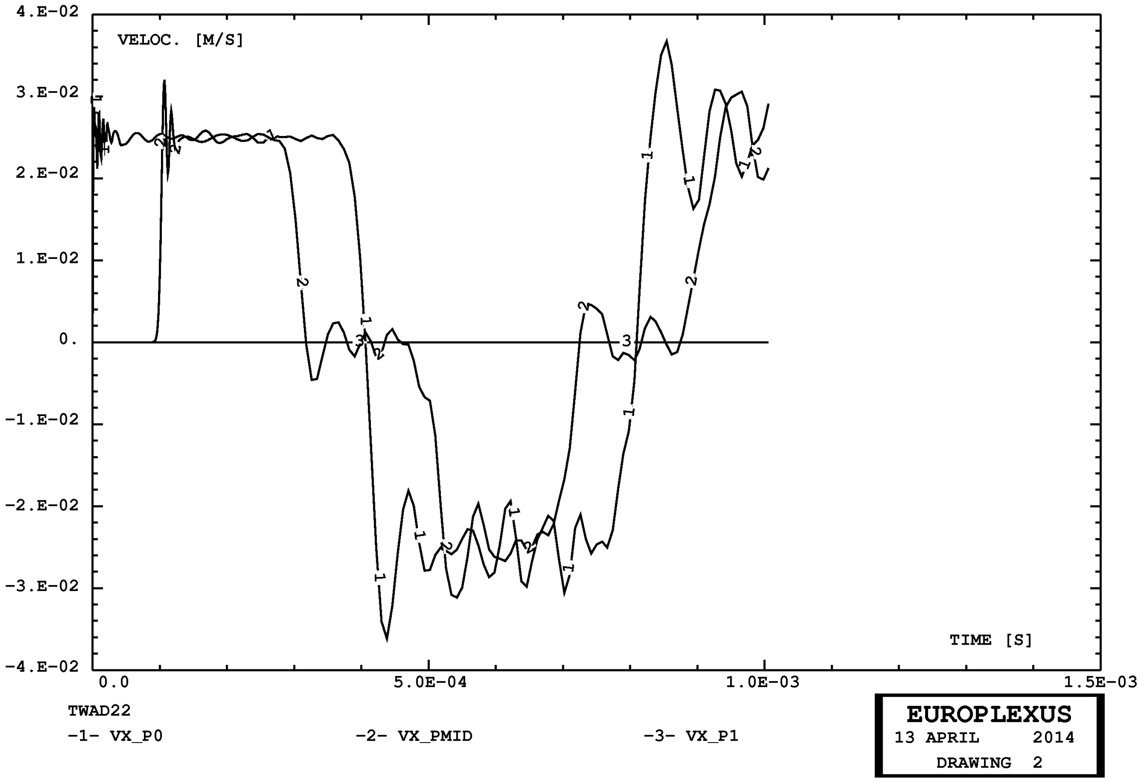


Figure 39 - Velocities in case TWAD22

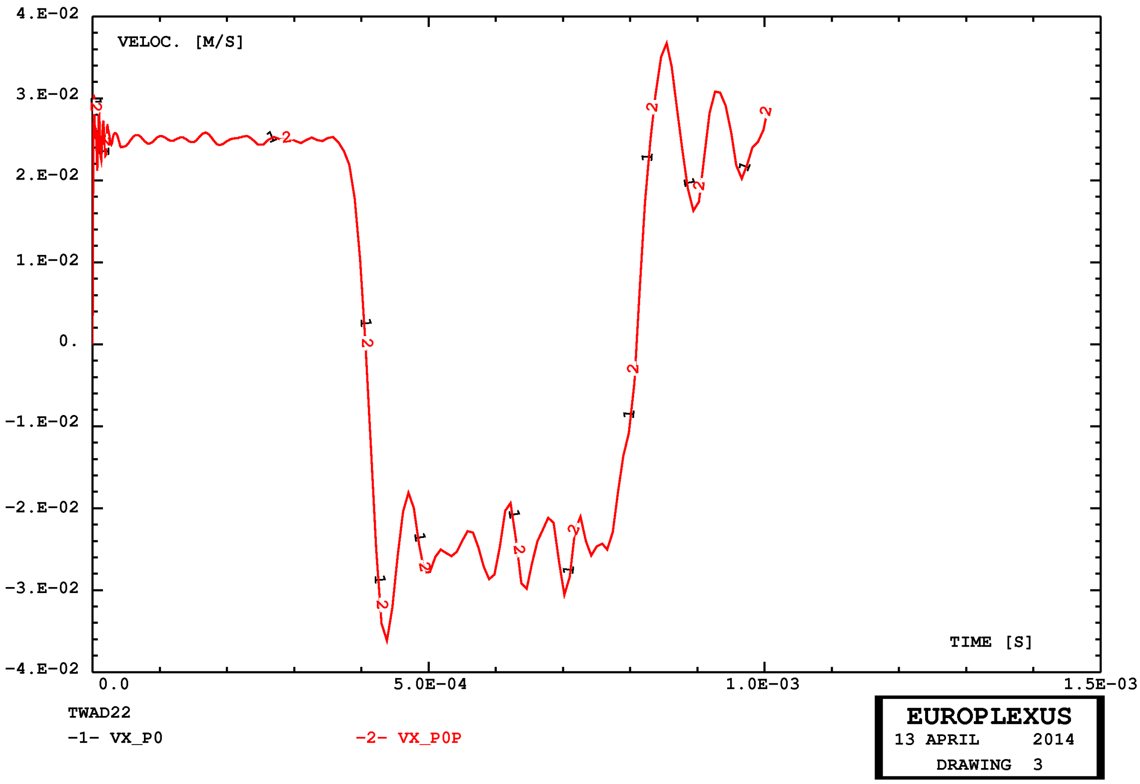


Figure 40 - Velocities of two symmetric points in case TWAD22

4.6 Bar impact in 3D

The first 3D example is that of the impact of an elastic bar on a rigid obstacle. An elastic bar of square unit cross-section and length 100 units impacts at an initial velocity of 100 m/s on a rigid wall. The material is steel-like. The calculation is performed until 40 ms, when rebound of the bar starts.

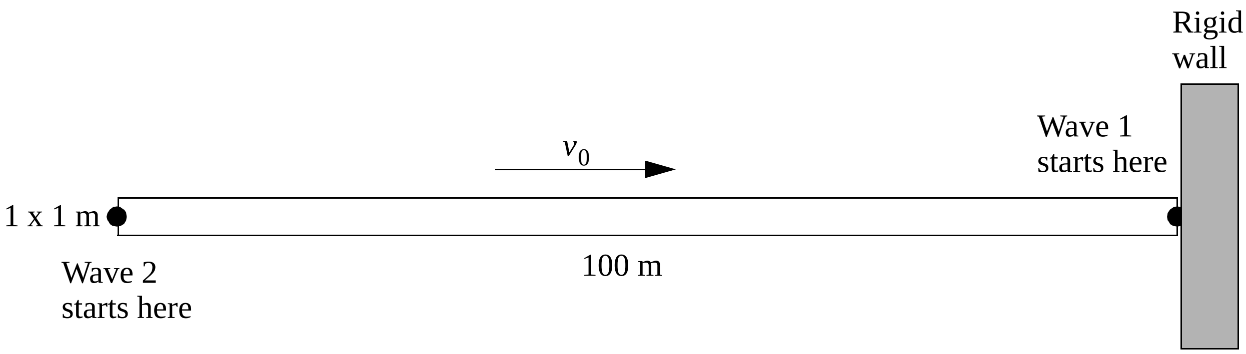


Figure 41 - Definition of the bar impact problem in 3D

First, reference solutions (without and with adaptivity) are obtained by means of hexahedra. Then, equivalent solutions with tetrahedra (without and with adaptivity) are obtained. All performed calculations are summarized in Table 6.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
BICU01	100 CUBE	No adaptivity	293	0.2	29,400
BICU02	100 CUBE	WAVE 2 PLAN MAXL 2	585	0.5	96,463
BICU03	100 CUBE	WAVE 2 PLAN MAXL 3	1,169	2.3	751,634
BITE01	100 TETR	No adaptivity	511	0.6	614,400
BITE02	100 TETR	WAVE 2 PLAN MAXL 2	1,013	4.0	2,003,313
BITE03	100 TETR	WAVE 2 PLAN MAXL 3	2,028	147.6	15,643,835

Table 6 - Calculations for the bar impact problem in 3D

BICU01

This test uses a mesh of just 100 CUBE hexahedral elements. The solutions is considered as a (rough, because of the coarse mesh) reference, since no adaptivity is used. Figure 42 shows the spatial distribution of the velocity every 10 ms.

BICU02

This test is similar to BICU01 but uses adaptivity. Two `WAVE` directives are specified, the first starting at the right end of the bar and at time 0 (incident wave), when impact occurs, the second starting at the left end of the bar at time 20 ms (reflected wave). A maximum refinement level of `MAXL 2` is prescribed (recall that level 1 is the base mesh), so elements are refined just once. Figure 43 shows the spatial distribution of the velocity every 10 ms.

BICU03

This test is similar to BICU02 but uses `MAXL 3`. Figure 44 shows the spatial distribution of the velocity every 10 ms. Figures 45 and 46 compare the three solutions with hexahedra at 10 ms (incident wave) and at 30 ms (reflected wave), respectively. As the mesh is progressively refined, the solution becomes steeper and the oscillations amplitude diminishes.

BITE01

This test uses a mesh of just 100 TETR tetrahedral elements. The solutions is considered as a (rough, because of the coarse mesh) reference, since no adaptivity is used. Figure 47 shows the spatial distribution of the velocity every 10 ms.

BITE02

This test is similar to BITE01 but uses adaptivity. Two `WAVE` directives are specified, the first starting at the right end of the bar and at time 0 (incident wave), when impact occurs, the second starting at the left end of the bar at time 20 ms (reflected wave). A maximum refinement level of `MAXL 2` is prescribed (recall that level 1 is the base mesh), so elements are refined just once. Figure 48 shows the spatial distribution of the velocity every 10 ms.

BITE03

This test is similar to BITE02 but uses `MAXL 3`. Figure 49 shows the spatial distribution of the velocity every 10 ms. Figures 50 and 51 compare the three solutions with tetrahedra at 10 ms (incident wave) and at 30 ms (reflected wave), respectively. As the mesh is progressively refined, the solution becomes steeper and the oscillations amplitude diminishes.

Comparison of solutions with hexahedra and tetrahedra

Finally, Figures 52 and 53 compare all six solutions (three with hexahedra and three with tetrahedra) at 10 ms (incident wave) and at 30 ms (reflected wave), respectively. Very good agreement is observed.

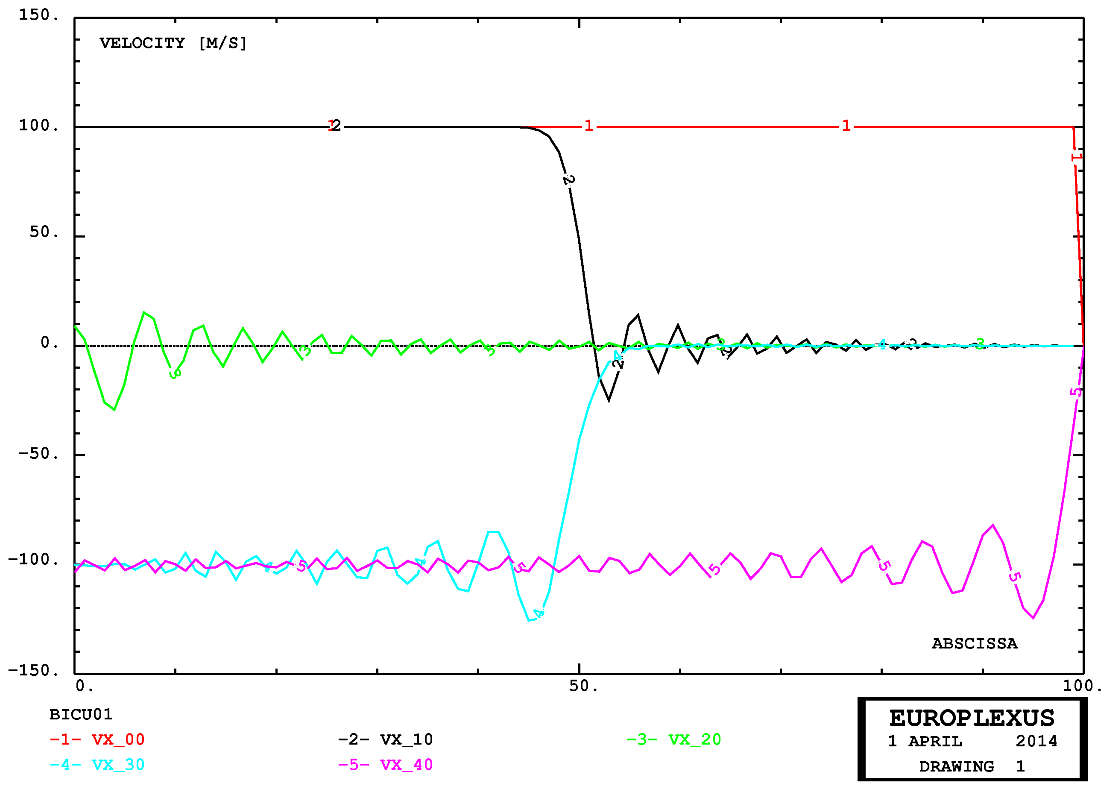


Figure 42 - Spatial distribution of the velocity every 10 ms in case BICU01

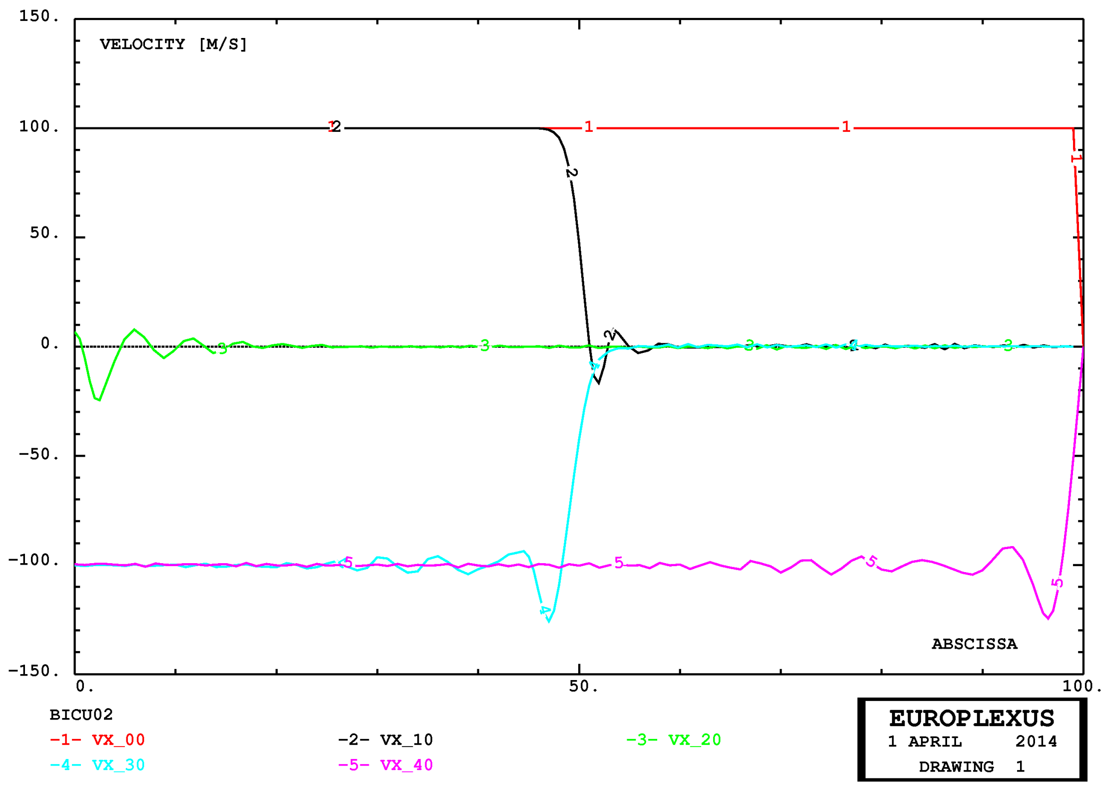


Figure 43 - Spatial distribution of the velocity every 10 ms in case BICU02

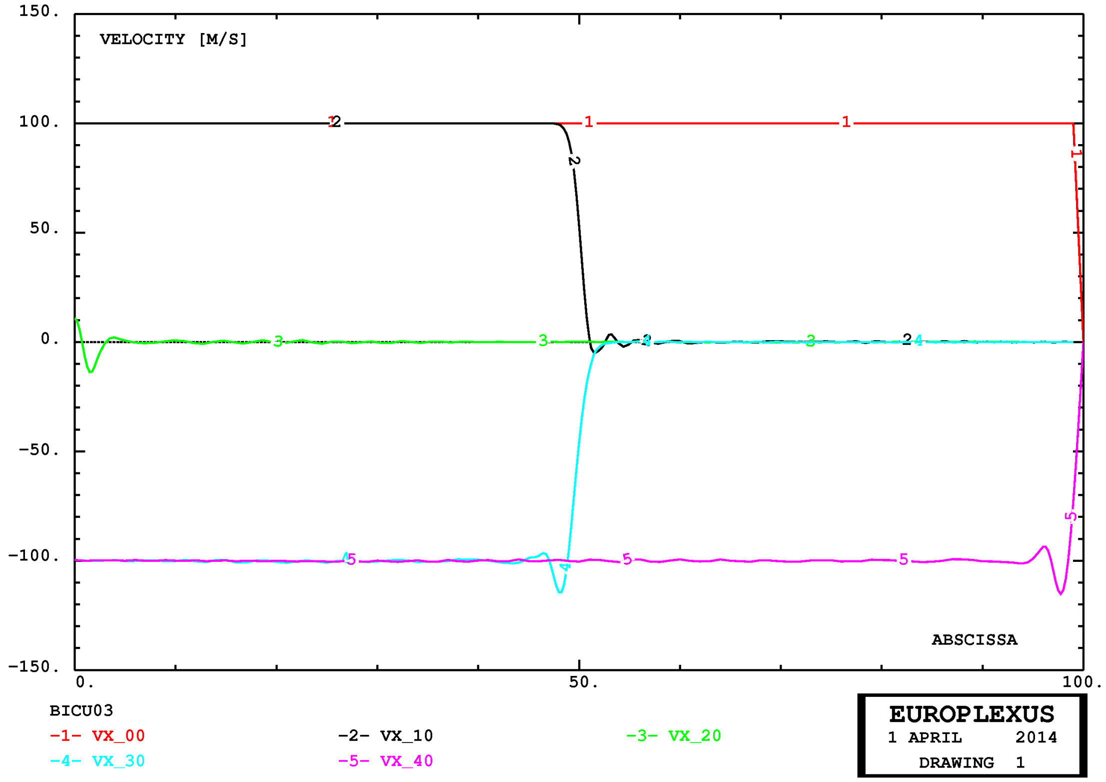


Figure 44 - Spatial distribution of the velocity every 10 ms in case BICU03

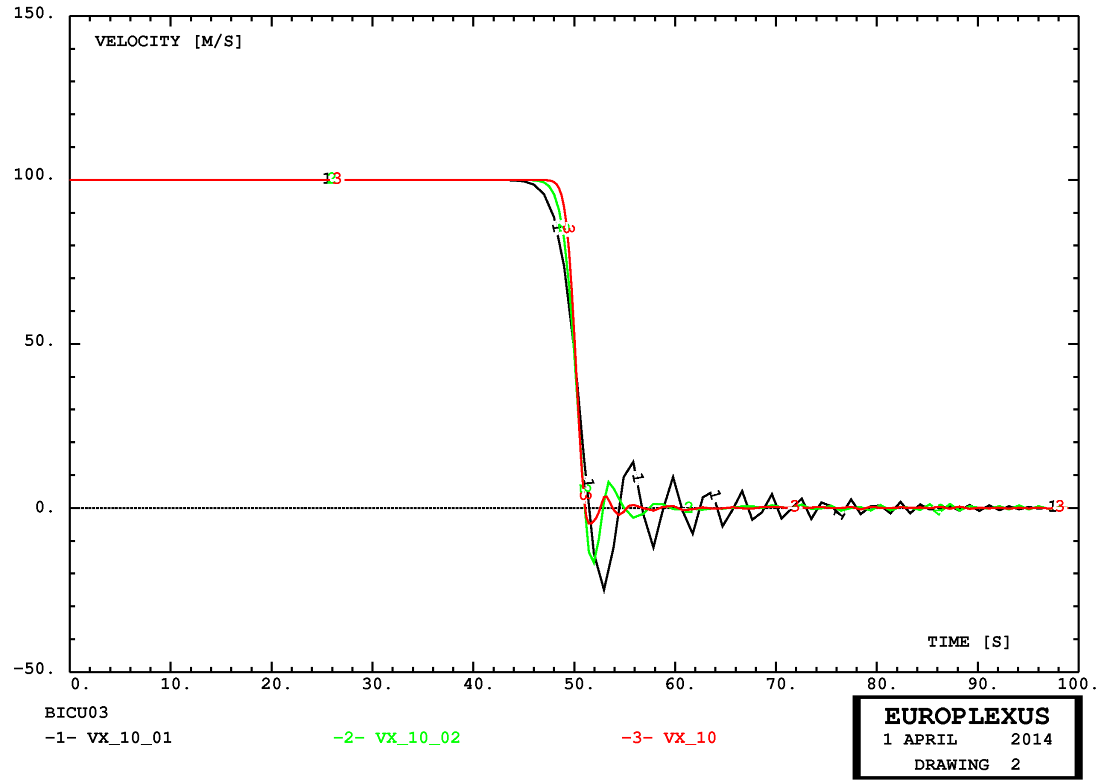


Figure 45 - Comparison of three solutions at 10 ms (incident wave) with hexahedra

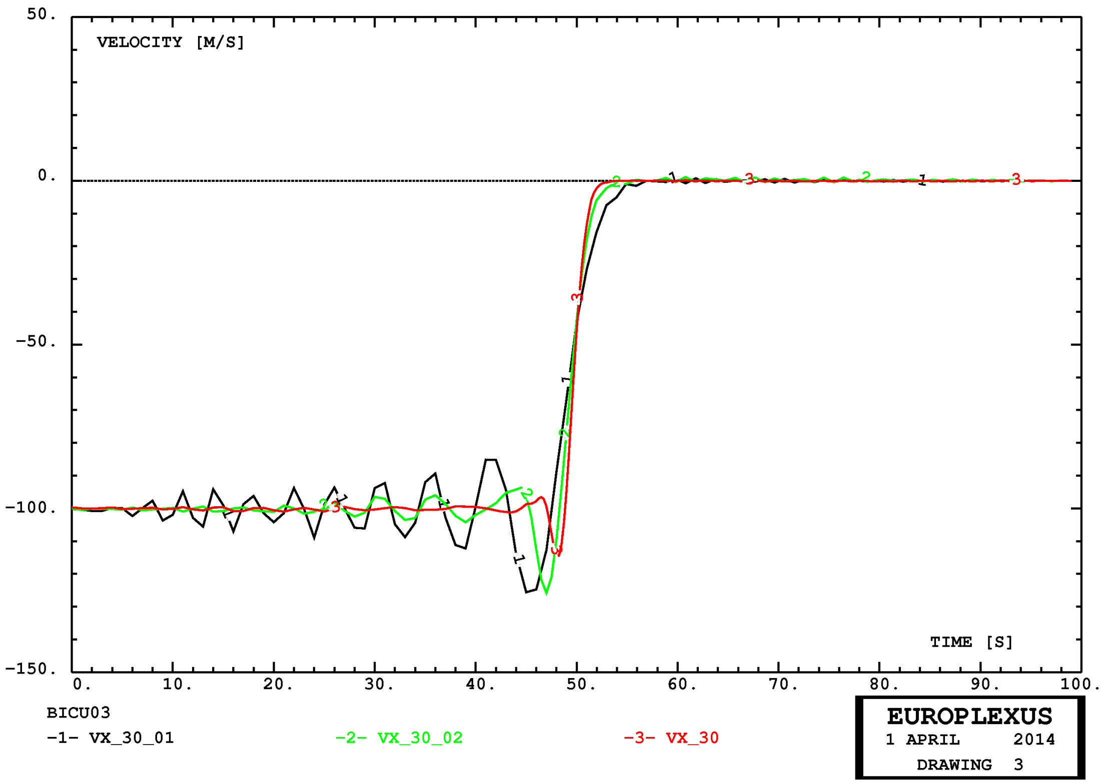


Figure 46 - Comparison of three solutions at 30 ms (reflected wave) with hexahedra

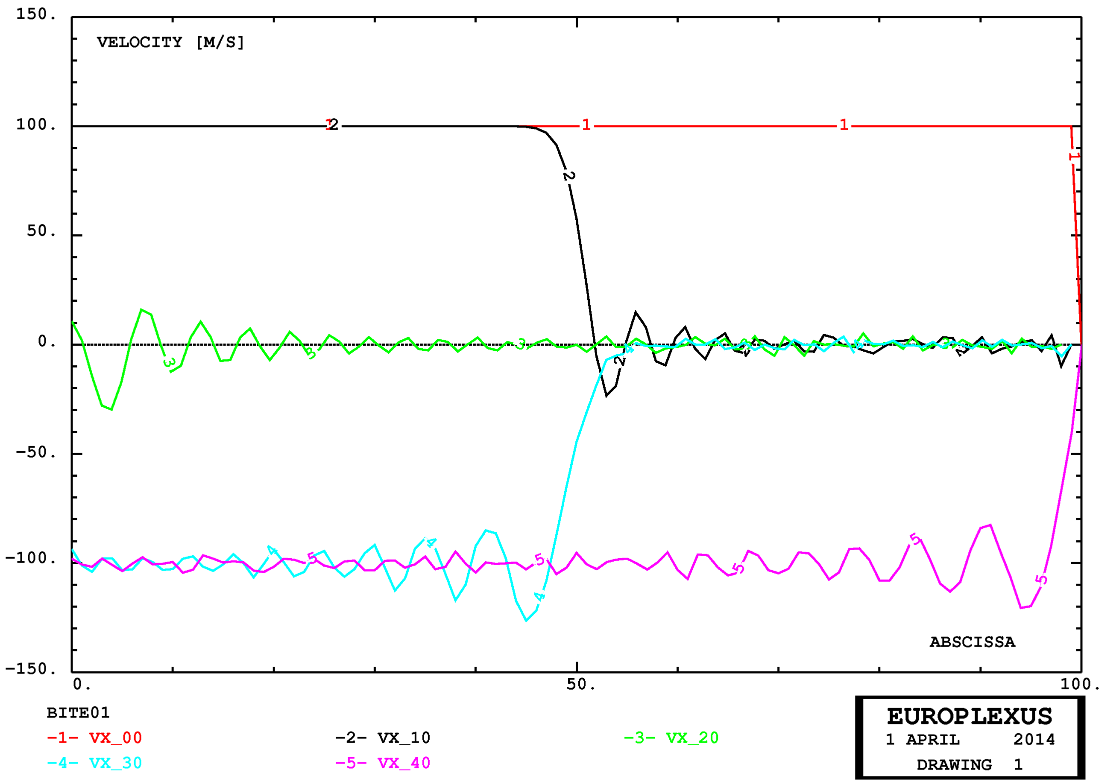


Figure 47 - Spatial distribution of the velocity every 10 ms in case BITE01

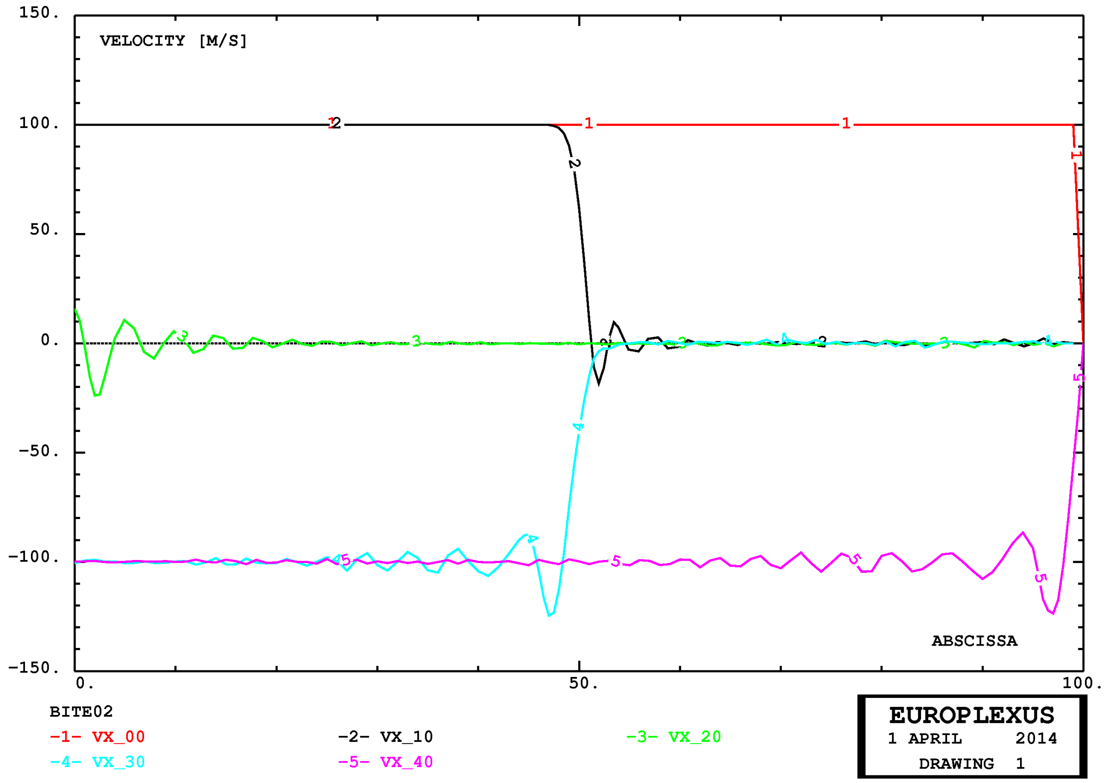


Figure 48 - Spatial distribution of the velocity every 10 ms in case BITE02

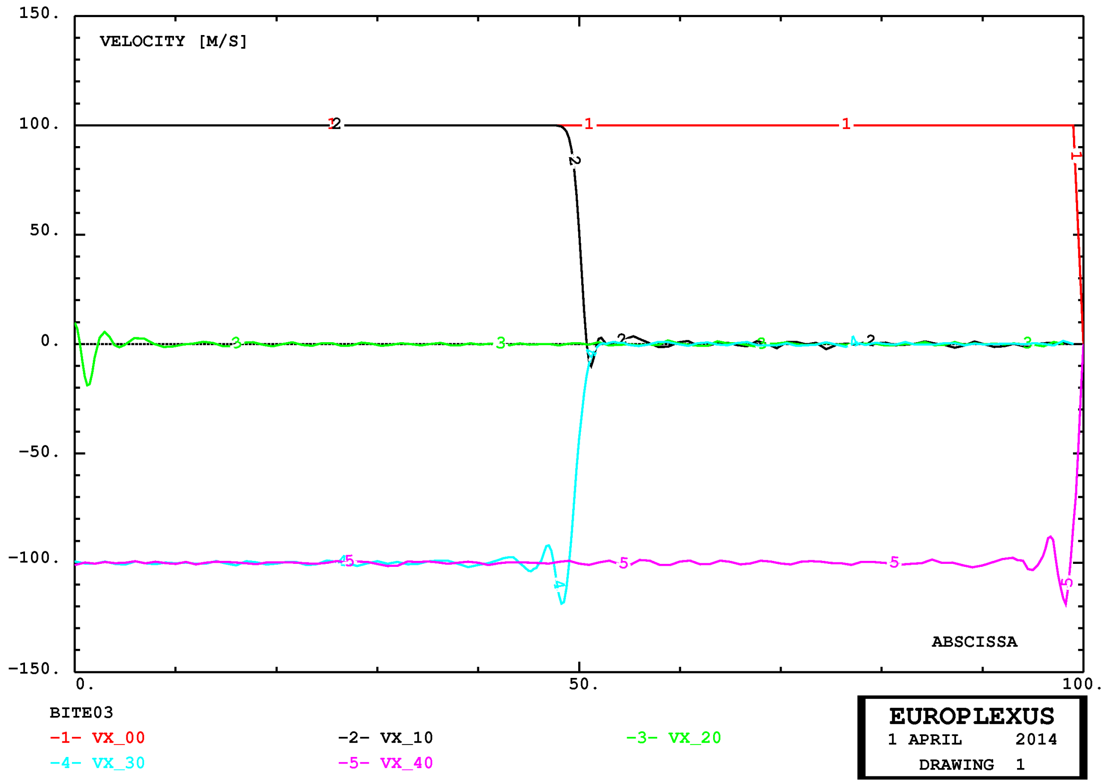


Figure 49 - Spatial distribution of the velocity every 10 ms in case BITE03

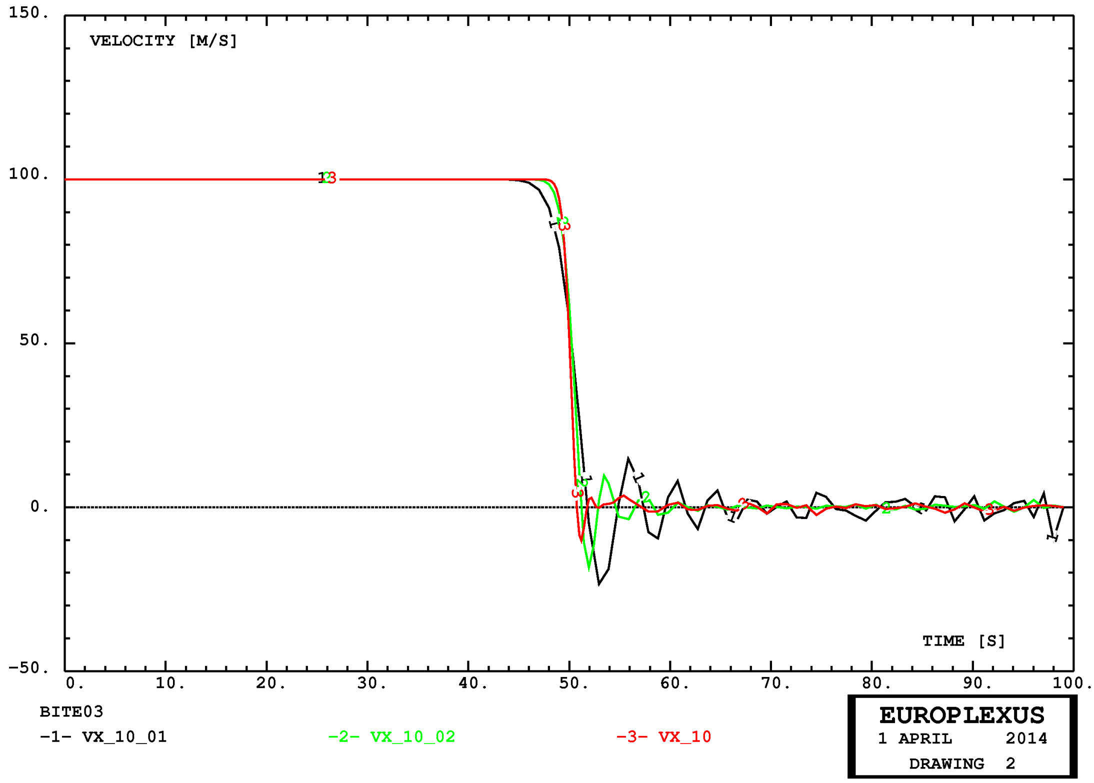


Figure 50 - Comparison of three solutions at 10 ms (incident wave) with tetrahedra

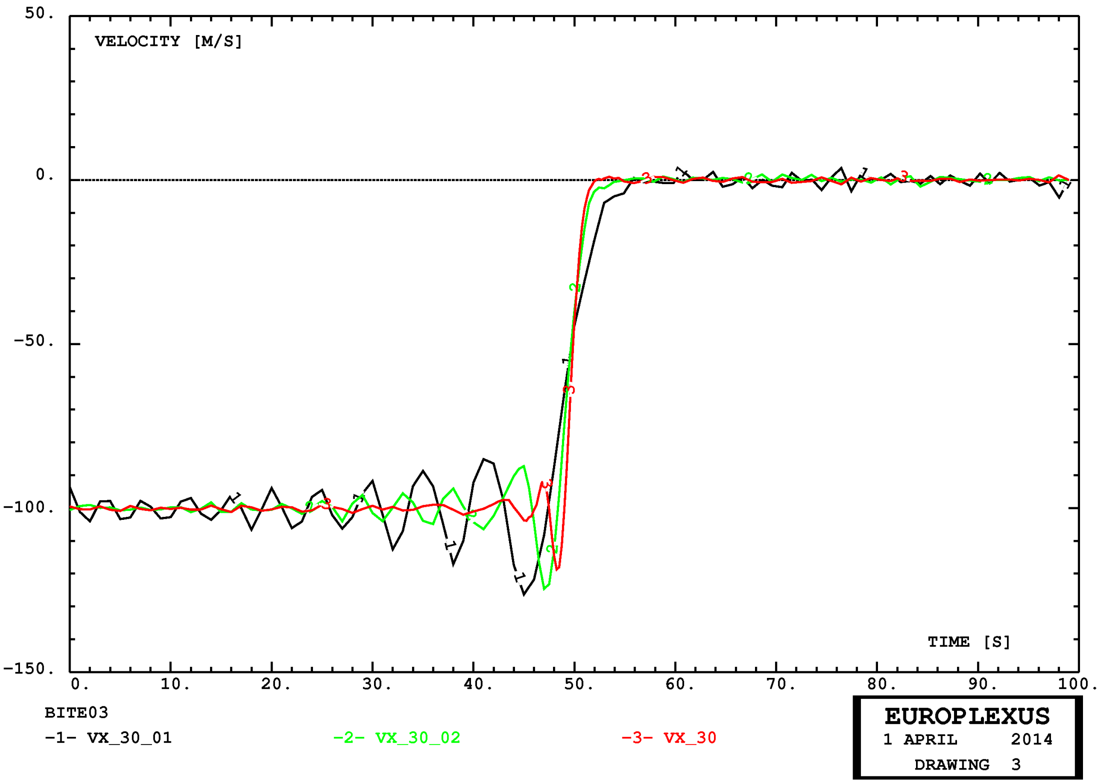


Figure 51 - Comparison of three solutions at 30 ms (reflected wave) with tetrahedra

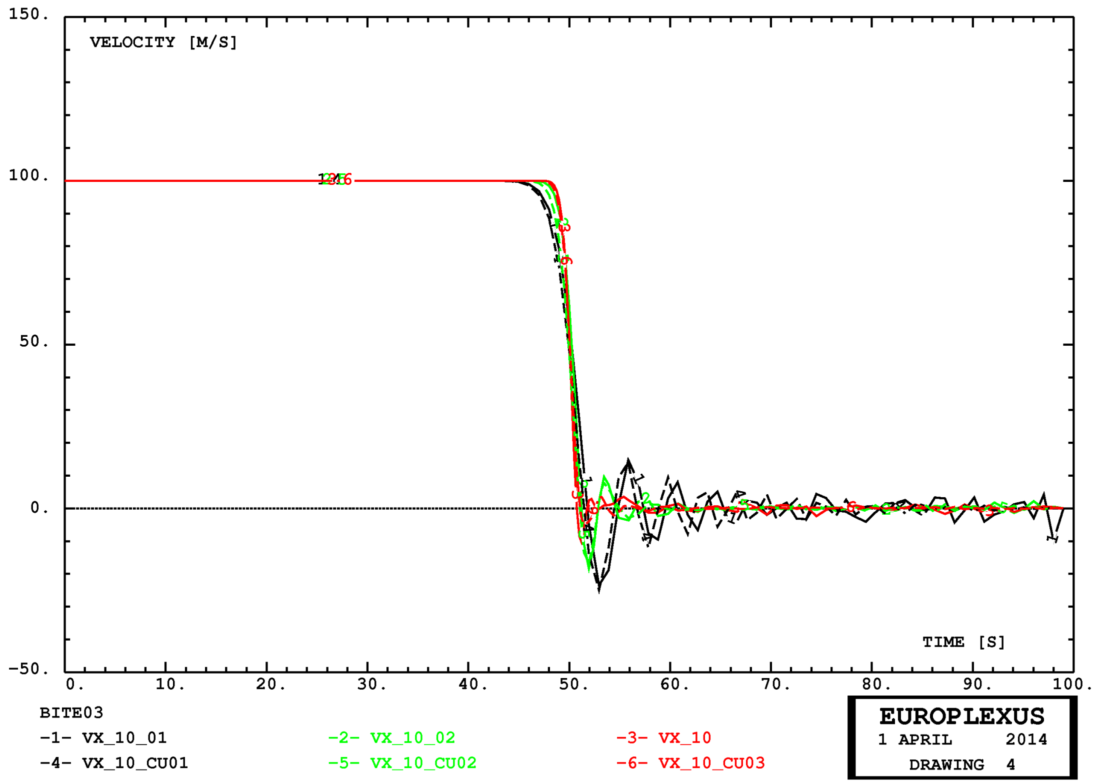


Figure 52 - Comparison of all six solutions at 10 ms (incident wave)

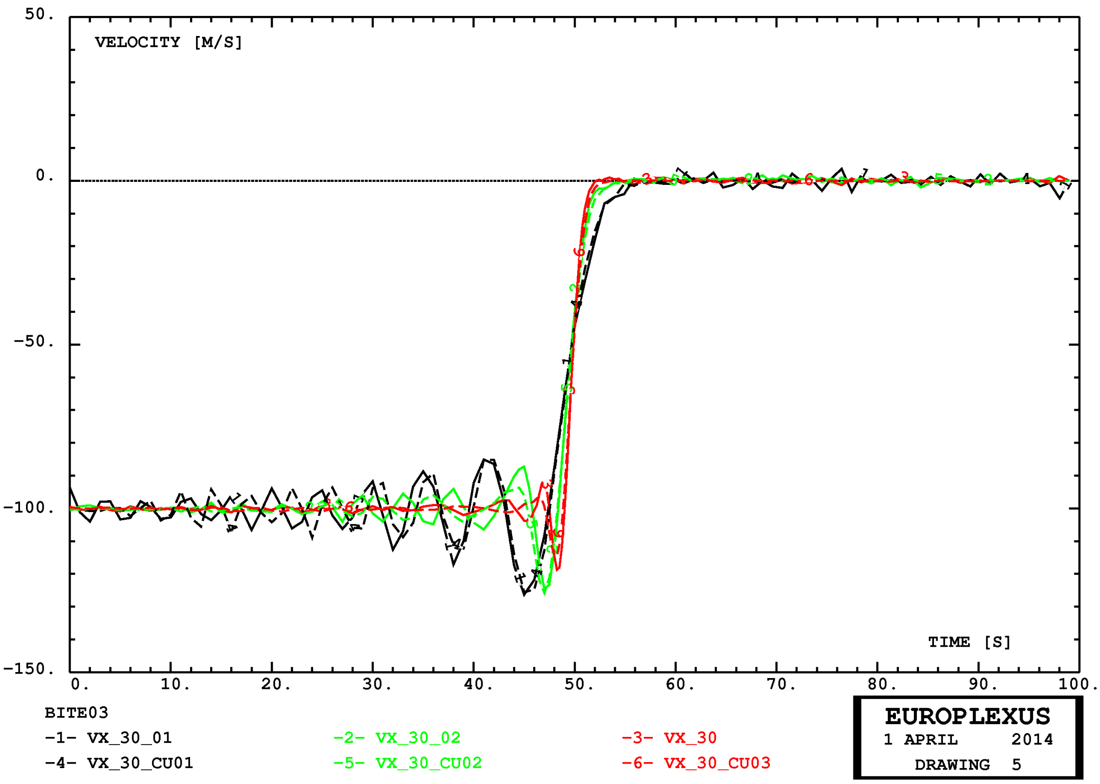


Figure 53 - Comparison of all six solutions at 30 ms (reflected wave)

4.7 Shock tube in 3D with Finite Elements

The next example is a classical shock tube, similar to those considered in reference [3]. The adaptive mesh refinement is once again piloted by the `WAVE` directive.

Two versions of the FL34 element (JRC's 4-node fluid tetrahedron) are available in the code. The old version (before 2007) can be selected by specifying the `OPTI OF34` option, but its use is discouraged and is retained only to repeat some old tests. The new version (after 2007) is now by default (or can be chosen explicitly by the `OPTI NF34` option). Only the new version of the element can be subjected to adaptivity.

The FL34 faces had a different numbering from those of TETR and TEVF, prior to the present work: faces 2 and 4 were interchanged. In order to simplify programming, the face numbering of FL34 has been changed and made identical to that of TETR and TEVF.

First, a reference solution is obtained by means of a fine mesh of (non-adaptive) tetrahedra. Then, an adaptive solution with tetrahedra is obtained. All performed calculations are summarized in Table 7.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
TES411	1,200 FL34	Non-adaptive mesh ALF0 0.5 BET0 0.2	522	1.3	627,600
TES412	1,200 FL34	Non-adaptive mesh ALF0 1 BET0 1	500	1.1	601,200
TES413	1,200 FL34	WAVE 4 PLAN MAXL 2 ALF0 1 BET0 1	1,473	8.3	2,907,070
TES418	1,200 FL34	WAVE 4 PLAN MAXL 2 ALF0 0.5 BET0 0.2	[475] [.15 ms]	[2.7]	[908,768]

Table 7 - Calculations for the shock tube problem in 3D with Finite Elements

TES411

This test uses a relatively fine non-adaptive fluid mesh, of $100 \times 12 = 1200$ tetrahedral fluid elements FL34, obtained from a uniform mesh of 100 hexahedra, each of which is split into 12 tetrahedra by the `pxhex2te.proc` procedure in Cast3m. The upwinding parameters are chosen as follows: ALF0 0.5 BET0 0.2, leading to a reasonably sharp solution with few oscillations. The solution is shown in Figures 54 (pressure), 55 (density) and 56 (velocity). The solution is not very precise, as can be seen by the comparison with the analytical curves. Better agreement can be obtained by even smaller values of the upwinding, and by using also a smaller artificial viscosity. The solution with tetrahedra seems to be very sensitive to all these parameters, even more than solutions with other element types.

TES412

This solution is identical to case TES411 but uses ALF0 1 BET0 1 in order to get a smoother solution. The result is indeed quite smooth, but not in good agreement with the analytical solution, see Figures 57, 58 and 59.

TES413

This solution is identical to case TES412 but uses adaptivity (four WAVE directives like in previous examples) with MAXL 2 (just one level of mesh refinement). The result is stable but very poor, see Figures 60, 61 and 62. This cannot be considered a satisfactory solution. The problem should be investigated. Maybe there is already a problem in the basic (non-adaptive) FL34 element, which becomes worse when adaptivity is applied.

TES418

This solution is an adaptive solution like in case TES413 but with the upwind parameters of case TES411. The solution is unstable. High velocities build up and the calculation stops after 0.14 ms instead of the final 0.6 ms.

The above solutions are potentially non-symmetric because of the subdivision of hexahedra into 12 tetrahedra to generate the base mesh (procedure `pxhex2te.proc`). In order to check this aspect, an alternative procedure `pxhex2t2.proc` has been written that splits each hexahedron into 24 tetrahedra, by adding not only a central node into the element volume, but also a central node in each element face, thus resulting into a symmetric base mesh. However, solutions with this mesh (not presented here for brevity) have shown the same instability problems as the ones with the unsymmetrical mesh.

As a result of these tests, the use of FL34 in adaptivity is not advisable until problems will have been solved. It is much better to use the VFCC element TEVF, which seems to give very good results both without and with adaptivity.

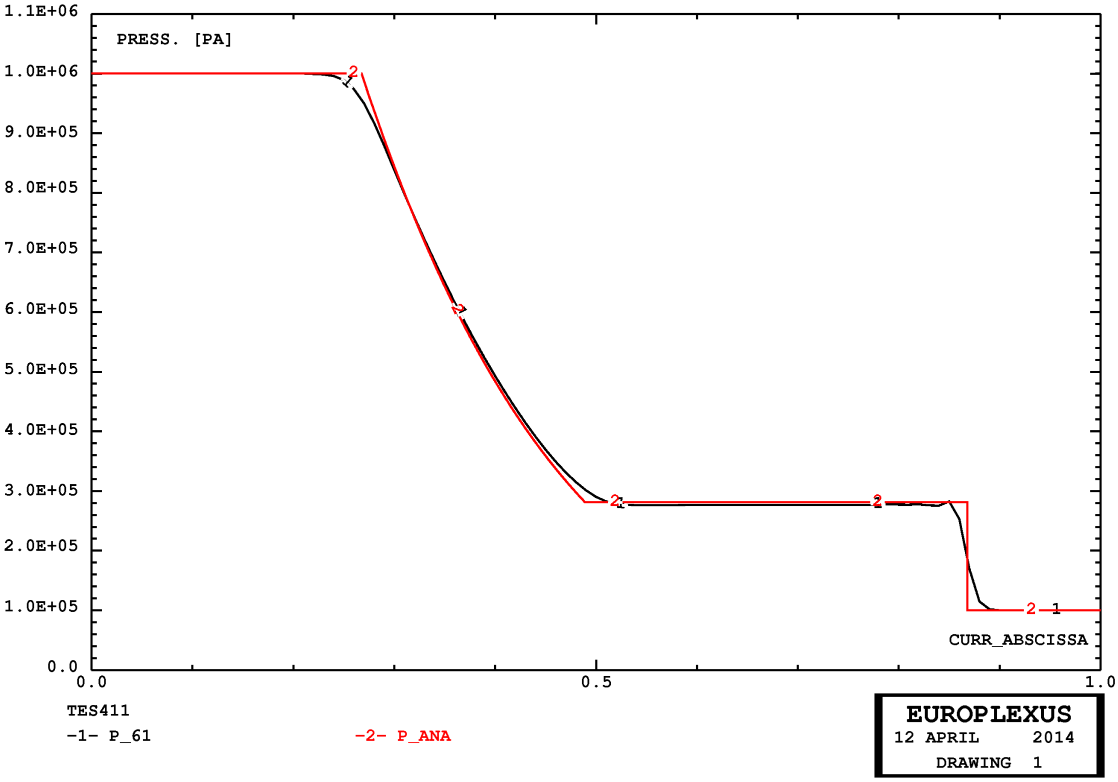


Figure 54 - Pressure in case TES411

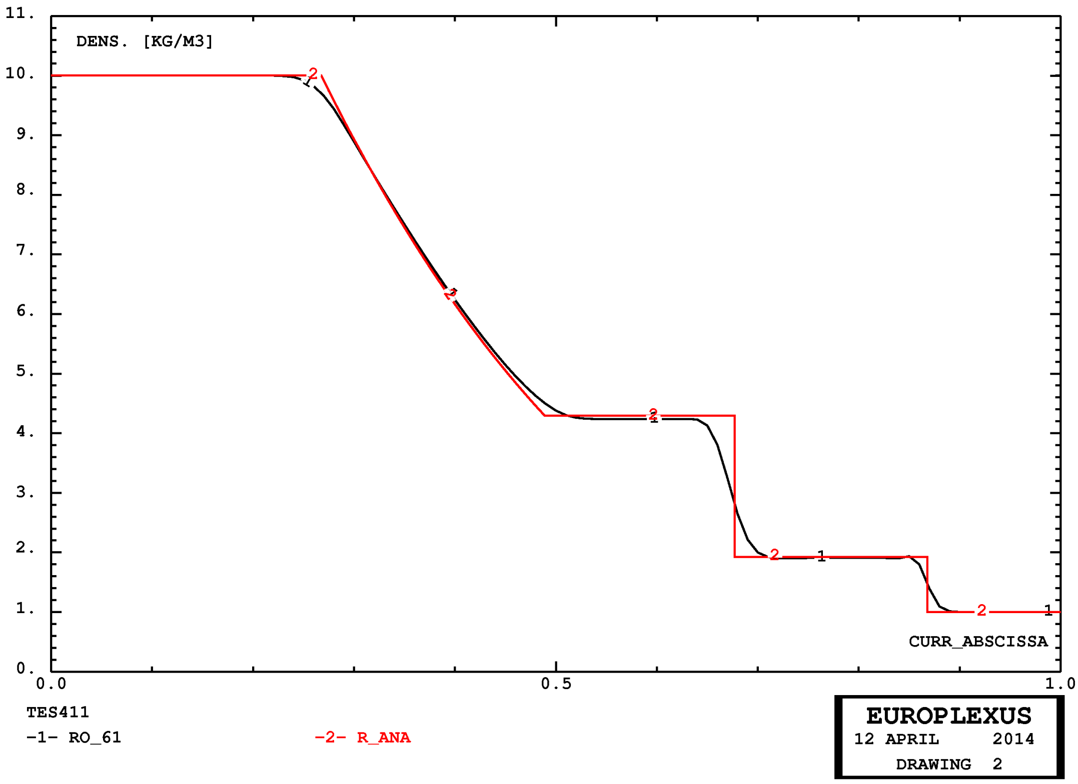


Figure 55 - Density in case TES411

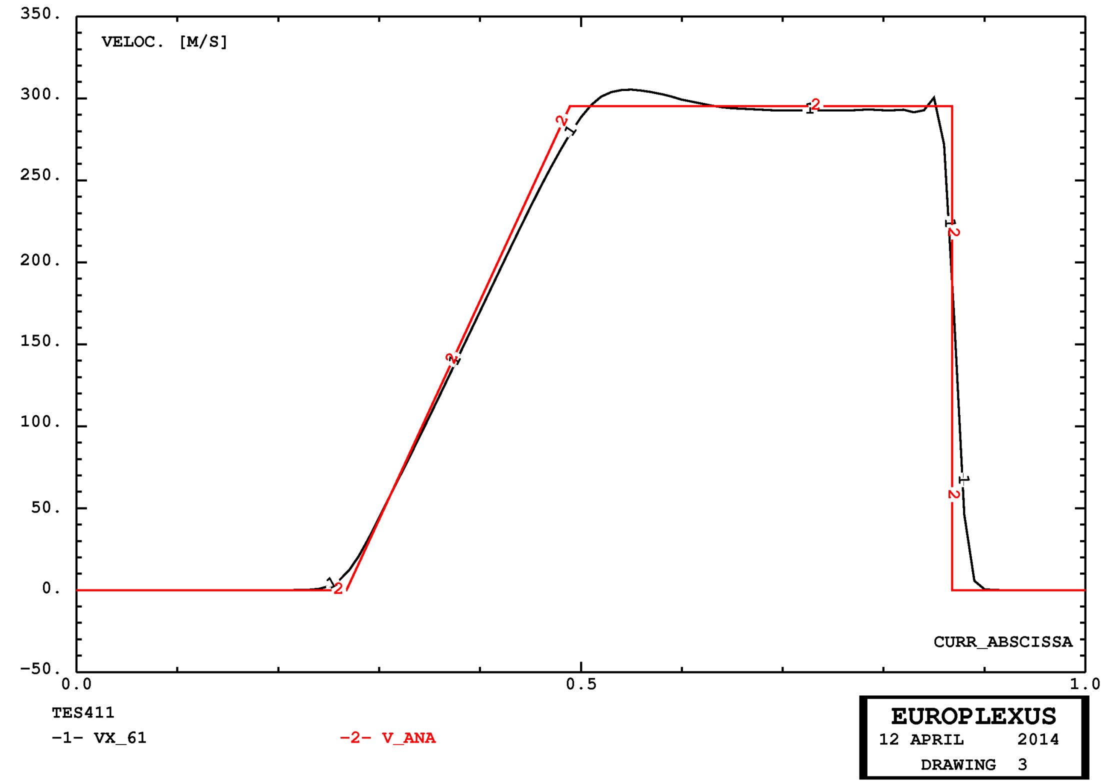


Figure 56 - Velocity in case TES411

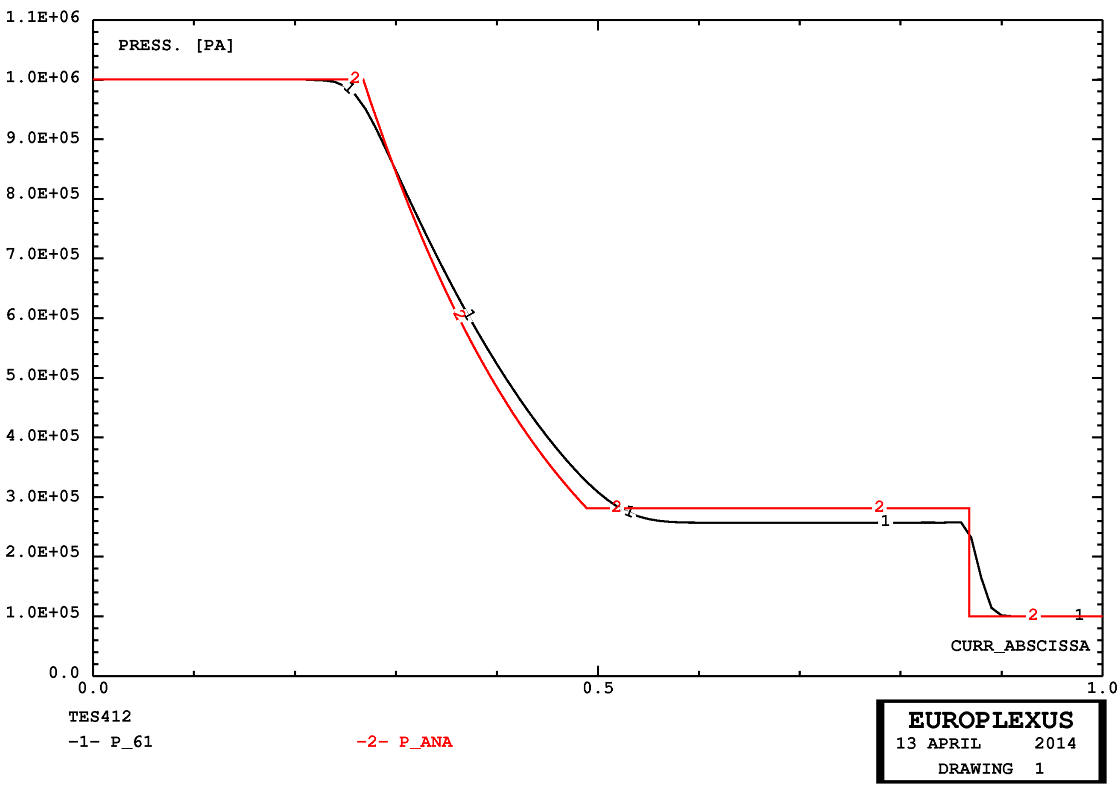


Figure 57 - Pressure in case TES412

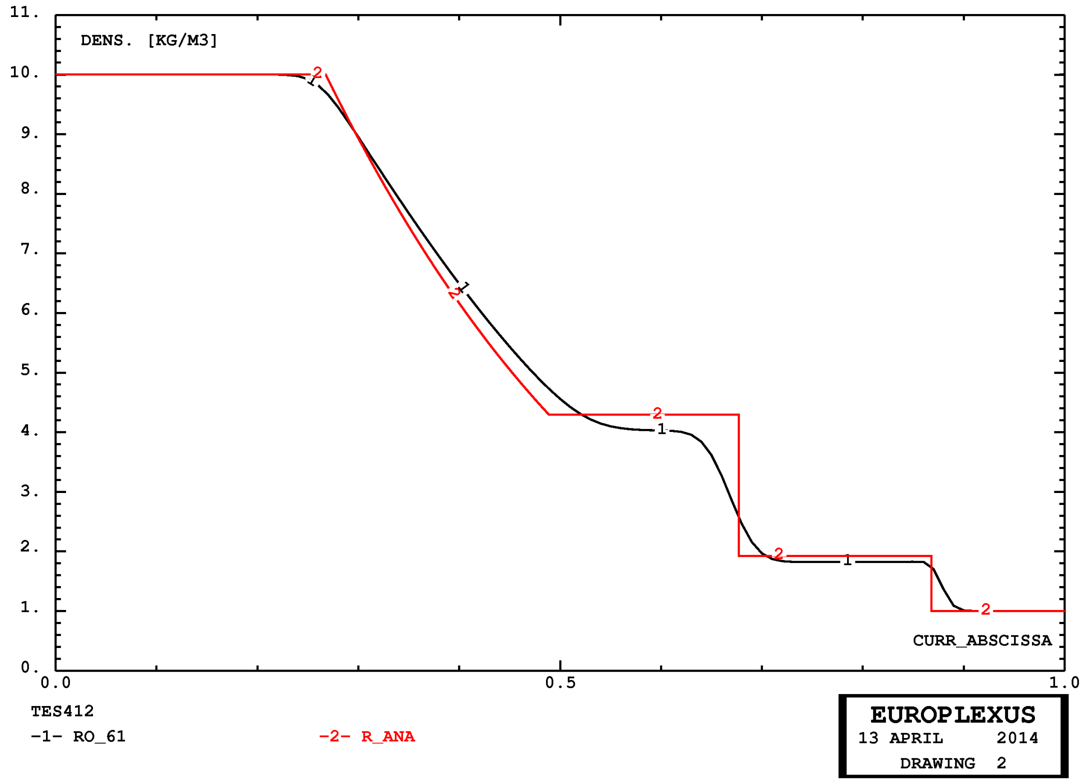


Figure 58 - Density in case TES412

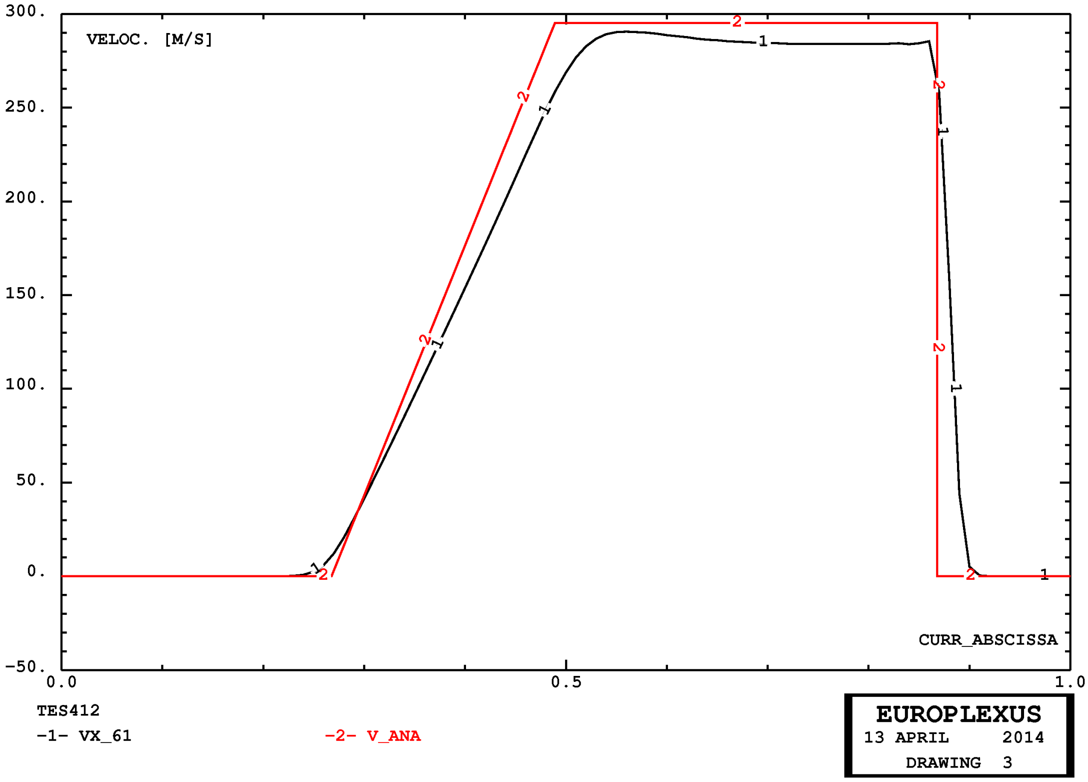


Figure 59 - Velocity in case TES412

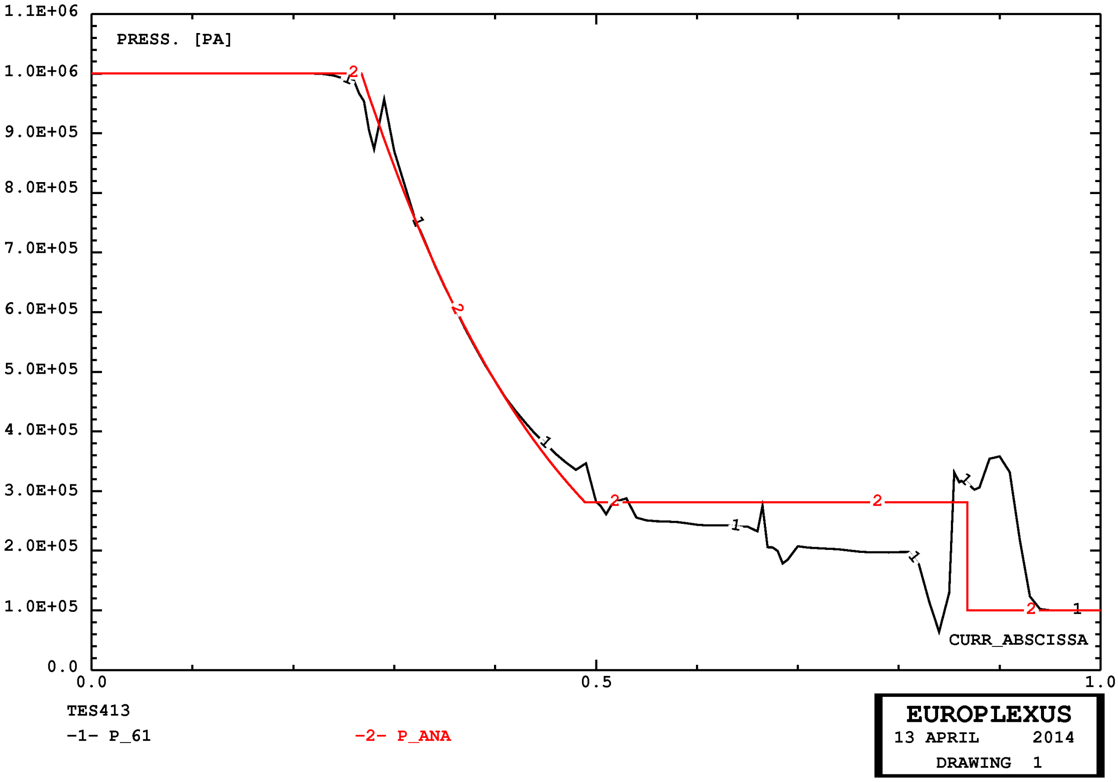


Figure 60 - Pressure in case TES413

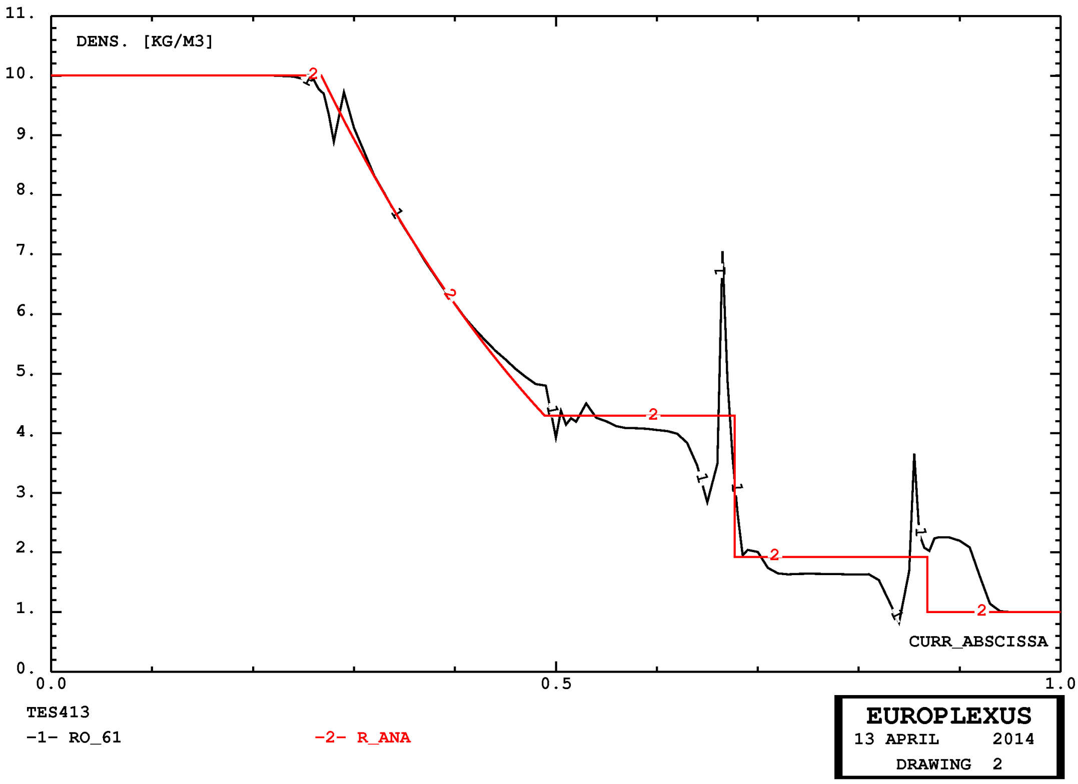


Figure 61 - Density in case TES413

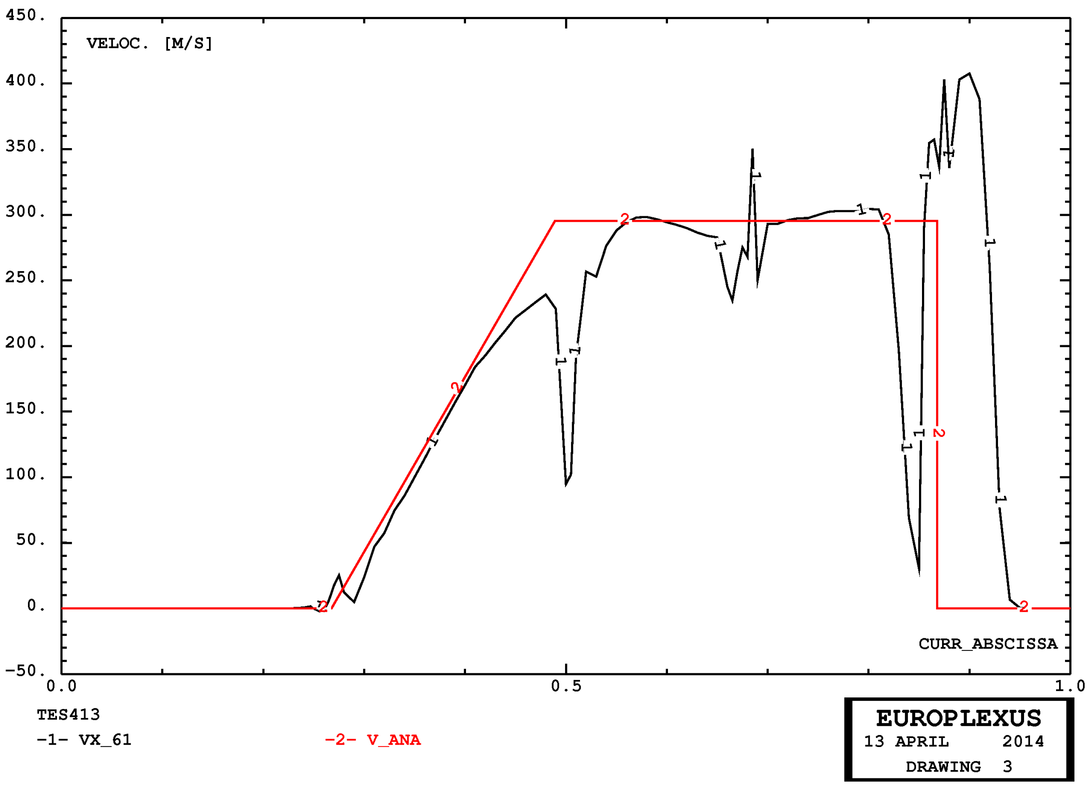


Figure 62 - Velocity in case TES413

4.8 Shock tube in 3D with Finite Volumes

The next example is the same shock tube problem considered in Section 4.7, but now solved with the Cell-Centred Finite Volume method, using the tetrahedron element TEVF. The problem formulation is taken from reference [9].

First, the problem is solved with CCFV hexahedra, element CUVF, without and with mesh adaptivity, for ease of comparison. Then, a reference tetrahedral solution is obtained by means of a fine mesh of (non-adaptive) tetrahedra. Finally, an adaptive solution with tetrahedra is obtained. All performed calculations are summarized in Table 8.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
CUSH01	100 CUVF	Non-adaptive mesh, first-order in space and time	119	0.1	12,000
CUSH07	100 CUVF	WAVE 4 PLAN MAXL 3, first-order in space and time	412	1.1	262,696

Table 8 - Calculations for the shock tube problem in 3D with Finite Volumes

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
CUSH11	100 CUVF	Non-adaptive mesh, second-order in space and time	119	0.2	12,000
CUSH17	100 CUVF	WAVE 4 PLAN MAXL 3, second-order in space and time	417	1.7	265,317
TESH01	100 TEVF	Non-adaptive mesh, first-order in space and time	461	1.0	554,400
TESH07	100 TEVF	WAVE 4 PLAN MAXL 3, first-order in space and time	1,732	31.1	13,194,382
TESH11	100 TEVF	Non-adaptive mesh, second-order in space and time	475	2.1	571,200
TESH17	100 TEVF	WAVE 4 PLAN MAXL 3, second-order in space and time	1,738	58.3	13,219,460

Table 8 - Calculations for the shock tube problem in 3D with Finite Volumes

CUSH01

This test uses a relatively coarse non-adaptive fluid mesh, of 100 cubic fluid volumes CUVF. A first-order formulation in both space and time is assumed. The solution is shown in Figures 63 (pressure), 64 (density) and 65 (velocity), compared with the analytical solution (in red), with which it is in good agreement (for the coarse mesh chosen). This is taken as a reference for the subsequent solutions.

CUSH07

This solution is adaptive and uses the same base fluid mesh as case CUSH01, of just 100 hexahedral fluid volumes CUVF. Four `WAVE` directives with `MAXL 3` are used to drive mesh refinement and unrefinement. The solution (in green) is shown in Figures 66 (pressure), 67 (density) and 68 (velocity) and is in good agreement with the reference (in black) and with the analytical solution (in red).

CUSH11

This test is identical to CUSH01 but uses a second-order formulation in space and time. The solution is shown in Figures 69 (pressure), 70 (density) and 71 (velocity), compared with the analytical solution (in red), with which it is in very good agreement (for the coarse mesh chosen). The solution is more accurate than the first-order solution, as expected.

CUSH17

This solution is similar to CUSH07 but uses a second-order formulation in space and time. The solution is shown in Figures 72 (pressure), 73 (density) and 74 (velocity), compared with the analytical solution (in red), with which it is in very good agreement (for the coarse mesh chosen).

TESH01

This test is similar to CUSH01 but uses tetrahedral finite elements TEVF. The mesh is obtained from the 100-element mesh of case CUSH01 by subdividing each hexahedron into twelve tetrahedra by means of the `pxhex2te.proc` Cast3m procedure listed in Appendix. This (non-adaptive) solution is first-order in space and time and is shown in Figures 75 (pressure), 76 (density) and 77 (velocity), compared with the analytical solution (in red), with which it is in very good agreement (for the coarse mesh chosen).

TESH07

This solution is adaptive and uses the same base fluid mesh as case TESH01, of $100 \times 12 = 1200$ tetrahedral fluid volumes TEVF. Four `WAVE` directives with `MAXL 3` are used to drive mesh refinement and unrefinement. The solution (in green) is shown in Figures 78 (pressure), 79 (density) and 80 (velocity) and is in good agreement with the reference (in black) and with the analytical solution (in red).

TESH11

This test is similar to TESH01 but is second-order in space and time. The solution is shown in Figures 81 (pressure), 82 (density) and 83 (velocity), compared with the analytical solution (in red), with which it is in very good agreement (for the coarse mesh chosen).

TESH17

This test is similar to TESH07 but is second-order in space and time. The solution is shown in Figures 84 (pressure), 85 (density) and 86 (velocity), compared with the analytical solution (in red), with which it is in very good agreement.

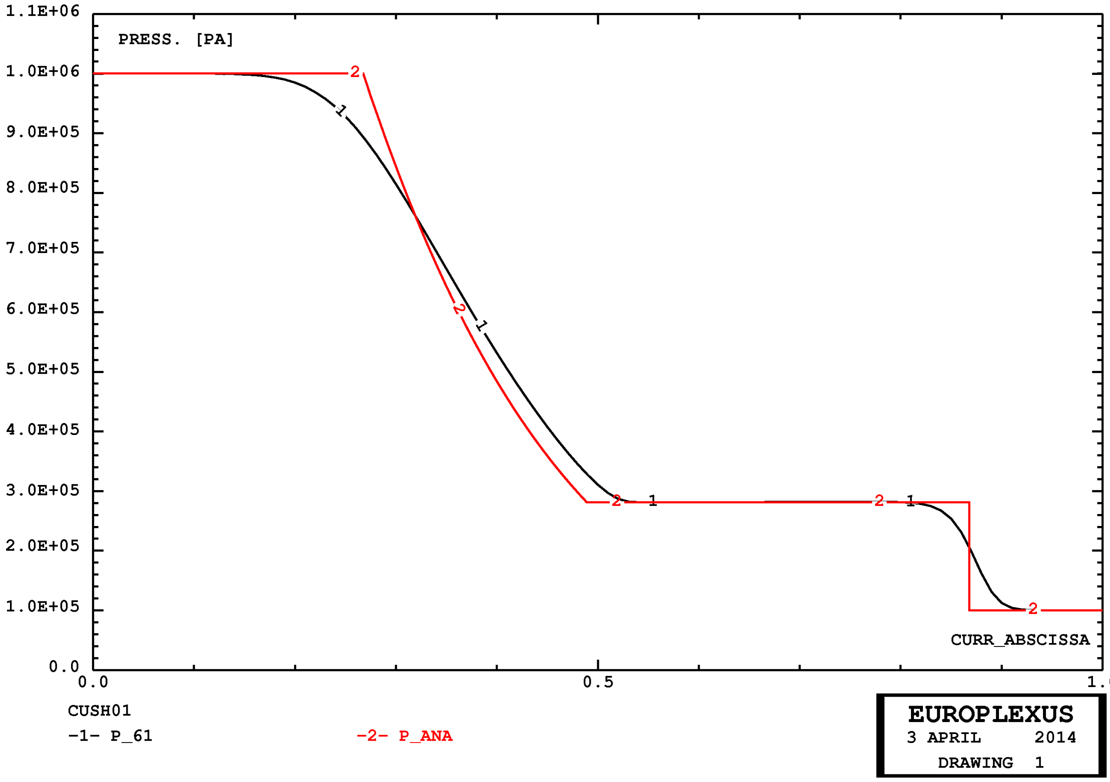


Figure 63 - Pressure in case CUSH01

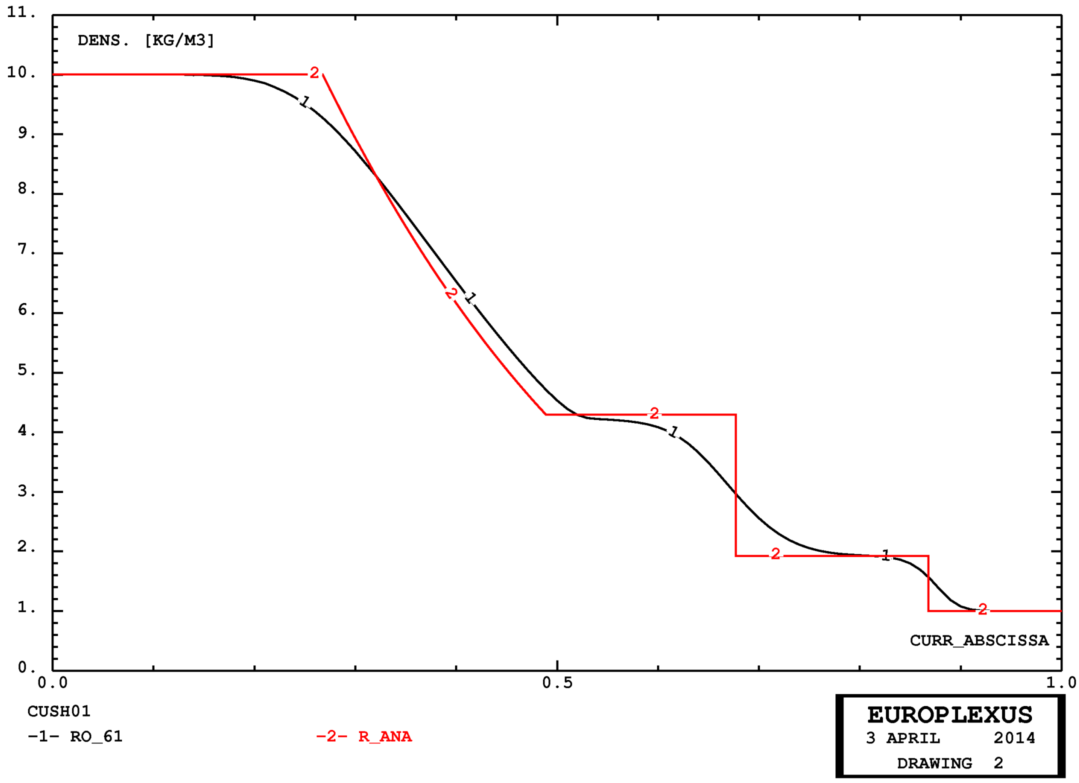


Figure 64 - Density in case CUSH01

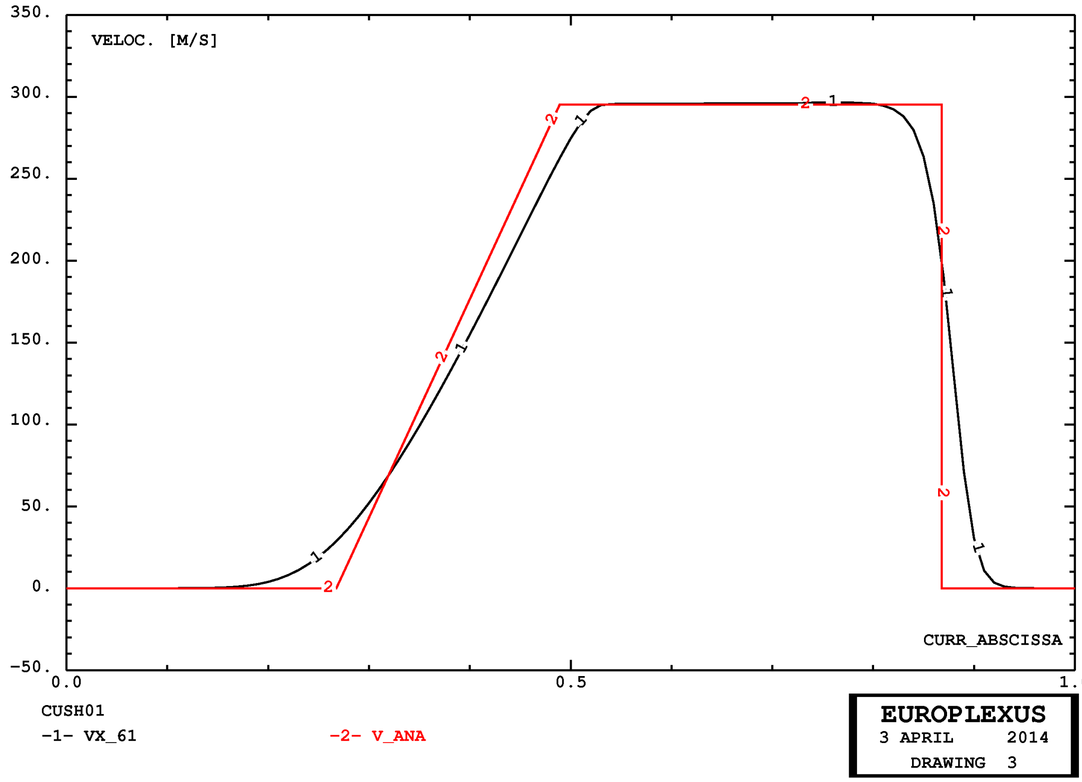


Figure 65 - Velocity in case CUSH01

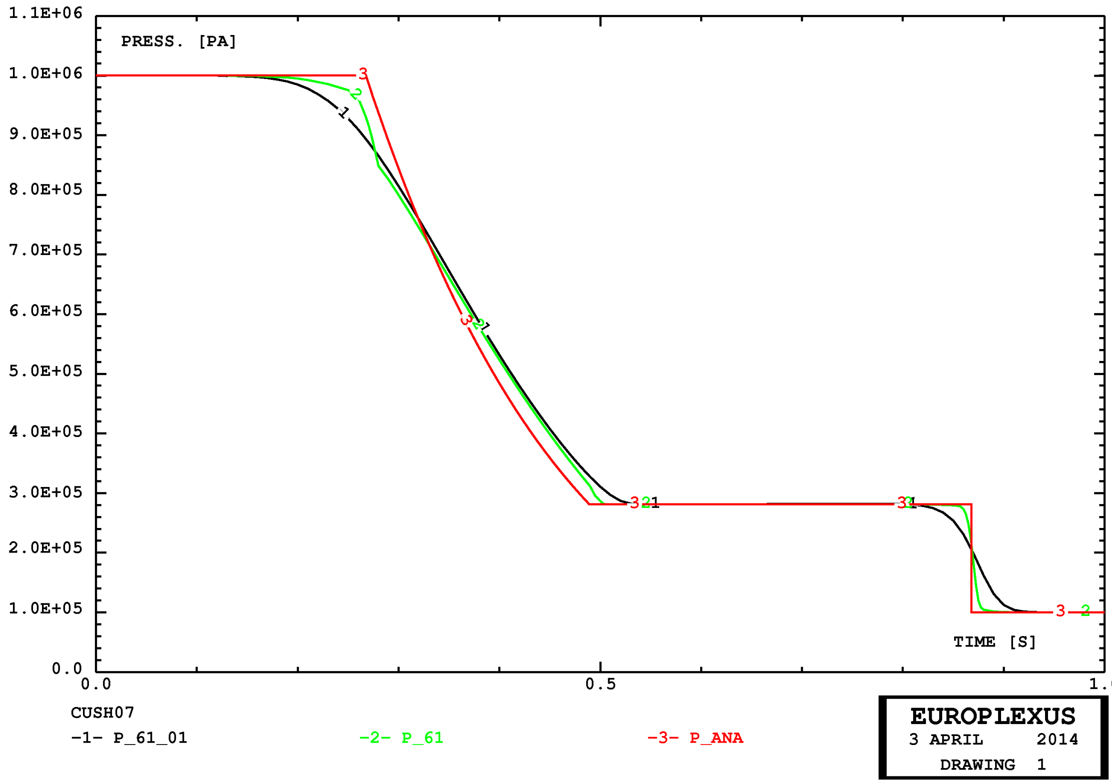


Figure 66 - Pressure in cases CUSH07 and CUSH01

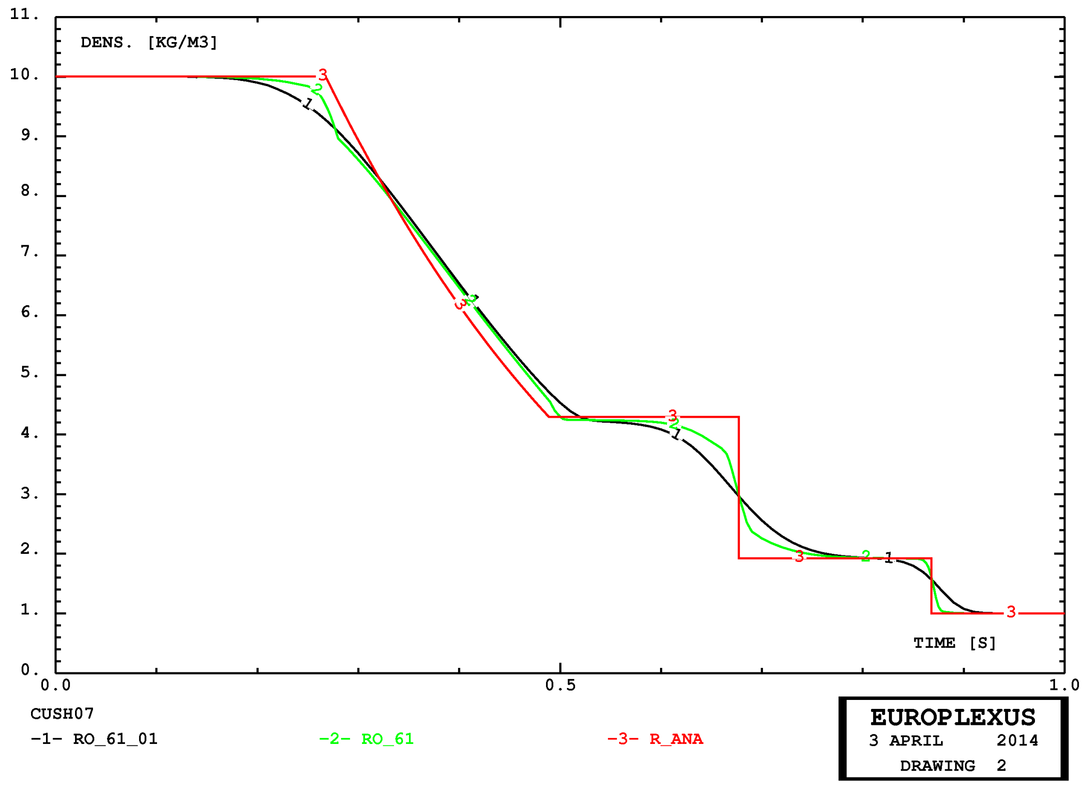


Figure 67 - Density in cases CUSH07 and CUSH01

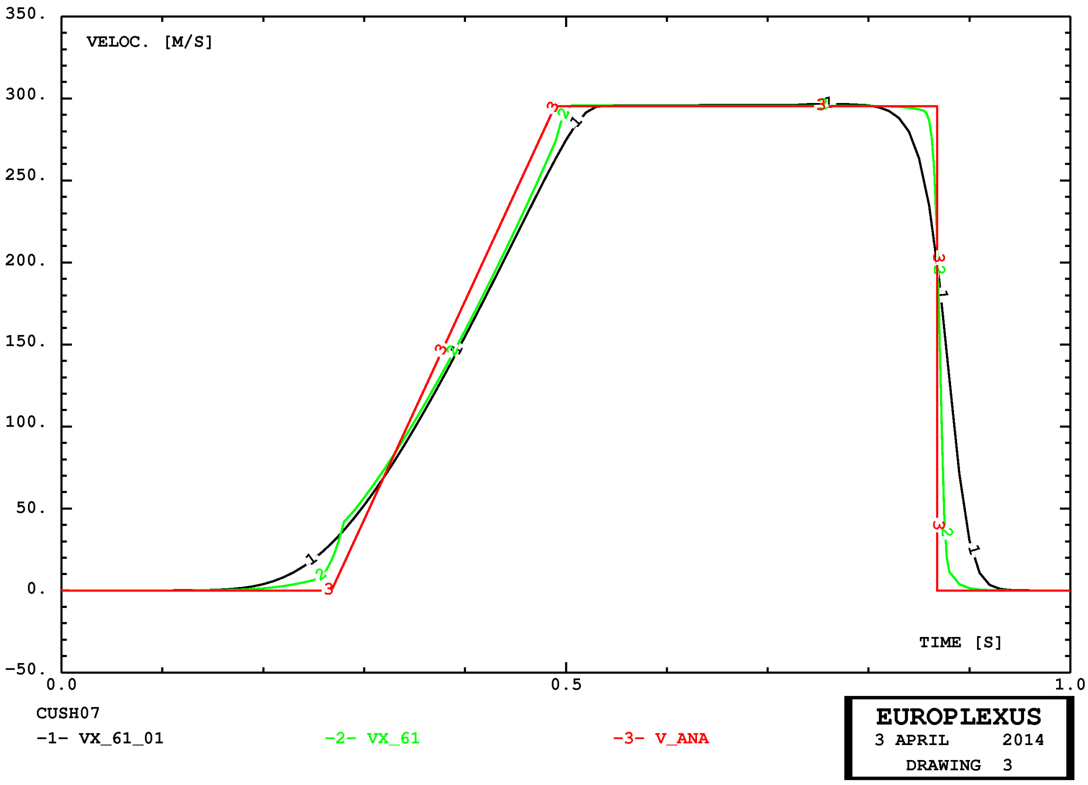


Figure 68 - Velocity in cases CUSH07 and CUSH01

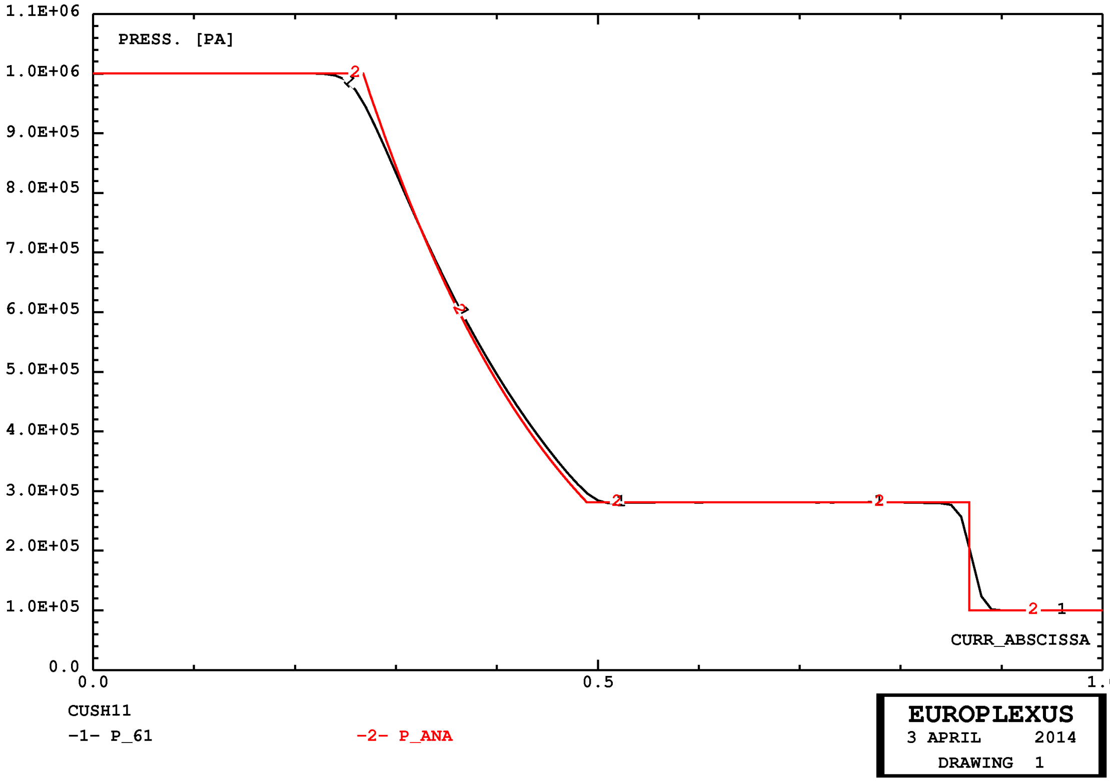


Figure 69 - Pressure in case CUSH11

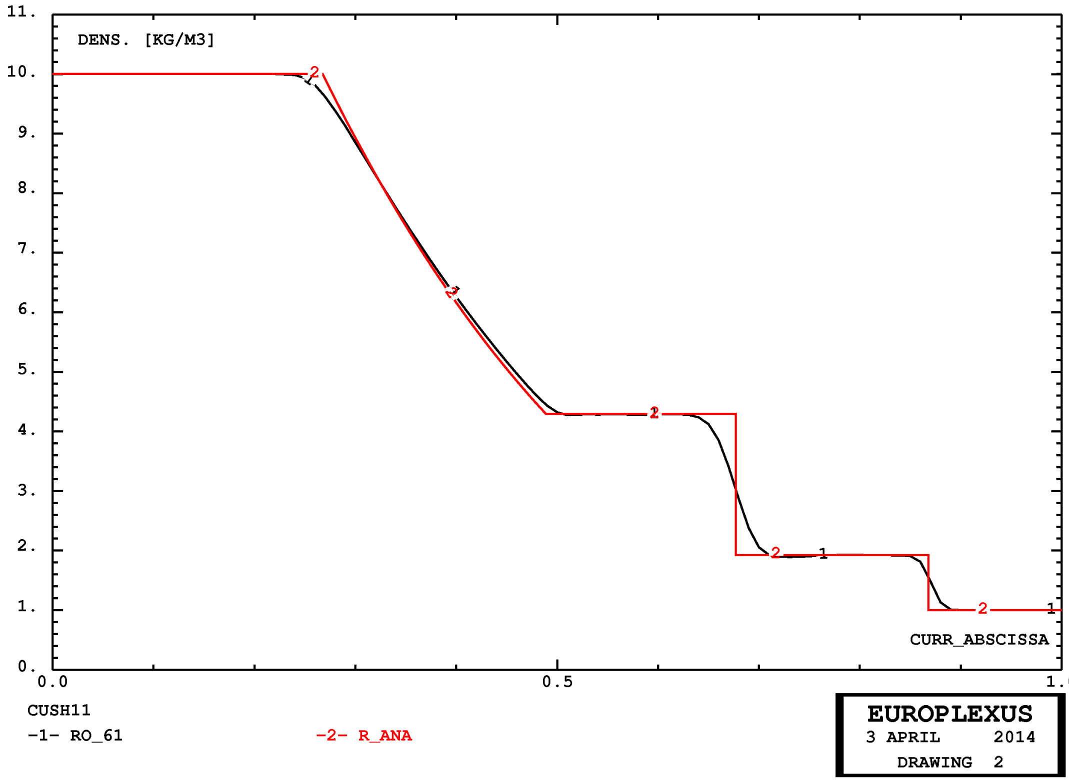


Figure 70 - Density in case CUSH11

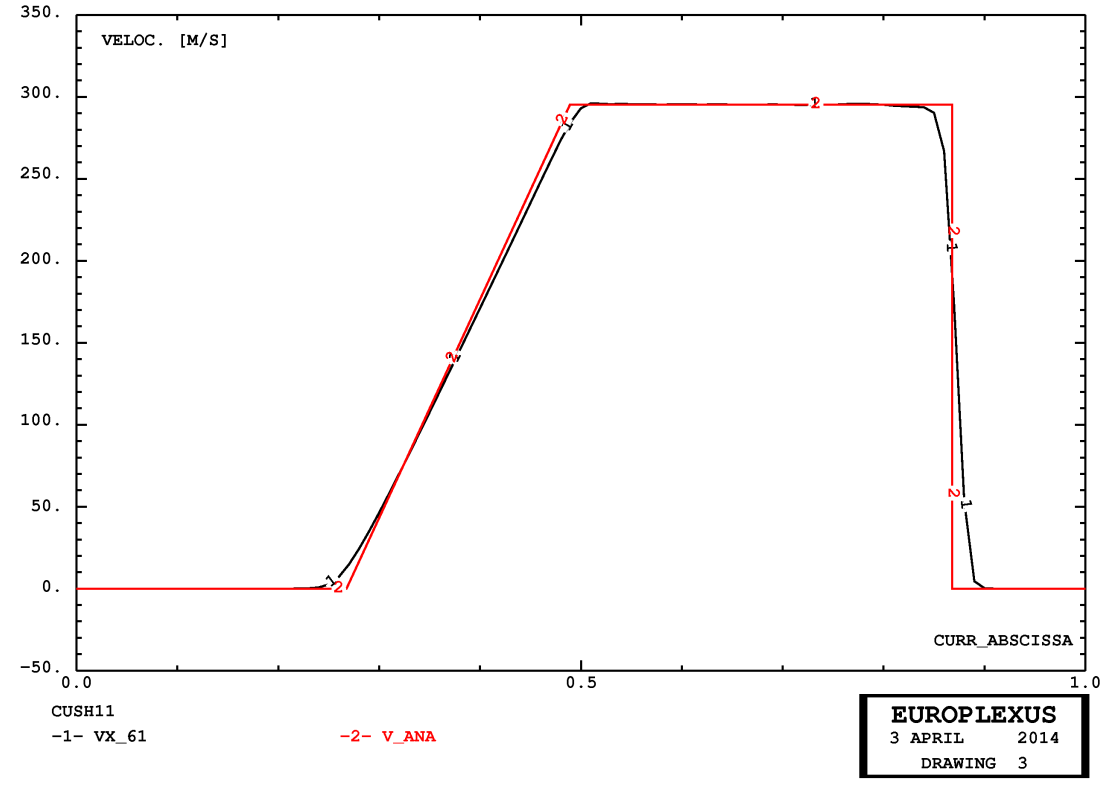


Figure 71 - Velocity in case CUSH11

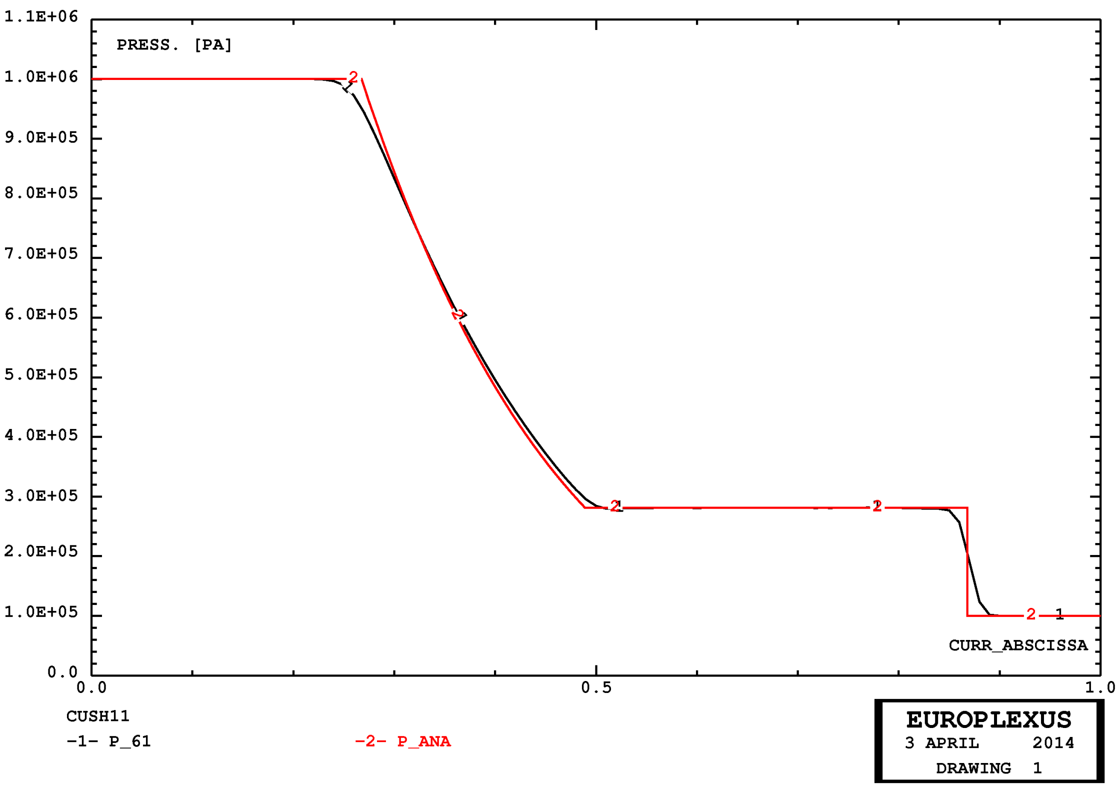


Figure 72 - Pressure in cases CUSH17 and CUSH11

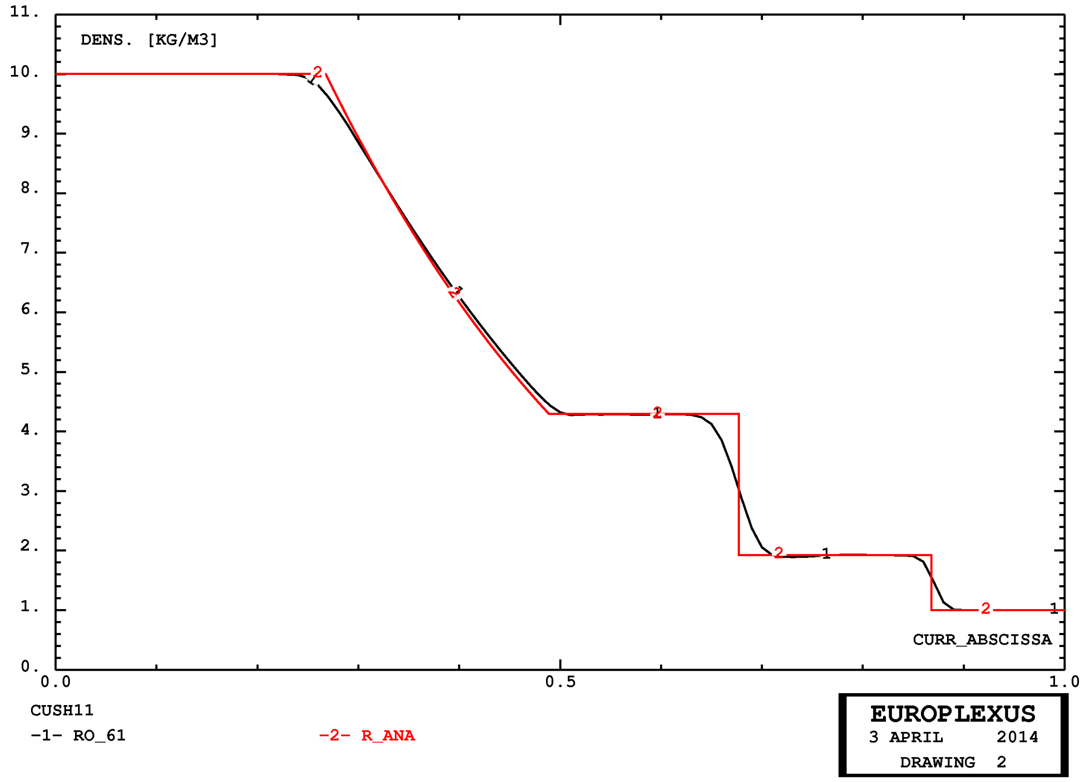


Figure 73 - Density in cases CUSH17 and CUSH11

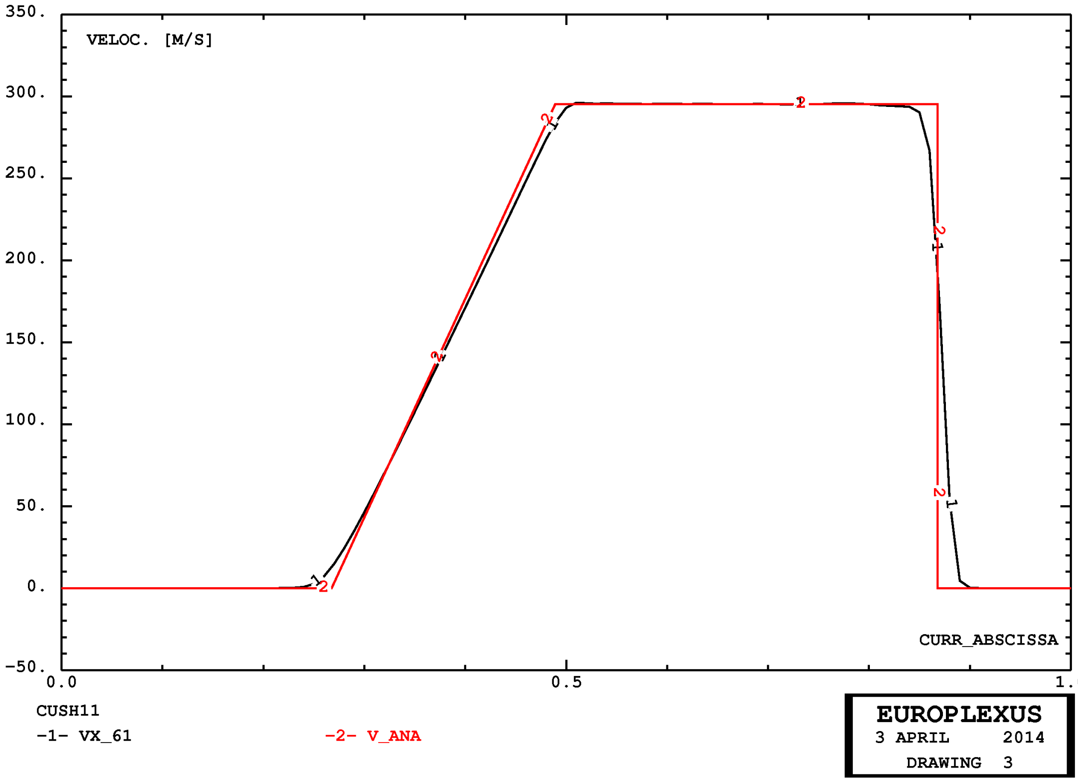


Figure 74 - Velocity in cases CUSH17 and CUSH11

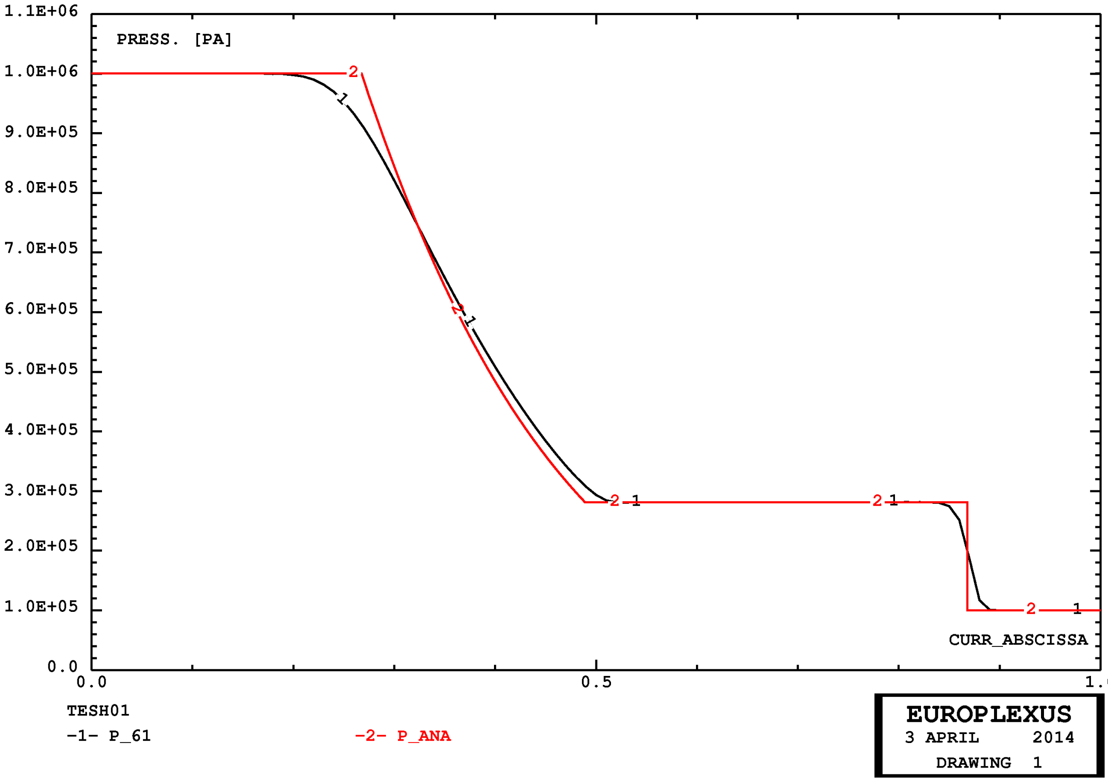


Figure 75 - Pressure in case TESH01

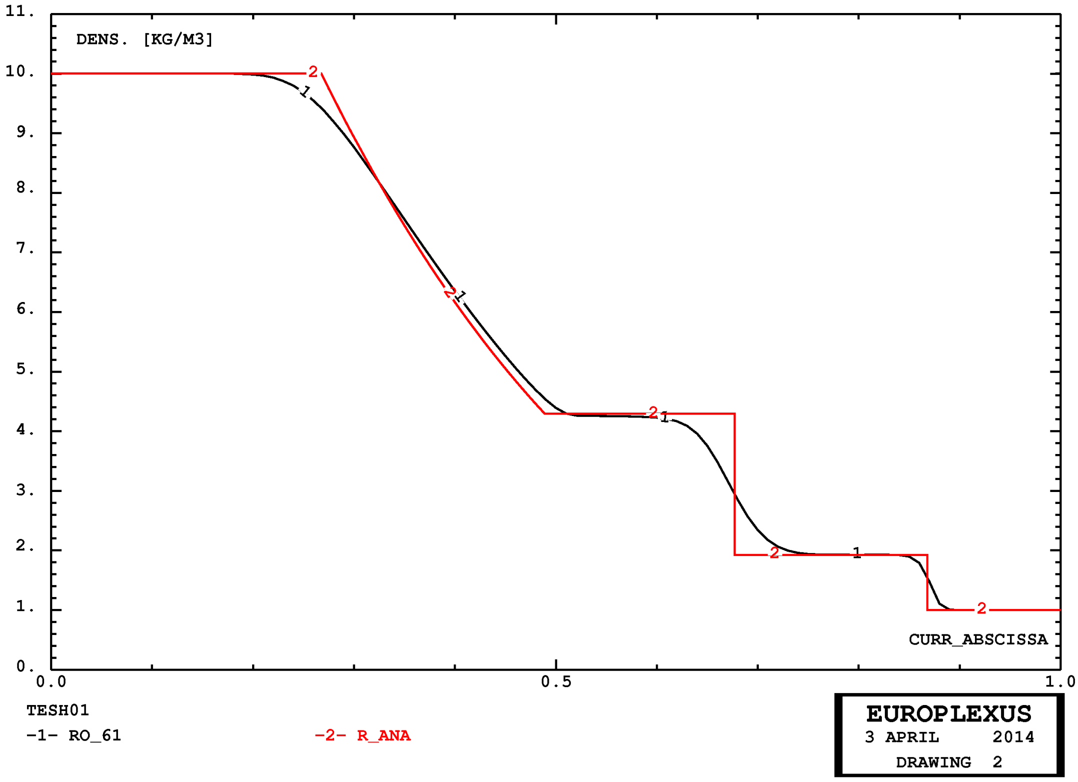


Figure 76 - Density in case TESH01

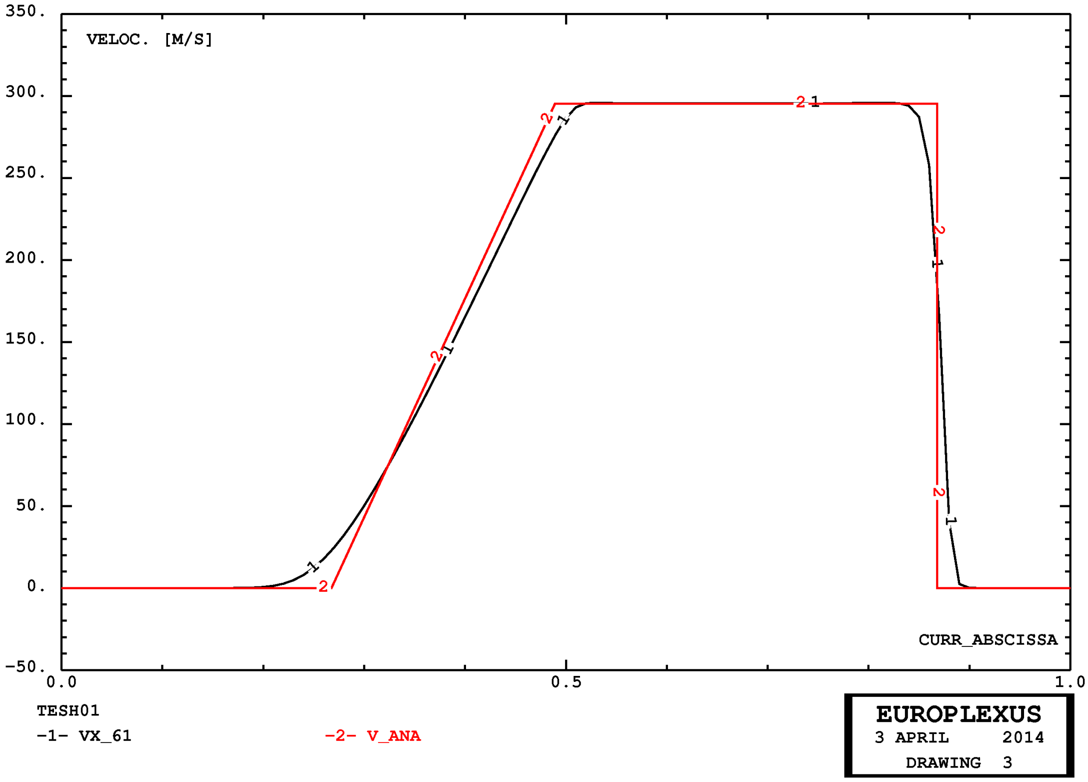


Figure 77 - Velocity in case TESH01

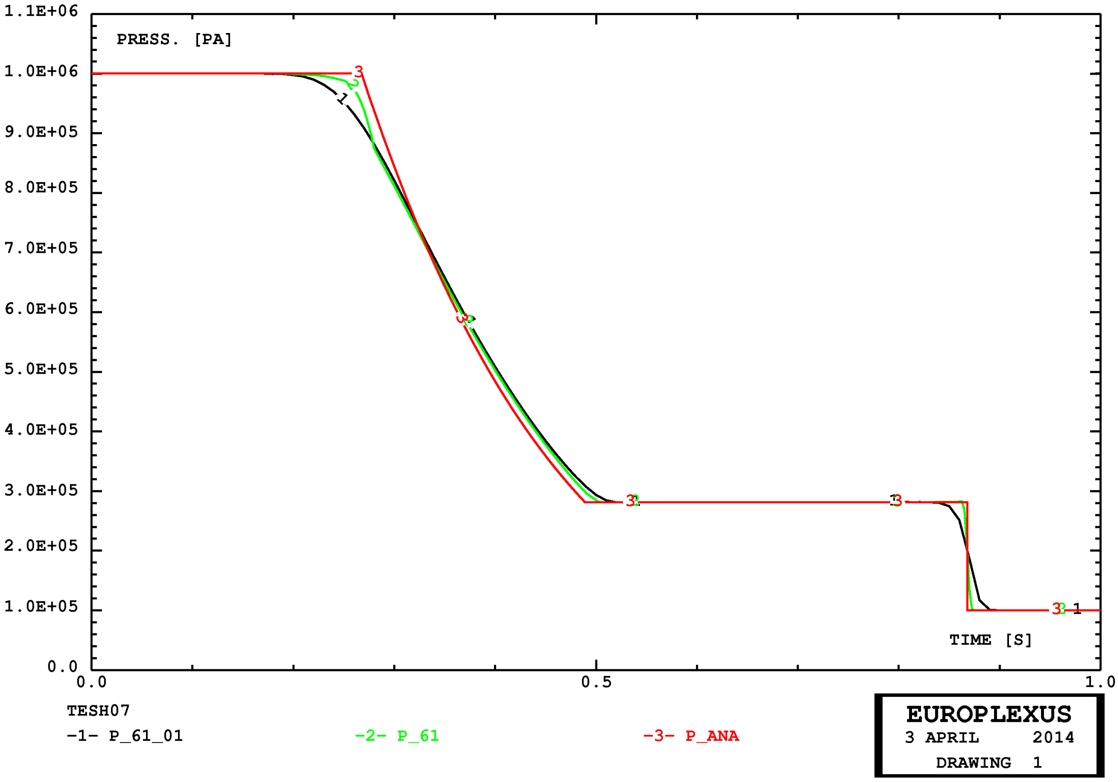


Figure 78 - Pressure in cases TESH07 and TESH01

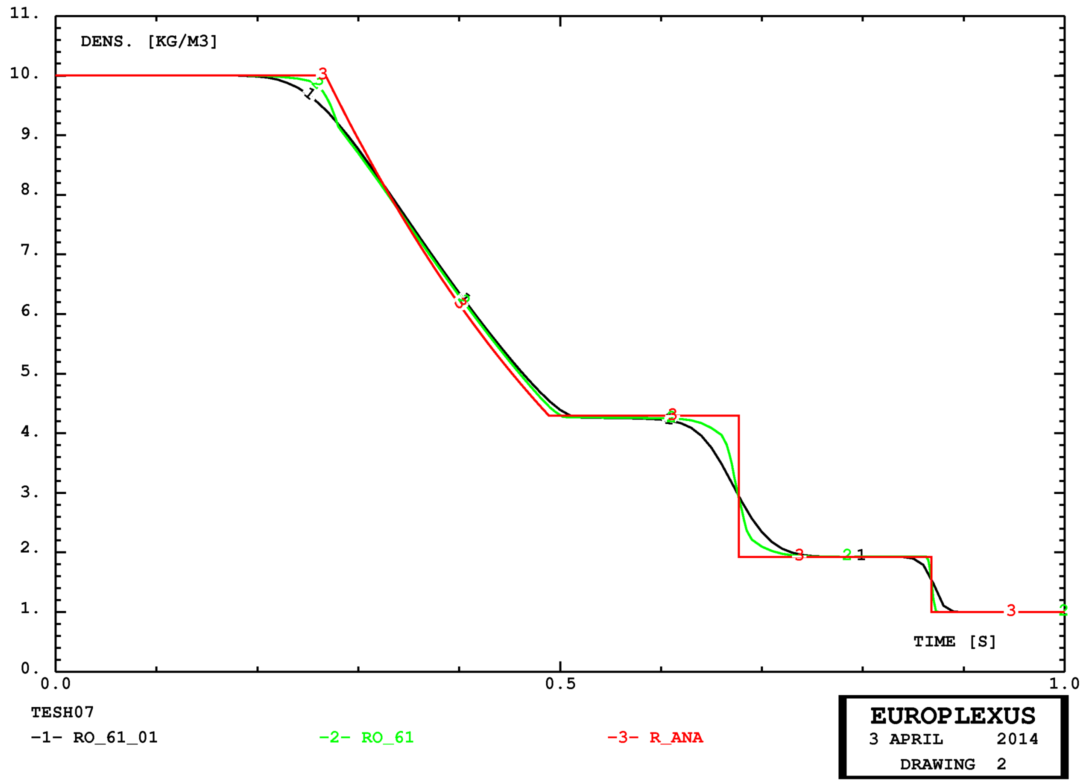


Figure 79 - Density in cases TESH07 and TESH01

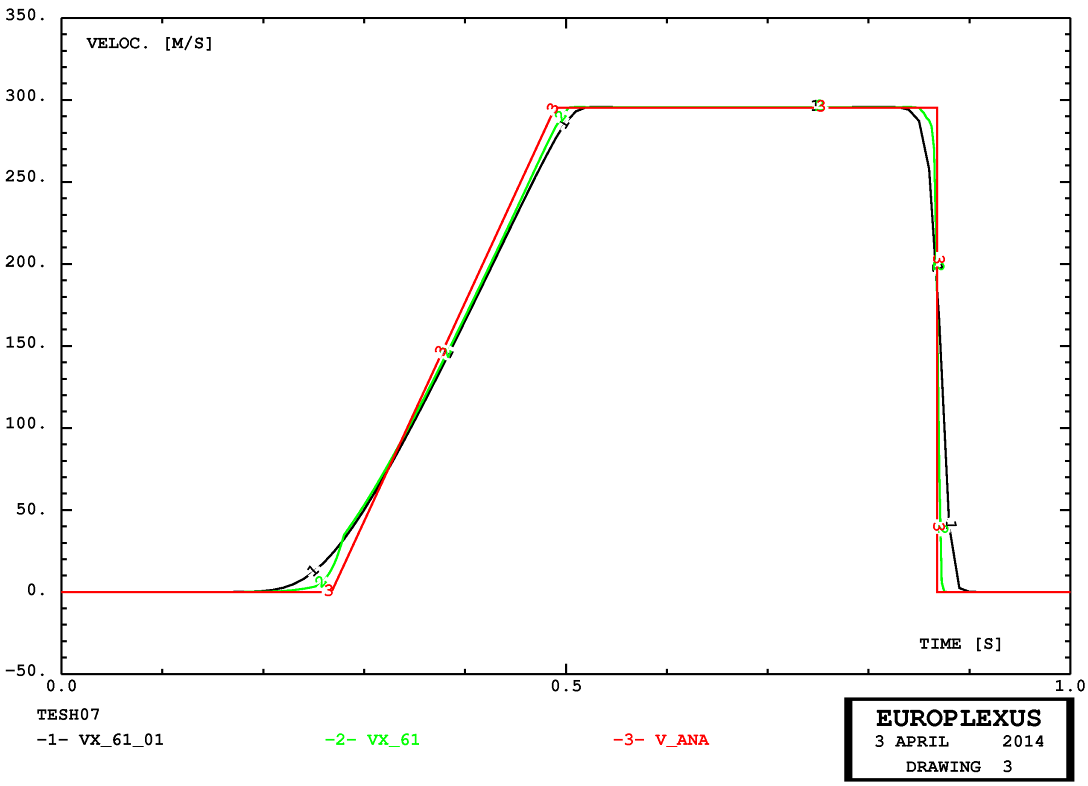


Figure 80 - Velocity in cases TESH07 and TESH01

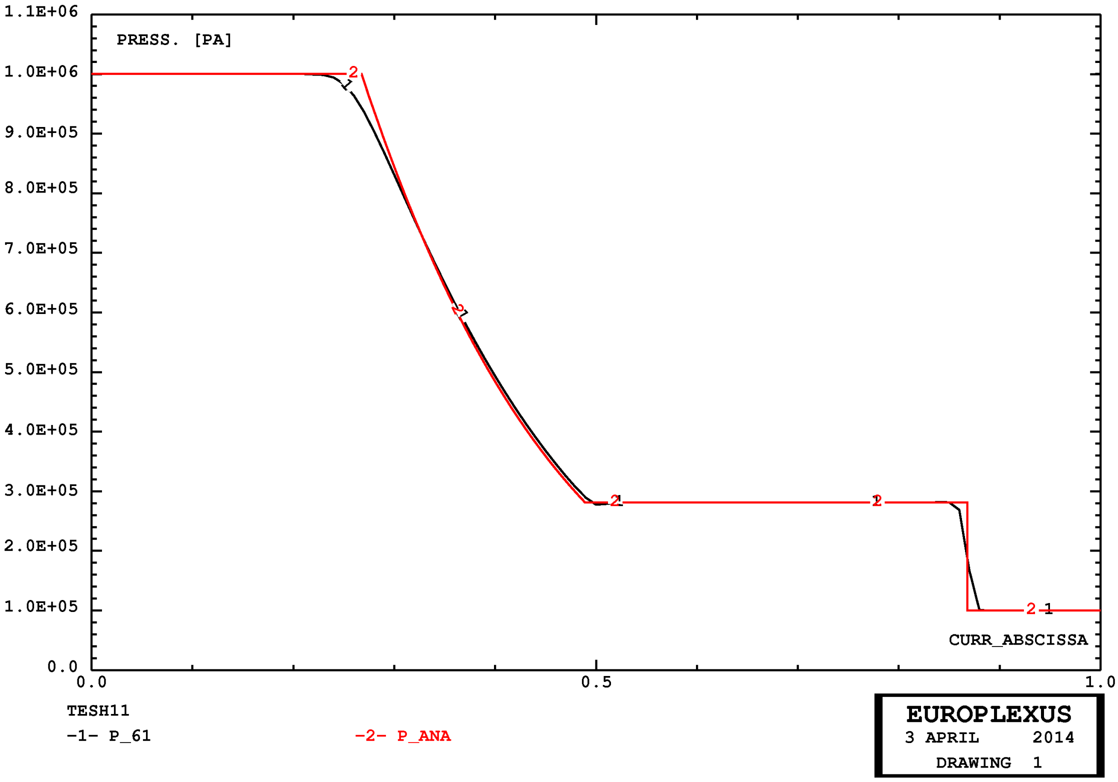


Figure 81 - Pressure in case TESH11

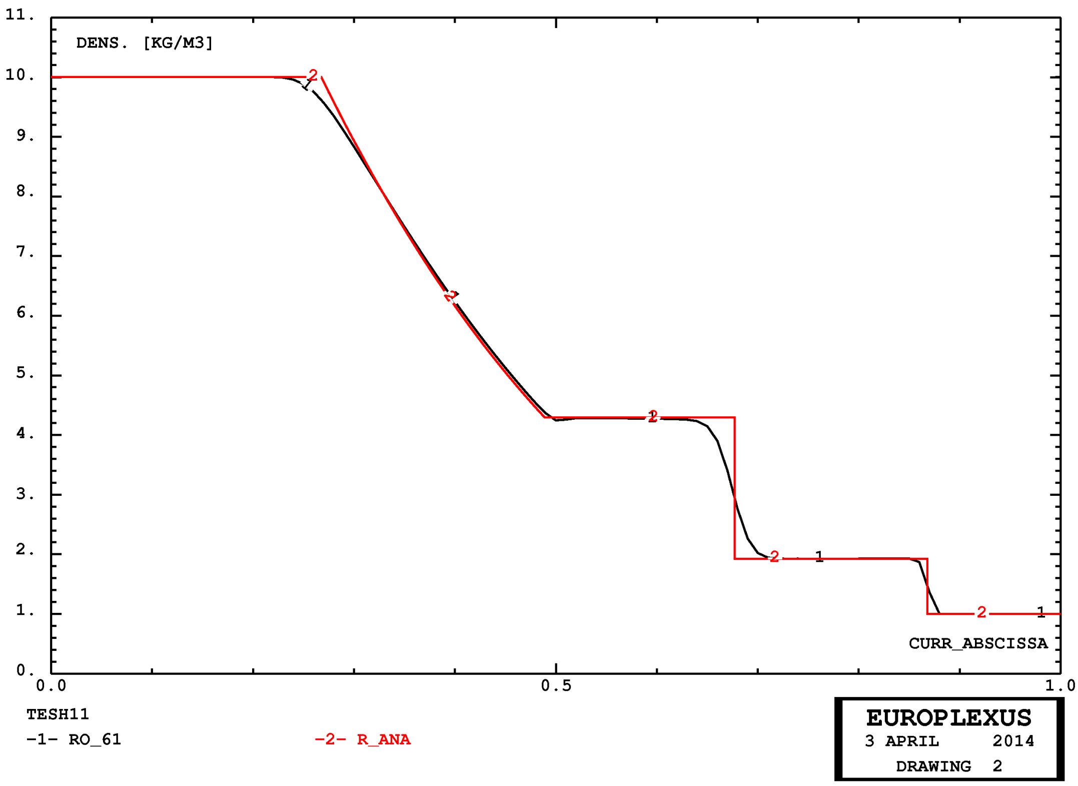


Figure 82 - Density in case TESH11

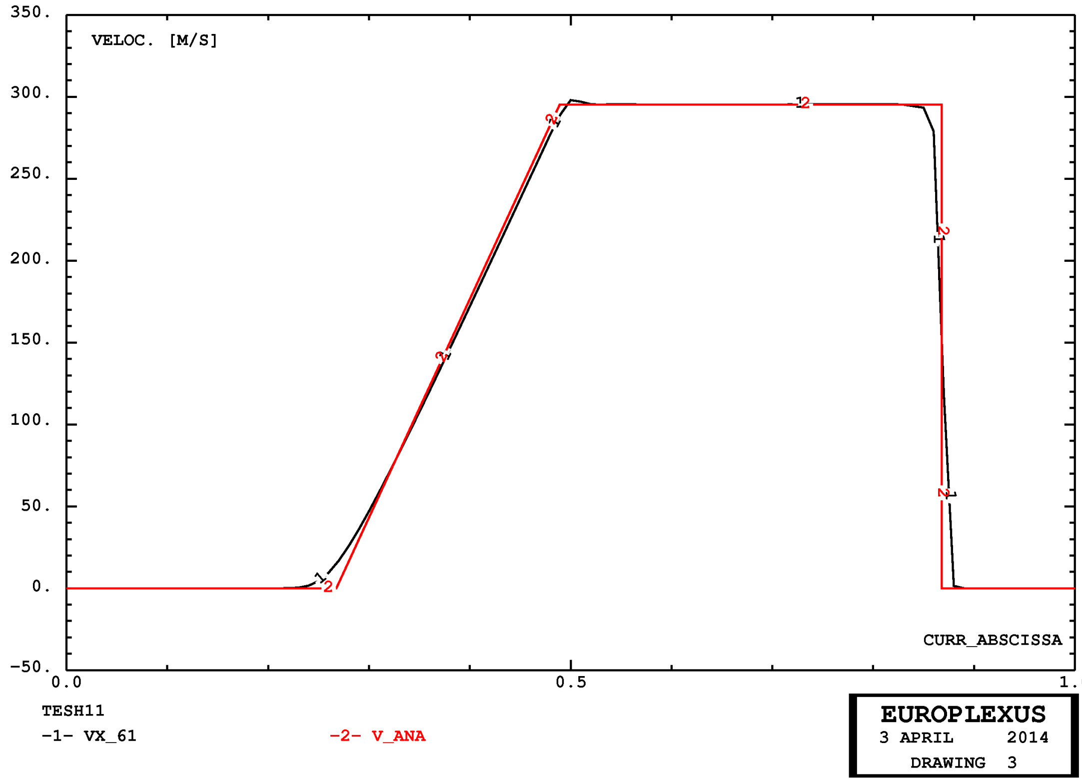


Figure 83 - Velocity in case TESH11

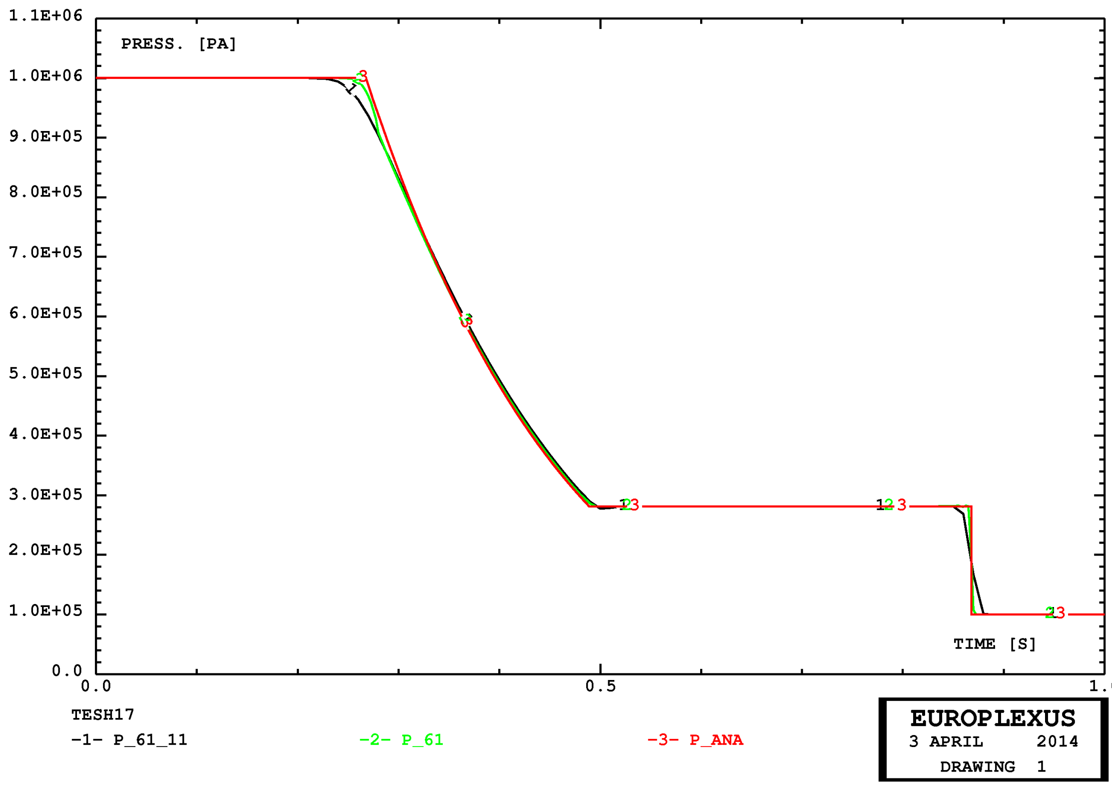


Figure 84 - Pressure in cases TESH17 and TESH11

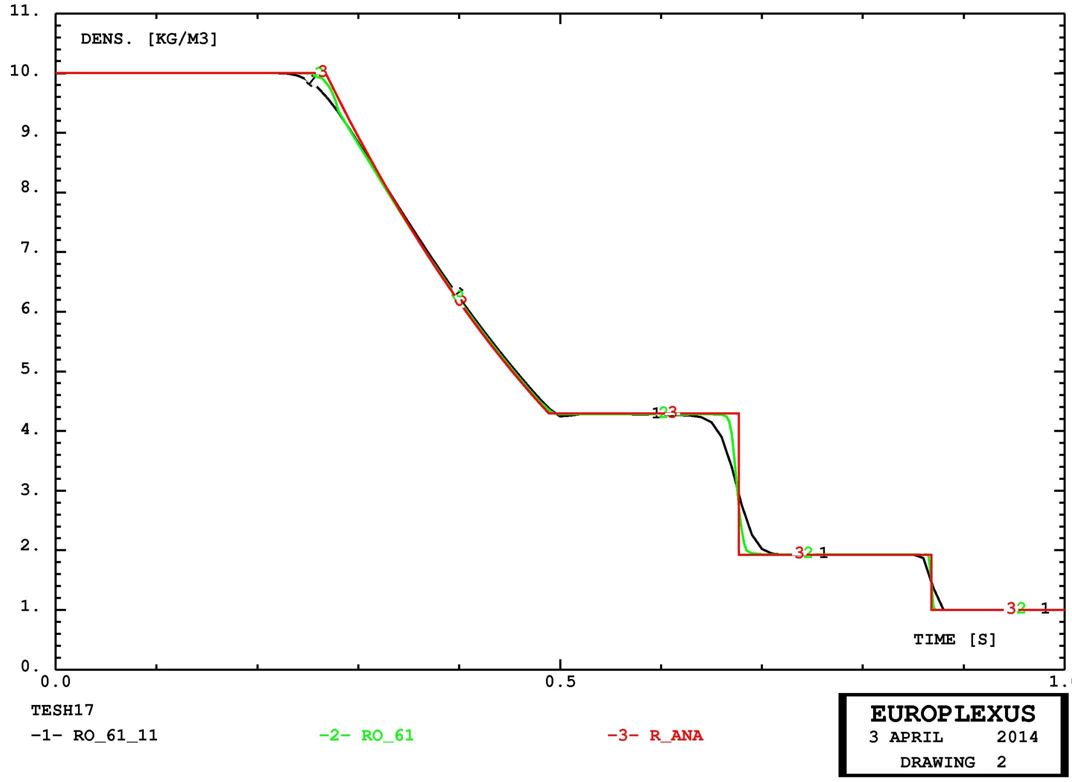


Figure 85 - Density in cases TESH17 and TESH11

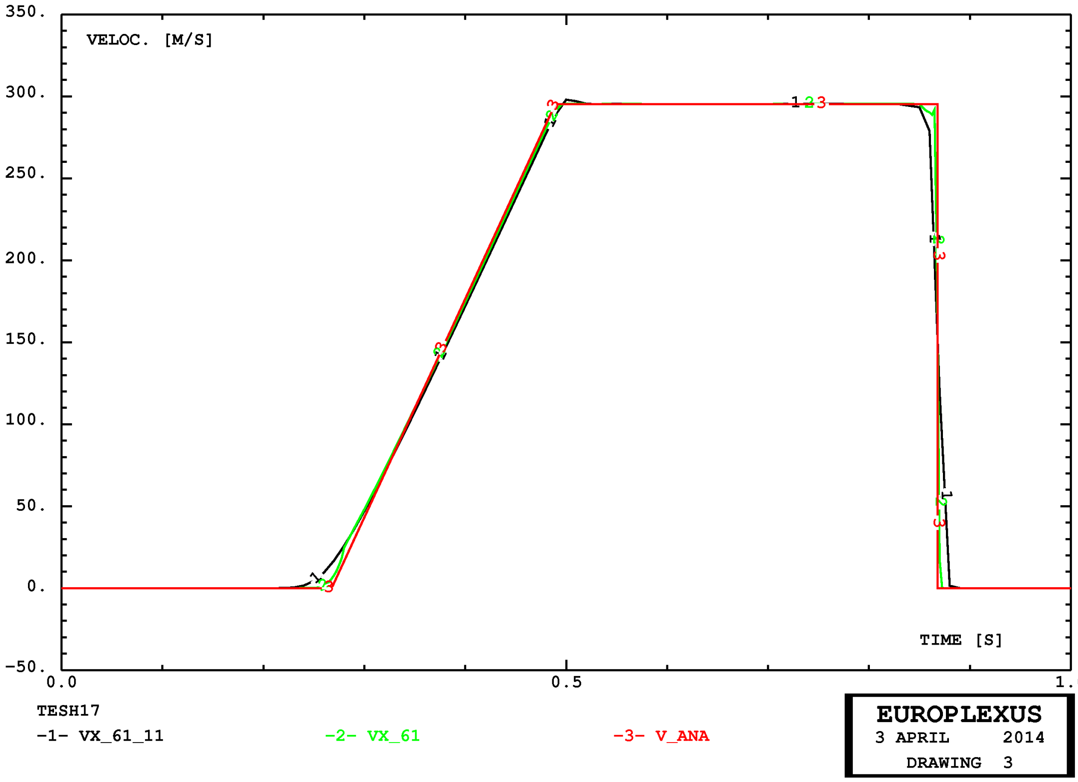


Figure 86 - Velocity in cases TESH17 and TESH11

4.9 Testing CLxx boundary conditions in 3D

The next example verifies the use of natural boundary conditions by means of CLxx elements in 3D. The test is similar to case TWAD11 of reference [1] and to the 2D test TWAD21/TWAD22 presented above in Section 4.5. A bar of constant cross section is loaded at the left end by an applied pressure, represented by a CL3I element with an IMPE PIMP material. The pressure is constant in time, and generates a stress wave in the bar.

All performed calculations are summarized in Table 9.

Case	Base Mesh	Notes	Steps	CPU [s]	Els*step
TWAD31	240 TETR 4 CL3I	WAVE 1 PLAN MAXL 2	228	0.8	42,990

Table 9 - Calculations for the pressure-loaded bar in 3D

TWAD31

This test uses a very coarse base mesh, of only 240 tetrahedral elements TETR, obtained by splitting a mesh of 10 regular hexahedra. Each hexahedron is split into 24 tetrahedra by means of the pxhex2t2.proc Gibiane procedure in Cast3m. The mesh is thus symmetric and so should be the solution. The solution is shown in Figures 87 (displacements), 88 (velocity) and 89 (velocities of four symmetric points in time). The waves in the bar are symmetric but not planar. However, this occurs also in a similar test done without adaptivity, so it is thought to be due to the nature of tetrahedra. The solution is indeed perfectly symmetric.

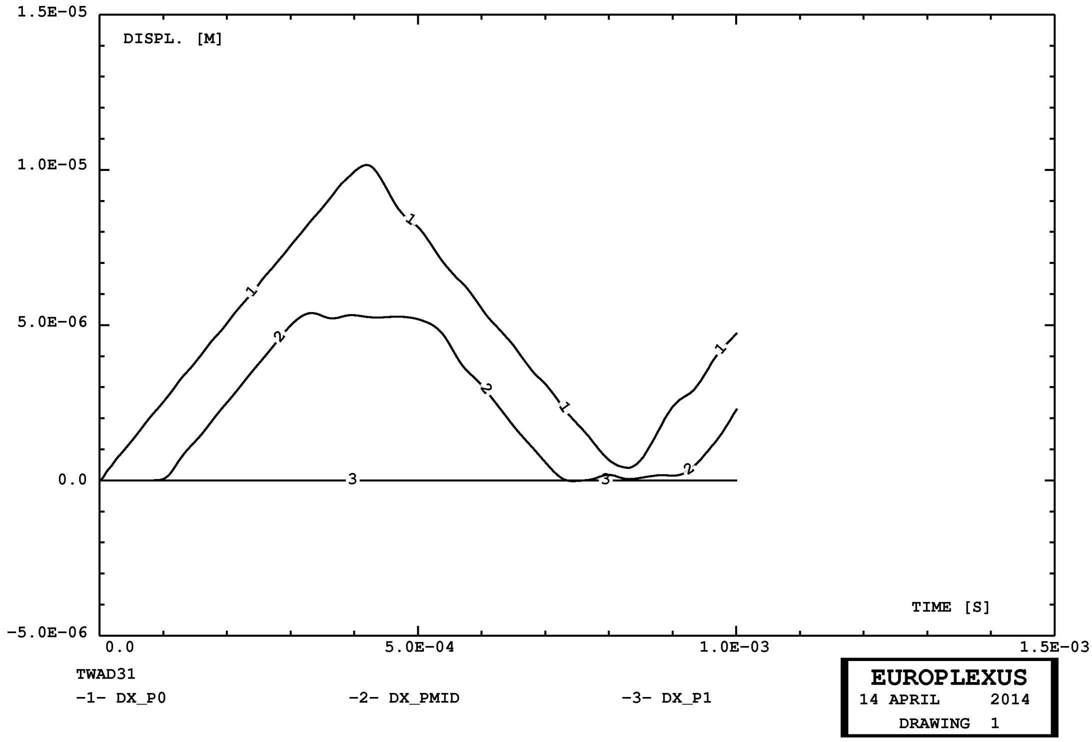


Figure 87 - Displacements in case TWAD31

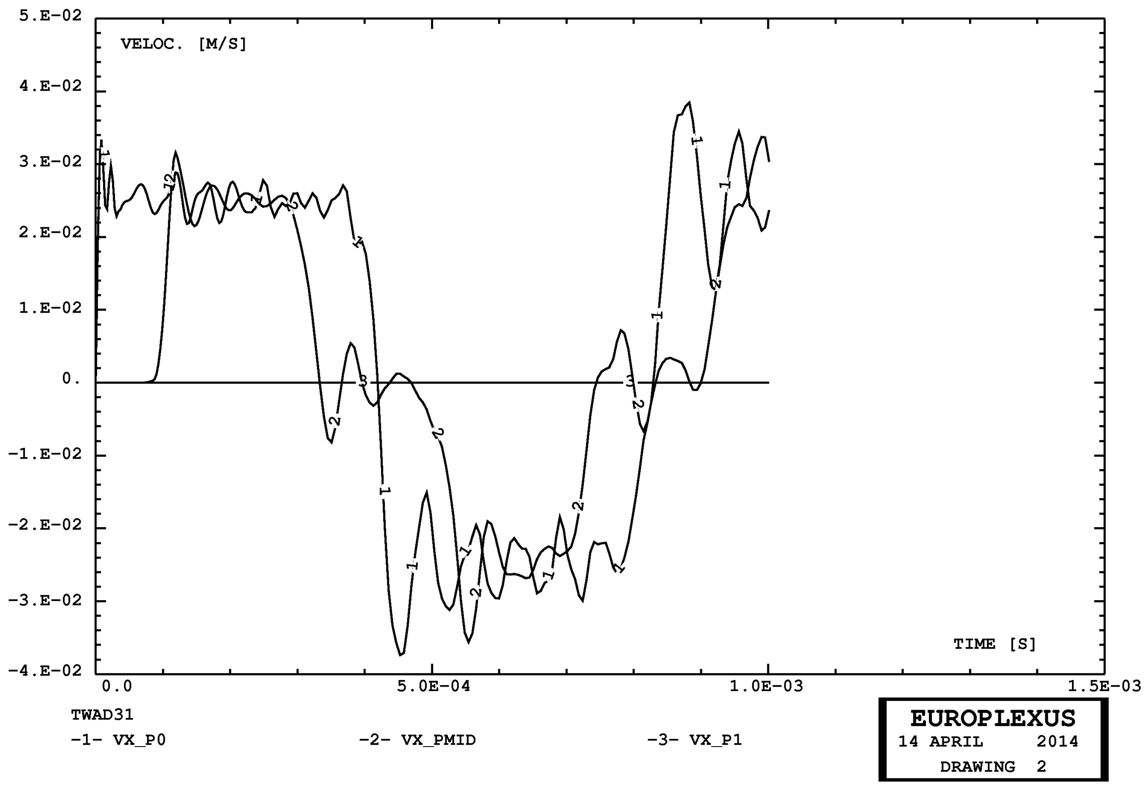


Figure 88 - Velocities in case TWAD31

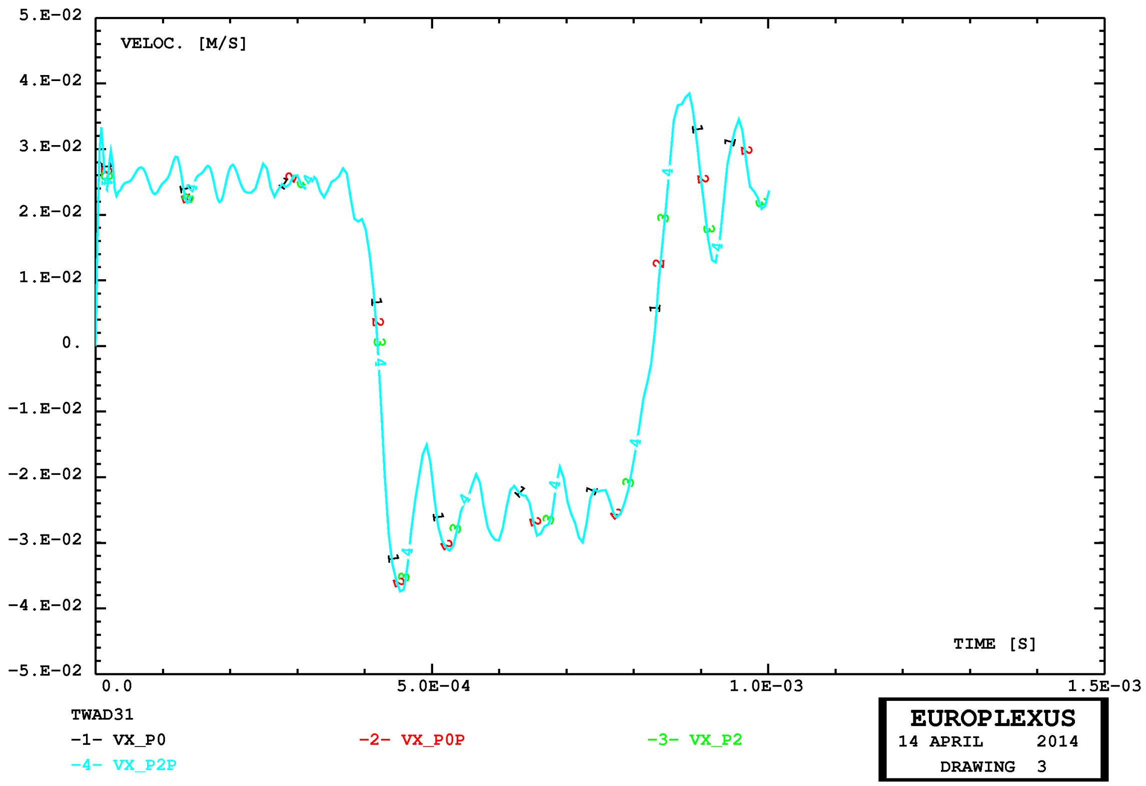


Figure 89 - Velocity of four symmetric points in case TWAD31

5. Conclusions

In this report the application of mesh adaptivity to simplex elements, the three-node triangle in 2D and the four-node tetrahedron in 3D, has been presented. The formulation is applied to structural (solid) elements as well as to fluid elements, the latter both using Finite Element (FE) and Cell-Centred Finite Volumes (CCFV).

Results for solid elements and for CCFV fluids are very encouraging, as shown in the numerical examples. As concerns fluid FEs, the results for the triangle in 2D (element FL23) are not very accurate, but acceptable. Instead, in 3D the results for the FL34 are very bad. This may be due to problems in the FL34 element itself, which become worse when adaptivity is activated. The subject is under investigation. For the moment, for 3D fluids it is advised to use the TEVF tetrahedron, which gives excellent results.

Among the things that remain to be done, is to allow the possibility of mixing up (contiguous) quadrilaterals and triangles in 2D applications with adaptivity, especially in fluids.

6. References

[1] F. CASADEI, P. DÍEZ, F. VERDUGO: “A Data Structure for Adaptivity in EUROPLEXUS”, JRC Technical Note PUBSY N. JRC60795, September 2010.

[2] F. CASADEI, P. DÍEZ, F. VERDUGO: “Adaptivity in FE Models for Fluids in EUROPLEXUS”, JRC Technical Note PUBSY N. JRC61622, November 2010.

[3] F. CASADEI, P. DÍEZ, F. VERDUGO: “Adaptive 3D Refinement and Un-refinement of 8-node Solid and Fluid Hexahedra in EUROPLEXUS”, JRC Technical Note PUBSY N. JRC63833, March 2011.

[4] F. CASADEI, P. DÍEZ, F. VERDUGO: “Implementation of a 2D Adaptivity Indicator for Fast Transient Dynamics in EUROPLEXUS”, JRC Technical Note PUBSY N. JRC64506, April 2011.

[5] F. CASADEI, P. DÍEZ, F. VERDUGO: “Further Development of 2D Adaptivity Error Indicators in EUROPLEXUS”, JRC Technical Note, PUBSY No. JRC66337, September 2011.

[6] F. VERDUGO, P. DÍEZ, F. CASADEI: “Natural quantities of interest in linear elastodynamics for goal oriented error estimation and adaptivity”, Proceedings of the V International Conference on Adaptive Modeling and Simulation (ADMOS 2011), D. Aubry and P. Díez (Eds), Paris, France, 6-8 June 2011.

[7] F. VERDUGO, P. DÍEZ, F. CASADEI: “General form of the natural quantities of interest for goal oriented error assessment and adaptivity in linear elastodynamics”, Submitted for publication in the International Journal for Numerical Methods in Engineering, DOI: 10.1002/nme, PUBSY No. JRC65788, July 2011.

[8] F. CASADEI, G. VALSAMOS, P. DÍEZ, F. VERDUGO: “Implementation of Adaptivity in 2D Cell Centred Finite Volumes in EUROPLEXUS”, Technical Note, PUBSY No. JRC67859, December 2011.

[9] F. CASADEI, P. DÍEZ, F. VERDUGO: “Implementation of Adaptivity in 3D Cell Centred Finite Volumes in EUROPLEXUS”, Technical Note, PUBSY No. JRC68168, December 2011.

[10] F. CASADEI, P. DÍEZ, F. VERDUGO: “Testing Adaptivity in 2D Cell Centred Finite Volumes with the CDEM Combustion Model in EUROPLEXUS”, Technical Note, PUBSY No. JRC68333, December 2011.

[11] F. CASADEI, P. DÍEZ, F. VERDUGO: “An algorithm for mesh refinement and un-refinement in fast transient dynamics”, International Journal of Computational Methods, DOI 10.1142/S0219876213500187, Vol. 10, No. 4, pp. 1350018-1 / 1350018-31, 2013.

[12] F. CASADEI, G. VALSAMOS, A. BECCANTINI: “Combination of Mesh Adaptivity with Fluid-

Structure Interaction in EUROPLEXUS”, Technical Note, in publication, 2014.

[13] “*EUROPLEXUS User’s Manual*”, on-line version: http://europlexus.jrc.ec.europa.eu.

Appendix

Sample input files

This Section contains, in alphabetical file order, the listings of all input files related to the examples which were proposed in the previous Sections.

bicu01.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'BICU01';
opti sauv form 'bicu01.msh';
opti trac psc ftra 'bicu01_mesh.ps';
p0 = 0 0 0;
dd = 1.0;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bicu01.epx

```
BICU01
ECHO
!CONV WIN
CAST mesh
TRID LAGR
GEOM CUBE bar TERM
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0 Z1 0
                              X2 100 Y2 0 Z2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*=====================================================================
FIN
```

bicu01a.epx

```
BICU01A
ECHO
RESU ALIC 'bicu01.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
FIN
```

bicu02.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'BICU02';
opti sauv form 'bicu02.msh';
opti trac psc ftra 'bicu02_mesh.ps';
p0 = 0 0 0;
dd = 1.0;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bicu02.epx

```
BICU02
ECHO
!CONV WIN
CAST mesh
TRID LAGR
DIME
  ADAP NPOI 145 CUBE 80 ENDA
TERM
GEOM CUBE bar TERM
WAVE 2 PLAN  X 100  Y 0  Z 0 T0 0
            NX  -1 NY 0 NZ 0 C 5000 MAXL 2 H1 6 H2 20
       PLAN  X   0  Y 0  Z 0 T0 20.E-3
            NX   1 NY 0 NZ 0 C 5000 MAXL 2 H1 6 H2 20
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0 Z1 0
                              X2 100 Y2 0 Z2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar _cube TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
```

```
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*======================================================================
FIN
```

bicu02a.epx

```
BICU02A
ECHO
RESU ALIC 'bicu02.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
FIN
```

bicu03.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'BICU03';
opti sauv form 'bicu03.msh';
opti trac psc ftra 'bicu03_mesh.ps';
p0 = 0 0 0;
dd = 1.0;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bicu03.epx

```
BICU03
ECHO
!CONV WIN
CAST mesh
TRID LAGR
DIME
  ADAP NPOI 955 CUBE 688 ENDA
TERM
GEOM CUBE bar TERM
WAVE 2 PLAN  X 100  Y 0  Z 0 T0 0
           NX  -1 NY 0 NZ 0 C 5000 MAXL 3 H1 6 H2 20
       PLAN  X   0  Y 0  Z 0 T0 20.E-3
           NX   1 NY 0 NZ 0 C 5000 MAXL 3 H1 6 H2 20
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
           'xaxis' LECT bar TERM
                   COND LINE X1   0 Y1 0 Z1 0
                            X2 100 Y2 0 Z2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar _cube TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*======================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*======================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*======================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*======================================================================
FIN
```

bicu03a.epx

```
BICU03A
ECHO
RESU ALIC 'bicu03.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
RCOU 11 'vx_10' FICH 'bicu01a.pun' RENA 'vx_10_01'
RCOU 13 'vx_30' FICH 'bicu01a.pun' RENA 'vx_30_01'
RCOU 21 'vx_10' FICH 'bicu02a.pun' RENA 'vx_10_02'
RCOU 23 'vx_30' FICH 'bicu02a.pun' RENA 'vx_30_02'
TRAC 11 21 1 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG
TRAC 13 23 3 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG
FIN
```

bite01.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'BITE01';
opti sauv form 'bite01.msh';
opti trac psc ftra 'bite01_mesh.ps';
p0 = 0 0 0;
dd = 1.0;
n = 100;
tol = 0.01;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bite01.epx

```
BITE01
ECHO
!CONV WIN
CAST mesh
TRID LAGR
GEOM TETR bar TERM
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
           'xaxis' LECT bar TERM
                   COND LINE X1   0 Y1 0 Z1 0
                            X2 100 Y2 0 Z2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0.3
     LECT bar TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 10.E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
```

```
FIN
```

bite01a.epx

```
BITE01A
ECHO
RESU ALIC 'bite01.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
FIN
```

bite02.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'BITE02';
opti sauv form 'bite02.msh';
opti trac psc ftra 'bite02_mesh.ps';
p0 = 0 0 0;
dd = 1.0;
n = 100;
tol = 0.01;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bite02.epx

```
BITE02
ECHO
!CONV WIN
CAST mesh
TRID LAGR
DIME
  ADAP NPOI 222 TETR 960 ENDA
TERM
GEOM TETR bar TERM
WAVE 2 PLAN  X 100  Y 0  Z 0 T0 0
            NX  -1 NY 0 NZ 0 C 5000 MAXL 2 H1 6 H2 20
       PLAN  X   0  Y 0  Z 0 T0 20.E-3
            NX   1 NY 0 NZ 0 C 5000 MAXL 2 H1 6 H2 20
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0 Z1 0
                              X2 100 Y2 0 Z2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar _tetr TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*=====================================================================
FIN
```

bite02a.epx

```
BITE02A
ECHO
RESU ALIC 'bite02.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
FIN
```

bite03.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'BITE03';
opti sauv form 'bite03.msh';
opti trac psc ftra 'bite03_mesh.ps';
p0 = 0 0 0;
dd = 1.0;
n = 100;
tol = 0.01;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bite03.epx

```
BITE03
ECHO
!CONV WIN
CAST mesh
TRID LAGR
DIME
  ADAP NPOI 10000 TETR 30000 ENDA
TERM
GEOM TETR bar TERM
WAVE 2 PLAN  X 100  Y 0  Z 0 T0 0
            NX  -1 NY 0 NZ 0 C 5000 MAXL 3 H1 6 H2 20
       PLAN  X   0  Y 0  Z 0 T0 20.E-3
            NX   1 NY 0 NZ 0 C 5000 MAXL 3 H1 6 H2 20
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0 Z1 0
                              X2 100 Y2 0 Z2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar _tetr TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
          POIN LECT 1 TERM
          ELEM LECT 1 TERM
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=====================================================================
SUIT
```

```
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*=====================================================================
FIN
```

bite03a.epx

```
BITE03A
ECHO
RESU ALIC 'bite03.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
RCOU 11 'vx_10' FICH 'bite01a.pun' RENA 'vx_10_01'
RCOU 13 'vx_30' FICH 'bite01a.pun' RENA 'vx_30_01'
RCOU 21 'vx_10' FICH 'bite02a.pun' RENA 'vx_10_02'
RCOU 23 'vx_30' FICH 'bite02a.pun' RENA 'vx_30_02'
TRAC 11 21 1 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG
TRAC 13 23 3 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG
RCOU 111 'vx_10' FICH 'bite01a.pun' RENA 'vx_10_te01'
RCOU 113 'vx_30' FICH 'bite01a.pun' RENA 'vx_30_te01'
RCOU 121 'vx_10' FICH 'bite02a.pun' RENA 'vx_10_te02'
RCOU 123 'vx_30' FICH 'bite02a.pun' RENA 'vx_30_te02'
RCOU 101 'vx_10' FICH 'bite03a.pun' RENA 'vx_10_te03'
RCOU 103 'vx_30' FICH 'bite03a.pun' RENA 'vx_30_te03'
TRAC 11 21 1 111 121 101 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG NOIR VERT ROUG
DASH 0    0    0    2    2    2
TRAC 13 23 3 113 123 103 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG NOIR VERT ROUG
DASH 0    0    0    2    2    2
FIN
```

bitr01.dgibi

```
opti echo 1;
opti dime 2 elem qua4;
opti titr 'BITR01';
opti sauv form 'bitr01.msh';
opti trac psc ftra 'bitr01_mesh.ps';
p0 = 0 0;
dd = 1.0;
n = 100;
p1 = 0 dd;
c1 = p0 d 1 p1;
bar4 = c1 tran n ((n*dd) 0);
bar = chan tri3 bar4;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bitr01.epx

```
BITR01
ECHO
!CONV WIN
CAST mesh
LAGR CPLA
GEOM TRIA bar TERM
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0
                              X2 100 Y2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=====================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*=====================================================================
FIN
```

bitr01a.epx

```
BITR01A
ECHO
RESU ALIC 'bitr01.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
FIN
```

bitr02.dgibi

```
opti echo 1;
opti dime 2 elem qua4;
opti titr 'BITR02';
opti sauv form 'bitr02.msh';
opti trac psc ftra 'bitr02_mesh.ps';
p0 = 0 0;
dd = 1.0;
n = 100;
p1 = 0 dd;
c1 = p0 d 1 p1;
bar4 = c1 tran n ((n*dd) 0);
bar = chan tri3 bar4;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bitr02.epx

```
BITR02
ECHO
!CONV WIN
CAST mesh
LAGR CPLA
DIME
  ADAP NPOI 41 TRIA 80 ENDA
TERM
GEOM TRIA bar TERM
WAVE 2 PLAN  X 100  Y 0  Z 0 T0 0
           NX  -1 NY 0 NZ 0 C 5000 MAXL 2 H1 6 H2 20
```

```
       PLAN  X   0  Y 0  Z 0 T0 20.E-3
            NX   1 NY 0 NZ 0 C 5000 MAXL 2 H1 6 H2 20
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0
                             X2 100 Y2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar _tria TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=======================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=======================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=======================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*=======================================================================
FIN
```

bitr02a.epx

```
BITR02A
ECHO
RESU ALIC 'bitr02.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
FIN
```

bitr03.dgibi

```
opti echo 1;
opti dime 2 elem qua4;
opti titr 'BITR03';
opti sauv form 'bitr03.msh';
opti trac psc ftra 'bitr03_mesh.ps';
p0 = 0 0;
dd = 1.0;
n = 100;
p1 = 0 dd;
c1 = p0 d 1 p1;
bar4 = c1 tran n ((n*dd) 0);
bar = chan tri3 bar4;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

bitr03.epx

```
BITR03
ECHO
!CONV WIN
CAST mesh
LAGR CPLA
DIME
  ADAP NPOI 180 TRIA 388 ENDA
TERM
GEOM TRIA bar TERM
WAVE 2 PLAN  X 100  Y 0  Z 0 T0 0
            NX  -1 NY 0 NZ 0 C 5000 MAXL 3 H1 6 H2 20
       PLAN  X   0  Y 0  Z 0 T0 20.E-3
            NX   1 NY 0 NZ 0 C 5000 MAXL 3 H1 6 H2 20
COMP COUL VERT LECT bar TERM
     NGRO 2 'end'   LECT bar TERM COND X GT 99.9
            'xaxis' LECT bar TERM
                    COND LINE X1   0 Y1 0
                             X2 100 Y2 0 TOL 0.01
MATE LINE RO 8000 YOUN 2.E11 NU 0
     LECT bar _tria TERM
LINK COUP BLOQ 1 LECT end TERM
INIT VITE 1 100.0 LECT bar DIFF end TERM
ECRI DEPL VITE ACCE FINT FEXT FLIA FDEC CONT ECRO TFRE 10.E-3
     FICH ALIC TFRE 0.4E-3
OPTI PAS AUTO NOTE LOG 1
CALC TINI 0 TEND 40.E-3
*=======================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
*=======================================================================
SUIT
Post-treatment from alice file
ECHO
RESU ALIC PSCR GARD
SORT VISU NSTO 1
*=======================================================================
PLAY
CAME   1 EYE   5.00000E+01  5.00000E-01  1.75518E+02
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
!NAVIGATION MODE: ROTATING CAMERA
!CENTER :  5.00000E+01  5.00000E-01  5.00000E-01
!RSPHERE:  5.00050E+01
!RADIUS :  1.75018E+02
!ASPECT :  1.33333E+00
!NEAR   :  1.25013E+02
!FAR    :  2.75028E+02
SCEN GEOM NAVI FREE
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 640 480 FICH AVI NOCL NFTO 101 FPS 15 KFRE 10 COMP -1
     REND
FREQ 1
GOTR LOOP 99 OFFS SIZE 640 480 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 640 480 FICH AVI CONT REND
ENDPLAY
*=======================================================================
FIN
```

bitr03a.epx

```
BITR03A
ECHO
RESU ALIC 'bitr03.ali' PSCR GARD
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 0 'vx_00' VITE COMP 1 T  0.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 1 'vx_10' VITE COMP 1 T 10.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 2 'vx_20' VITE COMP 1 T 20.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 3 'vx_30' VITE COMP 1 T 30.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
SCOU 4 'vx_40' VITE COMP 1 T 40.E-3 SAXE 1.0 'Abscissa' LECT xaxis TERM
TRAC 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
COLO ROUG NOIR VERT TURQ ROSE
LIST 0 1 2 3 4 AXES 1.0 'Velocity [m/s]' YZER
RCOU 11 'vx_10' FICH 'bitr01a.pun' RENA 'vx_10_01'
RCOU 13 'vx_30' FICH 'bitr01a.pun' RENA 'vx_30_01'
RCOU 21 'vx_10' FICH 'bitr02a.pun' RENA 'vx_10_02'
RCOU 23 'vx_30' FICH 'bitr02a.pun' RENA 'vx_30_02'
TRAC 11 21 1 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG
TRAC 13 23 3 AXES 1.0 'Velocity [m/s]' YZER
COLO NOIR VERT ROUG
FIN
```

cuad11.epx

```
CUAD11
ECHO
!CONV win
EULE TRID
DIME
  ADAP NPOI 38 NVFI 72 CUVF 16 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 8 CUVF 1 TERM
 0 0 0  1 0 0  1 1 0  0 1 0
 0 0 1  1 0 1  1 1 1  0 1 1
 1 2 3 4 5 6 7 8
MATE GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT 1 _cuvf TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP CHEC
!    LNKS STAT DUMP
 CSTA 0.5
 LOG 1
```

```
!VFCC FCON 1             ! OK
!VFCC FCON 2 VISC 0.75   ! OK
 VFCC FCON 3             ! OK
!VFCC FCON 4             ! OK
!VFCC FCON 5             ! OK
!VFCC FCON 6             ! OK
!VFCC FCON 7             ! OK
!VFCC FCON 8             ! OK
!VFCC FCON 9             ! OK
!VFCC FCON 10            ! OK
!VFCC FCON 11            ! OK
!VFCC FCON 12            ! OK
CALC TINI 0. TEND 50.0E-3 NMAX 4
*=====================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
GO
ADAP
  SPLI 2
TERM
TRAC REND
GO
ADAP
  USPL 2
TERM
TRAC REND
GO
ADAP
  USPL 1
TERM
TRAC REND
ENDPLAY
*=====================================================================
FIN
```

cush01.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'CUSH01';
opti sauv form 'cush01.msh';
opti trac psc ftra 'cush01_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

cush01.epx

```
CUSH01
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM CUVF bar TERM
COMP GROU 4 'bar1' LECT 1 PAS 1 50 TERM
            'bar2' LECT 51 PAS 1 100 TERM
            'ea' LECT 26 TERM
            'eb' LECT 75 TERM
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                  X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
!VFCC FCON 1             ! OK
!VFCC FCON 2 VISC 0.75   ! OK
 VFCC FCON 3             ! OK
!VFCC FCON 4             ! OK
!VFCC FCON 5             ! OK
!VFCC FCON 6             ! OK
!VFCC FCON 7             ! OK
!VFCC FCON 8             ! OK
!VFCC FCON 9             ! OK
!VFCC FCON 10            ! OK
!VFCC FCON 11            ! OK
!VFCC FCON 12            ! OK
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  2.15823E+1 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.96368E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.19231E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81994E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.45160E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  2.08015E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'cush01t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

cush07.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'CUSH07';
opti sauv form 'cush07.msh';
opti trac psc ftra 'cush07_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

cush07.epx

```
CUSH07
ECHO
!CONV win
CAST mesh
```

```
EULE TRID
DIME
  ADAP NPOI 1045 NVFI 2624 CUVF 712 ENDA
TERM
GEOM CUVF bar TERM
COMP GROU 4 'bar1' LECT 1 PAS 1 50 TERM
            'bar2' LECT 51 PAS 1 100 TERM
            'ea' LECT 26 TERM
            'eb' LECT 75 TERM
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                          X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 3 H1 0.015 H2 0.05
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 _cuvf TERM
ECRI ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
RCOU 11 'p_61'  FICH 'cush01.pun' RENA 'p_61_01'
RCOU 12 'ro_61' FICH 'cush01.pun' RENA 'ro_61_01'
RCOU 15 'vx_61' FICH 'cush01.pun' RENA 'vx_61_01'
TRAC 11 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR VERT ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 12 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR VERT ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 15 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR VERT ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  6.75052E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95556E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.70465E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81378E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.80176E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  2.00207E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'cush07t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
RCOU 11 'p_ea'  FICH 'cush01t.pun' RENA 'p_ea_01'
RCOU 12 'ro_ea' FICH 'cush01t.pun' RENA 'ro_ea_01'
RCOU 13 'vx_ea' FICH 'cush01t.pun' RENA 'vx_ea_01'
RCOU 14 'p_eb'  FICH 'cush01t.pun' RENA 'p_eb_01'
RCOU 15 'ro_eb' FICH 'cush01t.pun' RENA 'ro_eb_01'
RCOU 16 'vx_eb' FICH 'cush01t.pun' RENA 'vx_eb_01'
TRAC 1 4 11 14 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR VERT VERT
TRAC 2 5 12 15 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR VERT VERT
TRAC 3 6 13 16 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR VERT VERT
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

cush11.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'CUSH11';
opti sauv form 'cush11.msh';
opti trac psc ftra 'cush11_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

cush11.epx

```
CUSH11
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM CUVF bar TERM
COMP GROU 4 'bar1' LECT 1 PAS 1 50 TERM
            'bar2' LECT 51 PAS 1 100 TERM
            'ea' LECT 26 TERM
            'eb' LECT 75 TERM
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                          X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
      ORDR 2    ! Ordre 2 en espace
      OTPS 2    ! Ordre 2 en temps
      RECO 1    ! Reconstruction de type Green-Gauss
      LMAS 3    ! k-limiteur de Dubois (eq. masse)
      LQDM 3    ! k-limiteur de Dubois (eq. QDM)
      LENE 3    ! k-limiteur de Dubois (eq. energie)
      KMAS 0.75 ! Coefficient de limitation (eq. masse)
      KQDM 0.75 ! Coefficient de limitation (eq. QDM)
      KENE 0.75 ! Coefficient de limitation (eq. energie)
      CENE      ! Correction de l'energie interne
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
```

```
                          VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  3.99030E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95184E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.84641E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81041E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.89743E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.89723E+0 TOLE 2.E-2
*==================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'cush11t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*==================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*==================================================================
FIN
```

cush17.dgibi

```
opti echo 1;
opti dime 3 elem cub8;
opti titr 'CUSH17';
opti sauv form 'cush17.msh';
opti trac psc ftra 'cush17_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar = base volu n tran ((n*dd) 0 0);
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

cush17.epx

```
CUSH17
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 1045 NVFI 2624 CUVF 712 ENDA
TERM
GEOM CUVF bar TERM
COMP GROU 4 'bar1' LECT 1 PAS 1 50 TERM
            'bar2' LECT 51 PAS 1 100 TERM
            'ea' LECT 26 TERM
            'eb' LECT 75 TERM
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                             X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.27828983645 9 ! c.d. wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 3 H1 0.015 H2 0.05
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 _cuvf TERM
ECRI ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
!VFCC FCON 1             ! OK
!VFCC FCON 2 VISC 0.75   ! OK
 VFCC FCON 3             ! OK
!VFCC FCON 4             ! OK
!VFCC FCON 5             ! OK
!VFCC FCON 6             ! OK
!VFCC FCON 7             ! OK
!VFCC FCON 8             ! OK
!VFCC FCON 9             ! OK
!VFCC FCON 10            ! OK
!VFCC FCON 11            ! OK
!VFCC FCON 12            ! OK
      ORDR 2    ! Ordre 2 en espace
      OTPS 2    ! Ordre 2 en temps
      RECO 1    ! Reconstruction de type Green-Gauss
      LMAS 3    ! k-limiteur de Dubois (eq. masse)
      LQDM 3    ! k-limiteur de Dubois (eq. QDM)
      LENE 3    ! k-limiteur de Dubois (eq. energie)
      KMAS 0.75 ! Coefficient de limitation (eq. masse)
      KQDM 0.75 ! Coefficient de limitation (eq. QDM)
      KENE 0.75 ! Coefficient de limitation (eq. energie)
      CENE      ! Correction de l'energie interne
CALC TINI 0. TEND 0.60E-3
*==================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
RCOU 11 'p_61'  FICH 'cush11.pun' RENA 'p_61_11'
RCOU 12 'ro_61' FICH 'cush11.pun' RENA 'ro_61_11'
RCOU 15 'vx_61' FICH 'cush11.pun' RENA 'vx_61_11'
TRAC 11 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR VERT ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 12 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR VERT ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 15 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR VERT ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  1.98076E-1 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95348E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.99129E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81236E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.99419E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.92754E+0 TOLE 2.E-2
*==================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'cush17t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
RCOU 11 'p_ea'  FICH 'cush11t.pun' RENA 'p_ea_11'
RCOU 12 'ro_ea' FICH 'cush11t.pun' RENA 'ro_ea_11'
RCOU 13 'vx_ea' FICH 'cush11t.pun' RENA 'vx_ea_11'
RCOU 14 'p_eb'  FICH 'cush11t.pun' RENA 'p_eb_11'
RCOU 15 'ro_eb' FICH 'cush11t.pun' RENA 'ro_eb_11'
RCOU 16 'vx_eb' FICH 'cush11t.pun' RENA 'vx_eb_11'
TRAC 1 4 11 14 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR VERT VERT
TRAC 2 5 12 15 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR VERT VERT
TRAC 3 6 13 16 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR VERT VERT
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
```

```
*===============================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!         Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*===============================================================
FIN
```

fvtu00.dgibi

```
opti echo 0;
opti donn 'pxordpoi.proc';
opti echo 1;
opti dime 2 elem qua4;
opti sauv form 'fvtu00.msh';
opti trac psc ftra 'fvtu00_mesh.ps';
p0 = 0 0;
p0p = p0 plus (0 0.00125);
pmid = 0.5 0;
p1 = 1 0;
p1p = p1 plus (0 0.00125);
pa = 0.25 0;
pb = 0.75 0;
tol = 1.E-5;
n = 800;
n2 = n / 2;
n4 = n2 / 2;
c11 = p0 d n4 pa;
c12 = pa d n4 pmid;
c1 = c11 et c12;
c21 = pmid d n4 pb;
c22 = pb d n4 p1;
c2 = c21 et c22;
bar11 = c11 tran 1 (0 0.00125);
bar12 = c12 tran 1 (0 0.00125);
bar1q = bar11 et bar12;
bar1 = chan tri3 bar1q;
bar21 = c21 tran 1 (0 0.00125);
bar22 = c22 tran 1 (0 0.00125);
bar2q = bar21 et bar22;
bar2 = chan tri3 bar2q;
bar = bar1 et bar2;
elim tol (bar et p0p et p1p et pa et pb);
ea = bar1 elem cont pa;
eb = bar2 elem cont pb;
xax = chan 'POI1' (c1 et c2);
xaxo = pxordpoi xax p0;
mesh = bar et ea et eb et xaxo;
tass mesh;
sauv form mesh;
trac qual mesh;
trac ((cont mesh) et ea et eb);
fin;
```

fvtu00.epx

```
FVTU00 (with mesh reduced to 800 x 1 x 2 to save CPU time)
ECHO
!CONV win
CAST mesh
EULE DPLA
GEOM T3VF bar TERM
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT pa pmid pb TERM
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 csta 0.5
 log 1
!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
CALC TINI 0. TEND 0.60E-3
*===============================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
!PERF 'bm_vfcc_adap_shocktube_2d_00.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  1.57251E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95347E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.93867E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81231E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.95907E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.92774E+0 TOLE 2.E-2
*===============================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!         Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
          LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
          LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*===============================================================
FIN
```

fvtu01.epx

```
FVTU01
ECHO
! CONV win
EULE DPLA
DIME
  ADAP NPOI 676 NVFI 2492 T3VF 1528 ENDA
TERM
GEOM LIBR POIN 206 CAR1 1 T3VF 200 TERM
 0.00 0.00  0.01 0.00  0.02 0.00  0.03 0.00  0.04 0.00  0.05 0.00
            0.06 0.00  0.07 0.00  0.08 0.00  0.09 0.00  0.10 0.00
            0.11 0.00  0.12 0.00  0.13 0.00  0.14 0.00  0.15 0.00
            0.16 0.00  0.17 0.00  0.18 0.00  0.19 0.00  0.20 0.00
            0.21 0.00  0.22 0.00  0.23 0.00  0.24 0.00  0.25 0.00
            0.26 0.00  0.27 0.00  0.28 0.00  0.29 0.00  0.30 0.00
            0.31 0.00  0.32 0.00  0.33 0.00  0.34 0.00  0.35 0.00
            0.36 0.00  0.37 0.00  0.38 0.00  0.39 0.00  0.40 0.00
            0.41 0.00  0.42 0.00  0.43 0.00  0.44 0.00  0.45 0.00
            0.46 0.00  0.47 0.00  0.48 0.00  0.49 0.00  0.50 0.00
            0.51 0.00  0.52 0.00  0.53 0.00  0.54 0.00  0.55 0.00
            0.56 0.00  0.57 0.00  0.58 0.00  0.59 0.00  0.60 0.00
            0.61 0.00  0.62 0.00  0.63 0.00  0.64 0.00  0.65 0.00
            0.66 0.00  0.67 0.00  0.68 0.00  0.69 0.00  0.70 0.00
            0.71 0.00  0.72 0.00  0.73 0.00  0.74 0.00  0.75 0.00
            0.76 0.00  0.77 0.00  0.78 0.00  0.79 0.00  0.80 0.00
            0.81 0.00  0.82 0.00  0.83 0.00  0.84 0.00  0.85 0.00
            0.86 0.00  0.87 0.00  0.88 0.00  0.89 0.00  0.90 0.00
            0.91 0.00  0.92 0.00  0.93 0.00  0.94 0.00  0.95 0.00
            0.96 0.00  0.97 0.00  0.98 0.00  0.99 0.00  1.00 0.00
 0.00 0.01  0.01 0.01  0.02 0.01  0.03 0.01  0.04 0.01  0.05 0.01
            0.06 0.01  0.07 0.01  0.08 0.01  0.09 0.01  0.10 0.01
            0.11 0.01  0.12 0.01  0.13 0.01  0.14 0.01  0.15 0.01
            0.16 0.01  0.17 0.01  0.18 0.01  0.19 0.01  0.20 0.01
            0.21 0.01  0.22 0.01  0.23 0.01  0.24 0.01  0.25 0.01
            0.26 0.01  0.27 0.01  0.28 0.01  0.29 0.01  0.30 0.01
            0.31 0.01  0.32 0.01  0.33 0.01  0.34 0.01  0.35 0.01
            0.36 0.01  0.37 0.01  0.38 0.01  0.39 0.01  0.40 0.01
            0.41 0.01  0.42 0.01  0.43 0.01  0.44 0.01  0.45 0.01
            0.46 0.01  0.47 0.01  0.48 0.01  0.49 0.01  0.50 0.01
            0.51 0.01  0.52 0.01  0.53 0.01  0.54 0.01  0.55 0.01
            0.56 0.01  0.57 0.01  0.58 0.01  0.59 0.01  0.60 0.01
            0.61 0.01  0.62 0.01  0.63 0.01  0.64 0.01  0.65 0.01
            0.66 0.01  0.67 0.01  0.68 0.01  0.69 0.01  0.70 0.01
            0.71 0.01  0.72 0.01  0.73 0.01  0.74 0.01  0.75 0.01
            0.76 0.01  0.77 0.01  0.78 0.01  0.79 0.01  0.80 0.01
            0.81 0.01  0.82 0.01  0.83 0.01  0.84 0.01  0.85 0.01
            0.86 0.01  0.87 0.01  0.88 0.01  0.89 0.01  0.90 0.01
            0.91 0.01  0.92 0.01  0.93 0.01  0.94 0.01  0.95 0.01
            0.96 0.01  0.97 0.01  0.98 0.01  0.99 0.01  1.00 0.01
```

```
0 0  1 0  1 1  0 1      ! bidon nodes (203 a 206)
203 204 205 206         ! bidon element (1)
  1   2 103
103 102   1
  2   3 103
104 103   3
  3   4 105
105 104   3
  4   5 105
106 105   5
  5   6 107
107 106   5
  6   7 107
108 107   7
  7   8 109
109 108   7
  8   9 109
110 109   9
  9  10 111
111 110   9
 10  11 111
112 111  11
 11  12 113
113 112  11
 12  13 113
114 113  13
 13  14 115
115 114  13
 14  15 115
116 115  15
 15  16 117
117 116  15
 16  17 117
118 117  17
 17  18 119
119 118  17
 18  19 119
120 119  19
 19  20 121
121 120  19
 20  21 121
122 121  21
 21  22 123
123 122  21
 22  23 123
124 123  23
 23  24 125
125 124  23
 24  25 125
126 125  25
 25  26 127
127 126  25
 26  27 127
128 127  27
 27  28 129
129 128  27
 28  29 129
130 129  29
 29  30 131
131 130  29
 30  31 131
132 131  31
 31  32 133
133 132  31
 32  33 133
134 133  33
 33  34 135
135 134  33
 34  35 135
136 135  35
 35  36 137
137 136  35
 36  37 137
138 137  37
 37  38 139
139 138  37
 38  39 139
140 139  39
 39  40 141
141 140  39
 40  41 141
142 141  41
 41  42 143
143 142  41
 42  43 143
144 143  43
 43  44 145
145 144  43
 44  45 145
146 145  45
 45  46 147
147 146  45
 46  47 147
148 147  47
 47  48 149
149 148  47
 48  49 149
150 149  49
 49  50 151
151 150  49
 50  51 151
152 151  51
 51  52 153
153 152  51
 52  53 153
154 153  53
 53  54 155
155 154  53
 54  55 155
156 155  55
 55  56 157
157 156  55
 56  57 157
158 157  57
 57  58 159
159 158  57
 58  59 159
160 159  59
 59  60 161
161 160  59
 60  61 161
162 161  61
 61  62 163
163 162  61
 62  63 163
164 163  63
 63  64 165
165 164  63
 64  65 165
166 165  65
 65  66 167
167 166  65
 66  67 167
168 167  67
 67  68 169
169 168  67
 68  69 169
170 169  69
 69  70 171
171 170  69
 70  71 171
172 171  71
 71  72 173
173 172  71
 72  73 173
174 173  73
 73  74 175
175 174  73
 74  75 175
176 175  75
 75  76 177
177 176  75
 76  77 177
178 177  77
 77  78 179
179 178  77
 78  79 179
180 179  79
 79  80 181
181 180  79
 80  81 181
182 181  81
 81  82 183
183 182  81
 82  83 183
184 183  83
 83  84 185
185 184  83
 84  85 185
186 185  85
 85  86 187
187 186  85
 86  87 187
188 187  87
 87  88 189
189 188  87
 88  89 189
190 189  89
 89  90 191
191 190  89
 90  91 191
192 191  91
 91  92 193
193 192  91
 92  93 193
194 193  93
 93  94 195
195 194  93
 94  95 195
196 195  95
 95  96 197
197 196  95
 96  97 197
198 197  97
 97  98 199
199 198  97
 98  99 199
200 199  99
 99 100 201
201 200  99
100 101 201
202 201 101
COMP GROU 6 'bar1' LECT   2 PAS 1 101 TERM
            'bar2' LECT 102 PAS 1 201 TERM
            'bar'  LECT bar1 bar2 TERM
            'ea'   LECT  51 TERM
            'eb'   LECT 151 TERM
            'bidon' LECT 1 TERM
     NGRO 7 'p0'   LECT   1 TERM
            'p0p'  LECT 102 TERM
            'p1'   LECT 101 TERM
            'p1p'  LECT 202 TERM
            'pa'   LECT  26 TERM
            'pmid' LECT  51 TERM
            'pb'   LECT  76 TERM
WAVE 4 PLAN X 0.5 Y 0 NX 1 NY 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 4 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX 1 NY 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 4 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX 1 NY 0 T0 0 C 18.2004723251679 ! r.wave (right)
            MAXL 4 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX -1 NY 0 T0 0 C 387.298334620742 ! r. wave (left)
            MAXL 4 H1 0.015 H2 0.05
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 _t3vf TERM
*
**** Material with no elements, then isolated from the rest.
*    In this way it is taken into account in the dimension of ECRO
*    in the extension region. One can check that this material
*    does not affect the final result.
*
     CREB
        PINI 1.2  PREF 1.2  TINI  1.090909090909
        KSI0 0.0 ! Unburnt region.
```

```
        K0 0.0
*
        TMAX 6000.
        R    1.0
        NESP 2
        ORDP 0
        NLHS 1
*
        COMP1
        MMOL 1.0 H0 -4.2  CREA 1.
        CV0  2.5
        YMAS 0.7 ! Mass fraction if the unburnt region
*
        COMP2
        MMOL 1.0 H0 -4.2  CREA -1.
        CV0  2.5
        YMAS 0.3 ! Mass fraction if the unburnt region
*
        LECT NONE TERM
*
     FANT 1.0 LECT bidon TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT pa pmid pb TERM
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 csta 0.5
 log 1
 VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
!VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
COMP NGRO 1 'xaxo' LECT 1 PAS 1 101 TERM
SORT GRAP
!PERF 'bm_vfcc_adap_shocktube_2d_01.pun'
AXTE 1.0 'Time [s]'
*
* Attention: le SUPP /LECT/ est **mandatoire** dans les directives ci-dessous
* car sinon on risque de traiter les noeuds de l'element "bidon" comme
* faisant partie de l'bscisse curviligne (qui doit etre basee seulement
* sur les VFCC)
* En general, il est toujours une bonne idee de specifier le SUPPort,
* s'il y a des doutes ...
*
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        SUPP LECT bar TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        SUPP LECT bar TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        SUPP LECT bar TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
!RCOU 21 'p_61'  FICH 'bm_vfcc_adap_shocktube_2d_00.pun'
!                RENA 'p_61_00'
!RCOU 22 'ro_61' FICH 'bm_vfcc_adap_shocktube_2d_00.pun'
!                RENA 'ro_61_00'
!RCOU 25 'vx_61' FICH 'bm_vfcc_adap_shocktube_2d_00.pun'
!                RENA 'vx_61_00'
!TRAC 61 71 21 AXES 1.0 'PRESS. [PA]'
!COLO noir roug vert
!TRAC 62 72 22 AXES 1.0 'DENS. [KG/M3]'
!COLO noir roug vert
!TRAC 65 75 25 AXES 1.0 'VELOC. [M/S]'
!COLO noir roug vert
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  1.72568E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95523E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.93201E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81384E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.95460E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.97372E+0 TOLE 2.E-2
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
          LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
               SUPP LECT bar TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP OBJE LECT bar TERM REND
SCEN GEOM NAVI FREE
          LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
               SUPP LECT bar TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP OBJE LECT bar TERM REND
ENDPLAY
*=================================================================
FIN
```

pxhex2t2.proc

```
'DEBPROC' pxhex2t2 hexa*'MAILLAGE';
*
*-------------------------------------------------
* Splits a hexahedron into 24 tetrahedra.
* First, the hexahedron is split into 6 pyramids,
* one for each face, by introducing an extra node
* at the centre of the hexahedron.
* Then, each pyramid is split into 4 tetrahedra,
* by adding an extra node at the centre of the
* corresponding face of the hexahedron.
* This produces twice as much tetrahedra as
* the procedure pxhex2te, and they are worse
* shaped (thinner), but the advantage
* is that the resulting mesh is symmetric.
*
* Input :
* -----
*     hexa : a mesh containing just one hexahedron
* Output :
* ------
*     tetr : mesh containing 24 tetrahedra
*-------------------------------------------------
*
hh = chan poi1 hexa;
*h = hh elem 1;
*
p1 = hh poin 1;
p2 = hh poin 2;
p3 = hh poin 3;
p4 = hh poin 4;
p5 = hh poin 5;
p6 = hh poin 6;
p7 = hh poin 7;
p8 = hh poin 8;
*
n1 = noeu p1;
n2 = noeu p2;
n3 = noeu p3;
n4 = noeu p4;
n5 = noeu p5;
n6 = noeu p6;
n7 = noeu p7;
n8 = noeu p8;
*
x1 y1 z1 = coor p1;
x2 y2 z2 = coor p2;
x3 y3 z3 = coor p3;
x4 y4 z4 = coor p4;
x5 y5 z5 = coor p5;
x6 y6 z6 = coor p6;
x7 y7 z7 = coor p7;
x8 y8 z8 = coor p8;
*
x9 = (x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8) / 8.0;
y9 = (y1 + y2 + y3 + y4 + y5 + y6 + y7 + y8) / 8.0;
z9 = (z1 + z2 + z3 + z4 + z5 + z6 + z7 + z8) / 8.0;
*
p9 = x9 y9 z9;
*
* Pyramid # 1
*
x10 = (x1 + x2 + x3 + x4) / 4.0;
y10 = (y1 + y2 + y3 + y4) / 4.0;
z10 = (z1 + z2 + z3 + z4) / 4.0;
*
p10 = x10 y10 z10;
t1 = manu tet4 p1 p2 p10 p9;
t2 = manu tet4 p2 p3 p10 p9;
t3 = manu tet4 p3 p4 p10 p9;
t4 = manu tet4 p4 p1 p10 p9;
*
* Pyramid # 2
*
x11 = (x1 + x2 + x5 + x6) / 4.0;
y11 = (y1 + y2 + y5 + y6) / 4.0;
z11 = (z1 + z2 + z5 + z6) / 4.0;
*
p11 = x11 y11 z11;
t5 = manu tet4 p2 p1 p11 p9;
t6 = manu tet4 p6 p2 p11 p9;
t7 = manu tet4 p5 p6 p11 p9;
t8 = manu tet4 p1 p5 p11 p9;
*
* Pyramid # 3
*
x12 = (x2 + x3 + x6 + x7) / 4.0;
y12 = (y2 + y3 + y6 + y7) / 4.0;
z12 = (z2 + z3 + z6 + z7) / 4.0;
*
p12 = x12 y12 z12;
t9  = manu tet4 p3 p2 p12 p9;
t10 = manu tet4 p7 p3 p12 p9;
t11 = manu tet4 p6 p7 p12 p9;
t12 = manu tet4 p2 p6 p12 p9;
*
* Pyramid # 4
```

```
*
x13 = (x3 + x4 + x7 + x8) / 4.0;
y13 = (y3 + y4 + y7 + y8) / 4.0;
z13 = (z3 + z4 + z7 + z8) / 4.0;
*
p13 = x13 y13 z13;
t13 = manu tet4 p4 p3 p13 p9;
t14 = manu tet4 p3 p7 p13 p9;
t15 = manu tet4 p7 p8 p13 p9;
t16 = manu tet4 p8 p4 p13 p9;
*
* Pyramid # 5
*
x14 = (x1 + x4 + x5 + x8) / 4.0;
y14 = (y1 + y4 + y5 + y8) / 4.0;
z14 = (z1 + z4 + z5 + z8) / 4.0;
*
p14 = x14 y14 z14;
t17 = manu tet4 p1 p4 p14 p9;
t18 = manu tet4 p4 p8 p14 p9;
t19 = manu tet4 p8 p5 p14 p9;
t20 = manu tet4 p5 p1 p14 p9;
*
* Pyramid # 6
*
x15 = (x5 + x6 + x7 + x8) / 4.0;
y15 = (y5 + y6 + y7 + y8) / 4.0;
z15 = (z5 + z6 + z7 + z8) / 4.0;
*
p15 = x15 y15 z15;
t21 = manu tet4 p6 p5 p15 p9;
t22 = manu tet4 p7 p6 p15 p9;
t23 = manu tet4 p8 p7 p15 p9;
t24 = manu tet4 p5 p8 p15 p9;
*
tetr = t1 et t2 et t3 et t4 et t5 et t6
       et t7 et t8 et t9 et t10 et t11 et t12
       et t13 et t14 et t15 et t16 et t17 et t18
       et t19 et t20 et t21 et t22 et t23 et t24;
*
finproc tetr;
```

pxhex2te.proc

```
'DEBPROC' pxhex2te hexa*'MAILLAGE';
*
*-------------------------------------------------
* Splits a hexahedron into 12 tetrahedra.
* First, the hexahedron is split into 6 pyramids,
* one for each face, by introducing an extra node
* at the centre of the hexahedron.
* Then, each pyramid is split into 2 tetrahedra.
* This is done along the plane that passes
* across the node (on the 4-node face of the pyramid)
* with the LOWEST global index, thus possible
* neighbours on the other side of the face will
* be split consistently.
* The advantage of this algorithm is that it is
* independent from the neighbours and yields
* consistent tetrahedra (faces are coincident).
*
* Input :
* -----
*     hexa : a mesh containing just one hexahedron
* Output :
* ------
*     tetr : mesh containing 12 tetrahedra
*-------------------------------------------------
*
hh = chan poi1 hexa;
*h = hh elem 1;
*
p1 = hh poin 1;
p2 = hh poin 2;
p3 = hh poin 3;
p4 = hh poin 4;
p5 = hh poin 5;
p6 = hh poin 6;
p7 = hh poin 7;
p8 = hh poin 8;
*
n1 = noeu p1;
n2 = noeu p2;
n3 = noeu p3;
n4 = noeu p4;
n5 = noeu p5;
n6 = noeu p6;
n7 = noeu p7;
n8 = noeu p8;
*
x1 y1 z1 = coor p1;
x2 y2 z2 = coor p2;
x3 y3 z3 = coor p3;
x4 y4 z4 = coor p4;
x5 y5 z5 = coor p5;
x6 y6 z6 = coor p6;
x7 y7 z7 = coor p7;
x8 y8 z8 = coor p8;
*
x9 = (x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8) / 8.0;
y9 = (y1 + y2 + y3 + y4 + y5 + y6 + y7 + y8) / 8.0;
z9 = (z1 + z2 + z3 + z4 + z5 + z6 + z7 + z8) / 8.0;
*
p9 = x9 y9 z9;
n9 = noeu p9;
*
* Pyramid # 1
*
nlow = n1; ilow = 1;
si ( n2 < nlow ) ; nlow = n2; ilow = 2; finsi;
si ( n6 < nlow ) ; nlow = n6; ilow = 1; finsi;
si ( n5 < nlow ) ; nlow = n5; ilow = 2; finsi;
si (ilow ega 1);
  t1 = manu tet4 p1 p5 p6 p9;
  t2 = manu tet4 p6 p2 p1 p9;
sinon;
  t1 = manu tet4 p2 p1 p5 p9;
  t2 = manu tet4 p5 p6 p2 p9;
finsi;
*
* Pyramid # 2
*
nlow = n2; ilow = 1;
si ( n3 < nlow ) ; nlow = n3; ilow = 2; finsi;
si ( n7 < nlow ) ; nlow = n7; ilow = 1; finsi;
si ( n6 < nlow ) ; nlow = n6; ilow = 2; finsi;
si (ilow ega 1);
  t3 = manu tet4 p2 p6 p7 p9;
  t4 = manu tet4 p7 p3 p2 p9;
sinon;
  t3 = manu tet4 p3 p2 p6 p9;
  t4 = manu tet4 p6 p7 p3 p9;
finsi;
*
* Pyramid # 3
*
nlow = n5; ilow = 1;
si ( n6 < nlow ) ; nlow = n6; ilow = 2; finsi;
si ( n7 < nlow ) ; nlow = n7; ilow = 1; finsi;
si ( n8 < nlow ) ; nlow = n8; ilow = 2; finsi;
si (ilow ega 1);
  t5 = manu tet4 p5 p8 p7 p9;
  t6 = manu tet4 p7 p6 p5 p9;
sinon;
  t5 = manu tet4 p6 p5 p8 p9;
  t6 = manu tet4 p8 p7 p6 p9;
finsi;
*
* Pyramid # 4
*
nlow = n4; ilow = 1;
si ( n1 < nlow ) ; nlow = n1; ilow = 2; finsi;
si ( n5 < nlow ) ; nlow = n5; ilow = 1; finsi;
si ( n8 < nlow ) ; nlow = n8; ilow = 2; finsi;
si (ilow ega 1);
  t7 = manu tet4 p4 p8 p5 p9;
  t8 = manu tet4 p5 p1 p4 p9;
sinon;
  t7 = manu tet4 p1 p4 p8 p9;
  t8 = manu tet4 p8 p5 p1 p9;
finsi;
*
* Pyramid # 5
*
nlow = n1; ilow = 1;
si ( n2 < nlow ) ; nlow = n2; ilow = 2; finsi;
si ( n3 < nlow ) ; nlow = n3; ilow = 1; finsi;
si ( n4 < nlow ) ; nlow = n4; ilow = 2; finsi;
si (ilow ega 1);
  t9  = manu tet4 p1 p2 p3 p9;
  t10 = manu tet4 p3 p4 p1 p9;
sinon;
  t9  = manu tet4 p4 p1 p2 p9;
  t10 = manu tet4 p2 p3 p4 p9;
finsi;
*
* Pyramid # 6
*
nlow = n3; ilow = 1;
si ( n4 < nlow ) ; nlow = n4; ilow = 2; finsi;
si ( n8 < nlow ) ; nlow = n8; ilow = 1; finsi;
si ( n7 < nlow ) ; nlow = n7; ilow = 2; finsi;
si (ilow ega 1);
  t11 = manu tet4 p3 p7 p8 p9;
  t12 = manu tet4 p8 p4 p3 p9;
sinon;
  t11 = manu tet4 p4 p3 p7 p9;
  t12 = manu tet4 p7 p8 p4 p9;
finsi;
*
tetr = t1 et t2 et t3 et t4 et t5 et t6
       et t7 et t8 et t9 et t10 et t11 et t12;
*
finproc tetr;
```

pxordpoi.proc

```
*$$$$ PXORDPOI
*
* pour ordonner une serie de points PLIN en partant de P1
*
* Input:
* =====
* PLIN = objet MAILLAGE de type POI1 (ligne de points)
* P1   = premier point de la ligne (typ POINT)
*
* Output:
* ======
* PORDO = objet MAILLAGE de type POI1 (ligne de points) contenant
*         les points ordonnes a partir de P1
*
'DEBPROC' PXORDPOI PLIN*'MAILLAGE' P1*'POINT' ;
*-----------------------------------------------------------------
*
PORDO=P1;
PPA=P1;
NE='NBEL' PLIN;
*
I=0;
'REPETER' LAB1 (NE-1);
  I=I + 1;
* mess I;
  PLIN= 'DIFF' ((PPA 'ET' PPA) 'ELEM' 1) PLIN;
  PPA=PLIN 'POIN' 'PROC' PPA;
  PORDO=PORDO 'ET' PPA;
'FIN' LAB1;
*
'FINPROC' PORDO;
```

pxq42t34.proc

```
'DEBPROC' pxq42t34 quad*'MAILLAGE';
*
*--------------------------------------------------
* Splits a 2D quadrilateral into 4 triangles, by adding a central node.
* The resulting mesh is symmetric.
*
* Input :
* -----
*     quad : a mesh containing just one quadrilateral in 2D
* Output :
* ------
*     tria : mesh containing 4 triangles in 2d
*--------------------------------------------------
*
hh = chan poi1 quad;
*
p1 = hh poin 1;
p2 = hh poin 2;
p3 = hh poin 3;
p4 = hh poin 4;
*
x1 y1 = coor p1;
x2 y2 = coor p2;
x3 y3 = coor p3;
x4 y4 = coor p4;
*
x5 = (x1 + x2 + x3 + x4) / 4.0;
y5 = (y1 + y2 + y3 + y4) / 4.0;
*
p5 = x5 y5;
*
t1 = manu tri3 p1 p2 p5;
t2 = manu tri3 p2 p3 p5;
t3 = manu tri3 p3 p4 p5;
t4 = manu tri3 p4 p1 p5;
*
tria = t1 et t2 et t3 et t4;
*
finproc tria;
```

qua4tri3.f

```
      PROGRAM qua4tri3
      IMPLICIT NONE
      INTEGER :: i, j, k, ijkl(4,10)
      DO i = 1, 10
        READ(5,1) ((ijkl(k,j), k = 1, 4), j = 1, 10)
        DO j = 1, 10
!           WRITE (6,2) (ijkl(k,j), k = 1, 4)
!   2       FORMAT (4I4)
          IF (MOD(j,2) == 0) THEN
            WRITE (6,2) ijkl(1,j), ijkl(2,j), ijkl(4,j)
            WRITE (6,2) ijkl(3,j), ijkl(4,j), ijkl(2,j)
          ELSE
            WRITE (6,2) ijkl(1,j), ijkl(2,j), ijkl(3,j)
            WRITE (6,2) ijkl(3,j), ijkl(4,j), ijkl(1,j)
          ENDIF
        END DO
      END DO
    1 FORMAT (4I4, 1X, 4I4, 1X, 4I4, 1X, 4I4)
    2 FORMAT (3I4)
      END PROGRAM qua4tri3
```

quad01.epx

```
QUAD01
ECHO
 CONV win
LAGR DPLA
DIME
  ADAP NPOI 5 FL24 4 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 4 FL24 1 TERM
 0 0  1 0  0 1  1 1
 1 2 4 3
MATE FLUT RO 1.0 EINT 2.5E5 GAMM 1.4 PB 0
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT 1 _fl24 TERM
LINK COUP BLOQ 1 LECT 1 2 3 4 TERM
               2 LECT 1 2 3 4 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 2
*=======================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
ADAP
  USPL 1
TERM
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

quad02.epx

```
QUAD01
ECHO
 CONV win
LAGR DPLA
DIME
  ADAP NPOI 9 FL24 8 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 6 FL24 2 TERM
 0 0  1 0  2 0  0 1  1 1 2 1
 1 2 5 4
 2 3 6 5
MATE FLUT RO 1.0 EINT 2.5E5 GAMM 1.4 PB 0
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT 1 2 _fl24 TERM
LINK COUP BLOQ 1 LECT 1 3 4 6 TERM
               2 LECT 1 2 3 4 5 6 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 4
*=======================================================================
PLAY
TRAC REND
ADAP SPLI 1 TERM
GO
TRAC REND
ADAP SPLI 2 TERM
GO
TRAC REND
ADAP USPL 1 TERM
GO
TRAC REND
ADAP USPL 2 TERM
GO
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

sh3a04.epx

```
SH3A04
ECHO
 CONV win
EULE TRID
DIME
  ADAP NPOI 1072 FL38 736 ENDA
TERM
GEOM LIBR POIN 404 FL38 100 TERM
 0.00 0.00 0.00 0.01 0.00 0.00 0.02 0.00 0.00 0.03 0.00 0.00
 0.04 0.00 0.00 0.05 0.00 0.00 0.06 0.00 0.00 0.07 0.00 0.00
 0.08 0.00 0.00 0.09 0.00 0.00 0.10 0.00 0.00 0.11 0.00 0.00
 0.12 0.00 0.00 0.13 0.00 0.00 0.14 0.00 0.00 0.15 0.00 0.00
 0.16 0.00 0.00 0.17 0.00 0.00 0.18 0.00 0.00 0.19 0.00 0.00
 0.20 0.00 0.00 0.21 0.00 0.00 0.22 0.00 0.00 0.23 0.00 0.00
 0.24 0.00 0.00 0.25 0.00 0.00 0.26 0.00 0.00 0.27 0.00 0.00
 0.28 0.00 0.00 0.29 0.00 0.00 0.30 0.00 0.00 0.31 0.00 0.00
 0.32 0.00 0.00 0.33 0.00 0.00 0.34 0.00 0.00 0.35 0.00 0.00
 0.36 0.00 0.00 0.37 0.00 0.00 0.38 0.00 0.00 0.39 0.00 0.00
 0.40 0.00 0.00 0.41 0.00 0.00 0.42 0.00 0.00 0.43 0.00 0.00
 0.44 0.00 0.00 0.45 0.00 0.00 0.46 0.00 0.00 0.47 0.00 0.00
 0.48 0.00 0.00 0.49 0.00 0.00 0.50 0.00 0.00 0.51 0.00 0.00
 0.52 0.00 0.00 0.53 0.00 0.00 0.54 0.00 0.00 0.55 0.00 0.00
 0.56 0.00 0.00 0.57 0.00 0.00 0.58 0.00 0.00 0.59 0.00 0.00
 0.60 0.00 0.00 0.61 0.00 0.00 0.62 0.00 0.00 0.63 0.00 0.00
 0.64 0.00 0.00 0.65 0.00 0.00 0.66 0.00 0.00 0.67 0.00 0.00
 0.68 0.00 0.00 0.69 0.00 0.00 0.70 0.00 0.00 0.71 0.00 0.00
 0.72 0.00 0.00 0.73 0.00 0.00 0.74 0.00 0.00 0.75 0.00 0.00
 0.76 0.00 0.00 0.77 0.00 0.00 0.78 0.00 0.00 0.79 0.00 0.00
 0.80 0.00 0.00 0.81 0.00 0.00 0.82 0.00 0.00 0.83 0.00 0.00
 0.84 0.00 0.00 0.85 0.00 0.00 0.86 0.00 0.00 0.87 0.00 0.00
 0.88 0.00 0.00 0.89 0.00 0.00 0.90 0.00 0.00 0.91 0.00 0.00
 0.92 0.00 0.00 0.93 0.00 0.00 0.94 0.00 0.00 0.95 0.00 0.00
 0.96 0.00 0.00 0.97 0.00 0.00 0.98 0.00 0.00 0.99 0.00 0.00
 1.00 0.00 0.00 0.00 0.01 0.00 0.01 0.01 0.00 0.02 0.01 0.00
 0.03 0.01 0.00 0.04 0.01 0.00 0.05 0.01 0.00 0.06 0.01 0.00
 0.07 0.01 0.00 0.08 0.01 0.00 0.09 0.01 0.00 0.10 0.01 0.00
 0.11 0.01 0.00 0.12 0.01 0.00 0.13 0.01 0.00 0.14 0.01 0.00
 0.15 0.01 0.00 0.16 0.01 0.00 0.17 0.01 0.00 0.18 0.01 0.00
 0.19 0.01 0.00 0.20 0.01 0.00 0.21 0.01 0.00 0.22 0.01 0.00
 0.23 0.01 0.00 0.24 0.01 0.00 0.25 0.01 0.00 0.26 0.01 0.00
 0.27 0.01 0.00 0.28 0.01 0.00 0.29 0.01 0.00 0.30 0.01 0.00
 0.31 0.01 0.00 0.32 0.01 0.00 0.33 0.01 0.00 0.34 0.01 0.00
 0.35 0.01 0.00 0.36 0.01 0.00 0.37 0.01 0.00 0.38 0.01 0.00
 0.39 0.01 0.00 0.40 0.01 0.00 0.41 0.01 0.00 0.42 0.01 0.00
 0.43 0.01 0.00 0.44 0.01 0.00 0.45 0.01 0.00 0.46 0.01 0.00
 0.47 0.01 0.00 0.48 0.01 0.00 0.49 0.01 0.00 0.50 0.01 0.00
 0.51 0.01 0.00 0.52 0.01 0.00 0.53 0.01 0.00 0.54 0.01 0.00
 0.55 0.01 0.00 0.56 0.01 0.00 0.57 0.01 0.00 0.58 0.01 0.00
 0.59 0.01 0.00 0.60 0.01 0.00 0.61 0.01 0.00 0.62 0.01 0.00
 0.63 0.01 0.00 0.64 0.01 0.00 0.65 0.01 0.00 0.66 0.01 0.00
 0.67 0.01 0.00 0.68 0.01 0.00 0.69 0.01 0.00 0.70 0.01 0.00
 0.71 0.01 0.00 0.72 0.01 0.00 0.73 0.01 0.00 0.74 0.01 0.00
 0.75 0.01 0.00 0.76 0.01 0.00 0.77 0.01 0.00 0.78 0.01 0.00
 0.79 0.01 0.00 0.80 0.01 0.00 0.81 0.01 0.00 0.82 0.01 0.00
 0.83 0.01 0.00 0.84 0.01 0.00 0.85 0.01 0.00 0.86 0.01 0.00
 0.87 0.01 0.00 0.88 0.01 0.00 0.89 0.01 0.00 0.90 0.01 0.00
 0.91 0.01 0.00 0.92 0.01 0.00 0.93 0.01 0.00 0.94 0.01 0.00
 0.95 0.01 0.00 0.96 0.01 0.00 0.97 0.01 0.00 0.98 0.01 0.00
 0.99 0.01 0.00 1.00 0.01 0.00 0.00 0.00 0.01 0.01 0.00 0.01
 0.02 0.00 0.01 0.03 0.00 0.01 0.04 0.00 0.01 0.05 0.00 0.01
 0.06 0.00 0.01 0.07 0.00 0.01 0.08 0.00 0.01 0.09 0.00 0.01
 0.10 0.00 0.01 0.11 0.00 0.01 0.12 0.00 0.01 0.13 0.00 0.01
 0.14 0.00 0.01 0.15 0.00 0.01 0.16 0.00 0.01 0.17 0.00 0.01
 0.18 0.00 0.01 0.19 0.00 0.01 0.20 0.00 0.01 0.21 0.00 0.01
 0.22 0.00 0.01 0.23 0.00 0.01 0.24 0.00 0.01 0.25 0.00 0.01
 0.26 0.00 0.01 0.27 0.00 0.01 0.28 0.00 0.01 0.29 0.00 0.01
```

```
 0.30 0.00 0.01 0.31 0.00 0.01 0.32 0.00 0.01 0.33 0.00 0.01
 0.34 0.00 0.01 0.35 0.00 0.01 0.36 0.00 0.01 0.37 0.00 0.01
 0.38 0.00 0.01 0.39 0.00 0.01 0.40 0.00 0.01 0.41 0.00 0.01
 0.42 0.00 0.01 0.43 0.00 0.01 0.44 0.00 0.01 0.45 0.00 0.01
 0.46 0.00 0.01 0.47 0.00 0.01 0.48 0.00 0.01 0.49 0.00 0.01
 0.50 0.00 0.01 0.51 0.00 0.01 0.52 0.00 0.01 0.53 0.00 0.01
 0.54 0.00 0.01 0.55 0.00 0.01 0.56 0.00 0.01 0.57 0.00 0.01
 0.58 0.00 0.01 0.59 0.00 0.01 0.60 0.00 0.01 0.61 0.00 0.01
 0.62 0.00 0.01 0.63 0.00 0.01 0.64 0.00 0.01 0.65 0.00 0.01
 0.66 0.00 0.01 0.67 0.00 0.01 0.68 0.00 0.01 0.69 0.00 0.01
 0.70 0.00 0.01 0.71 0.00 0.01 0.72 0.00 0.01 0.73 0.00 0.01
 0.74 0.00 0.01 0.75 0.00 0.01 0.76 0.00 0.01 0.77 0.00 0.01
 0.78 0.00 0.01 0.79 0.00 0.01 0.80 0.00 0.01 0.81 0.00 0.01
 0.82 0.00 0.01 0.83 0.00 0.01 0.84 0.00 0.01 0.85 0.00 0.01
 0.86 0.00 0.01 0.87 0.00 0.01 0.88 0.00 0.01 0.89 0.00 0.01
 0.90 0.00 0.01 0.91 0.00 0.01 0.92 0.00 0.01 0.93 0.00 0.01
 0.94 0.00 0.01 0.95 0.00 0.01 0.96 0.00 0.01 0.97 0.00 0.01
 0.98 0.00 0.01 0.99 0.00 0.01 1.00 0.00 0.01 0.00 0.01 0.01
 0.01 0.01 0.01 0.02 0.01 0.01 0.03 0.01 0.01 0.04 0.01 0.01
 0.05 0.01 0.01 0.06 0.01 0.01 0.07 0.01 0.01 0.08 0.01 0.01
 0.09 0.01 0.01 0.10 0.01 0.01 0.11 0.01 0.01 0.12 0.01 0.01
 0.13 0.01 0.01 0.14 0.01 0.01 0.15 0.01 0.01 0.16 0.01 0.01
 0.17 0.01 0.01 0.18 0.01 0.01 0.19 0.01 0.01 0.20 0.01 0.01
 0.21 0.01 0.01 0.22 0.01 0.01 0.23 0.01 0.01 0.24 0.01 0.01
 0.25 0.01 0.01 0.26 0.01 0.01 0.27 0.01 0.01 0.28 0.01 0.01
 0.29 0.01 0.01 0.30 0.01 0.01 0.31 0.01 0.01 0.32 0.01 0.01
 0.33 0.01 0.01 0.34 0.01 0.01 0.35 0.01 0.01 0.36 0.01 0.01
 0.37 0.01 0.01 0.38 0.01 0.01 0.39 0.01 0.01 0.40 0.01 0.01
 0.41 0.01 0.01 0.42 0.01 0.01 0.43 0.01 0.01 0.44 0.01 0.01
 0.45 0.01 0.01 0.46 0.01 0.01 0.47 0.01 0.01 0.48 0.01 0.01
 0.49 0.01 0.01 0.50 0.01 0.01 0.51 0.01 0.01 0.52 0.01 0.01
 0.53 0.01 0.01 0.54 0.01 0.01 0.55 0.01 0.01 0.56 0.01 0.01
 0.57 0.01 0.01 0.58 0.01 0.01 0.59 0.01 0.01 0.60 0.01 0.01
 0.61 0.01 0.01 0.62 0.01 0.01 0.63 0.01 0.01 0.64 0.01 0.01
 0.65 0.01 0.01 0.66 0.01 0.01 0.67 0.01 0.01 0.68 0.01 0.01
 0.69 0.01 0.01 0.70 0.01 0.01 0.71 0.01 0.01 0.72 0.01 0.01
 0.73 0.01 0.01 0.74 0.01 0.01 0.75 0.01 0.01 0.76 0.01 0.01
 0.77 0.01 0.01 0.78 0.01 0.01 0.79 0.01 0.01 0.80 0.01 0.01
 0.81 0.01 0.01 0.82 0.01 0.01 0.83 0.01 0.01 0.84 0.01 0.01
 0.85 0.01 0.01 0.86 0.01 0.01 0.87 0.01 0.01 0.88 0.01 0.01
 0.89 0.01 0.01 0.90 0.01 0.01 0.91 0.01 0.01 0.92 0.01 0.01
 0.93 0.01 0.01 0.94 0.01 0.01 0.95 0.01 0.01 0.96 0.01 0.01
 0.97 0.01 0.01 0.98 0.01 0.01 0.99 0.01 0.01 1.00 0.01 0.01
   1   2 103 102 203 204 305 304   2   3 104 103 204 205 306 305
   3   4 105 104 205 206 307 306   4   5 106 105 206 207 308 307
   5   6 107 106 207 208 309 308   6   7 108 107 208 209 310 309
   7   8 109 108 209 210 311 310   8   9 110 109 210 211 312 311
   9  10 111 110 211 212 313 312  10  11 112 111 212 213 314 313
  11  12 113 112 213 214 315 314  12  13 114 113 214 215 316 315
  13  14 115 114 215 216 317 316  14  15 116 115 216 217 318 317
  15  16 117 116 217 218 319 318  16  17 118 117 218 219 320 319
  17  18 119 118 219 220 321 320  18  19 120 119 220 221 322 321
  19  20 121 120 221 222 323 322  20  21 122 121 222 223 324 323
  21  22 123 122 223 224 325 324  22  23 124 123 224 225 326 325
  23  24 125 124 225 226 327 326  24  25 126 125 226 227 328 327
  25  26 127 126 227 228 329 328  26  27 128 127 228 229 330 329
  27  28 129 128 229 230 331 330  28  29 130 129 230 231 332 331
  29  30 131 130 231 232 333 332  30  31 132 131 232 233 334 333
  31  32 133 132 233 234 335 334  32  33 134 133 234 235 336 335
  33  34 135 134 235 236 337 336  34  35 136 135 236 237 338 337
  35  36 137 136 237 238 339 338  36  37 138 137 238 239 340 339
  37  38 139 138 239 240 341 340  38  39 140 139 240 241 342 341
  39  40 141 140 241 242 343 342  40  41 142 141 242 243 344 343
  41  42 143 142 243 244 345 344  42  43 144 143 244 245 346 345
  43  44 145 144 245 246 347 346  44  45 146 145 246 247 348 347
  45  46 147 146 247 248 349 348  46  47 148 147 248 249 350 349
  47  48 149 148 249 250 351 350  48  49 150 149 250 251 352 351
  49  50 151 150 251 252 353 352  50  51 152 151 252 253 354 353
  51  52 153 152 253 254 355 354  52  53 154 153 254 255 356 355
  53  54 155 154 255 256 357 356  54  55 156 155 256 257 358 357
  55  56 157 156 257 258 359 358  56  57 158 157 258 259 360 359
  57  58 159 158 259 260 361 360  58  59 160 159 260 261 362 361
  59  60 161 160 261 262 363 362  60  61 162 161 262 263 364 363
  61  62 163 162 263 264 365 364  62  63 164 163 264 265 366 365
  63  64 165 164 265 266 367 366  64  65 166 165 266 267 368 367
  65  66 167 166 267 268 369 368  66  67 168 167 268 269 370 369
  67  68 169 168 269 270 371 370  68  69 170 169 270 271 372 371
  69  70 171 170 271 272 373 372  70  71 172 171 272 273 374 373
  71  72 173 172 273 274 375 374  72  73 174 173 274 275 376 375
  73  74 175 174 275 276 377 376  74  75 176 175 276 277 378 377
  75  76 177 176 277 278 379 378  76  77 178 177 278 279 380 379
  77  78 179 178 279 280 381 380  78  79 180 179 280 281 382 381
  79  80 181 180 281 282 383 382  80  81 182 181 282 283 384 383
  81  82 183 182 283 284 385 384  82  83 184 183 284 285 386 385
  83  84 185 184 285 286 387 386  84  85 186 185 286 287 388 387
  85  86 187 186 287 288 389 388  86  87 188 187 288 289 390 389
  87  88 189 188 289 290 391 390  88  89 190 189 290 291 392 391
  89  90 191 190 291 292 393 392  90  91 192 191 292 293 394 393
  91  92 193 192 293 294 395 394  92  93 194 193 294 295 396 395
  93  94 195 194 295 296 397 396  94  95 196 195 296 297 398 397
  95  96 197 196 297 298 399 398  96  97 198 197 298 299 400 399
  97  98 199 198 299 300 401 400  98  99 200 199 300 301 402 401
  99 100 201 200 301 302 403 402 100 101 202 201 302 303 404 403
COMP GROU 5 'bar'  LECT  1 PAS 1 100 TERM
            'bar1' LECT  1 PAS 1  50 TERM
            'bar2' LECT 51 PAS 1 100 TERM
            'ea'   LECT 25 TERM
            'eb'   LECT 75 TERM
     NGRO 11 'p0'   LECT   1 TERM
             'p0p'  LECT 102 TERM
             'p1'   LECT 101 TERM
             'p1p'  LECT 202 TERM
             'pp0'  LECT 203 TERM
             'pp0p' LECT 304 TERM
             'pp1'  LECT 303 TERM
             'pp1p' LECT 404 TERM
             'pa'   LECT  26 TERM
             'pmid' LECT  51 TERM
             'pb'   LECT  76 TERM
WAVE 4 PLAN X 0.5 Y 0 NX 1 NY 0 NZ 0 T0 0 C 1672  ! shock wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX 1 NY 0 NZ 0 T0 0 C 925.4 ! contact discont. wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX 1 NY 0 NZ 0 T0 0 C 30.12 ! rarefaction wave (right)
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX -1 NY 0 NZ 0 T0 0 C 1020 ! rarefaction wave (left)
            MAXL 3 H1 0.015 H2 0.05
MATE FLUT RO 1.22 EINT 3.046E6 GAMM 1.269 PB 0 ITER 1 ALF0 1
          BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 0.1237 EINT 3.046E6 GAMM 1.269 PB 0 ITER 1 ALF0 1
          BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56 PMIN 0 NUM 1
          LECT bar2 _fl38 TERM
LINK COUP BLOQ 23 LECT bar TERM ! don't use "tous" here !!!
                                ! setting links on non-base nodes is NOT allowed
          BLOQ 1 LECT p0 p0p p1 p1p pp0 pp0p pp1 pp1p TERM
ECRI COOR DEPL VITE ACCE FINT FEXT FLIA CONT ECRO TFRE 0.35E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT pa pmid pb TERM
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 0.5E-5
OPTI NOTE STEP LIBR
 log 1
CALC TINI 0. TEND 0.35E-3
fin
*=================================================================
SUIT
3-a) Post treatment (animation from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
          FACE HFRO
     ISO  FILL FIEL VITE SCAL USER PROG 65 PAS 65 910 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH AVI NOCL NFTO 71 FPS 15 KFRE 10
                                                 COMP -1 REND
FREQ 1
GOTR LOOP 69 OFFS SIZE 1400 400 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 1400 400 FICH AVI CONT REND
ENDPLAY
*=================================================================
SUIT
3-b) Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'sh3a04.pun'
AXTE 1.0 'Time [s]'
COUR  4 'vx_pa'   VITE COMP 1 NOEU LECT pa   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_pb'   VITE COMP 1 NOEU LECT pb   TERM
COUR 11 'p_ea'    ECRO COMP 1 ELEM LECT ea   TERM
COUR 12 'p_eb'    ECRO COMP 1 ELEM LECT eb   TERM
COUR 13 'r_ea'    ECRO COMP 2 ELEM LECT ea   TERM
COUR 14 'r_eb'    ECRO COMP 2 ELEM LECT eb   TERM
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
TRAC 11 12 AXES 1.0 'PRESS. [PA]'
LIST 11 12 AXES 1.0 'PRESS. [PA]'
TRAC 13 14 AXES 1.0 'DENS. [KG/M3]'
LIST 13 14 AXES 1.0 'DENS. [KG/M3]'
*
QUAL VITE COMP 1 LECT pa   TERM REFE  2.90784E+2 TOLE 5.E-3
     VITE COMP 1 LECT pmid TERM REFE  8.30017E+2 TOLE 5.E-3
     VITE COMP 1 LECT pb   TERM REFE  9.18916E+2 TOLE 5.E-3
     ECRO COMP 1 LECT ea   TERM REFE  7.02092E+5 TOLE 5.E-3
     ECRO COMP 1 LECT eb   TERM REFE  2.95917E+5 TOLE 5.E-3
     ECRO COMP 2 LECT ea   TERM REFE  9.23395E-1 TOLE 5.E-3
     ECRO COMP 2 LECT eb   TERM REFE  4.59999E-1 TOLE 5.E-3
*=================================================================
SUIT
3-c) Post treatment (animation from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
          FACE HFRO
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 0.1 PAS 0.05 0.75 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH AVI NOCL NFTO 71 FPS 15 KFRE 10
                                                 COMP -1 REND
FREQ 1
GOTR LOOP 69 OFFS SIZE 1400 400 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 1400 400 FICH AVI CONT REND
ENDPLAY
*=================================================================
SUIT
3-d) Post-treatment (space plots from alice file)
ECHO
RESU ALIC GARD PSCR
COMP NGRO 1 'xaxo' LECT 1 PAS 1 101 TERM
SORT GRAP
PERF 'sh3a04s.pun'
AXTE 1.0 'Time [s]'
SCOU 51 'p_51'  NSTO 51 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 52 'ro_51' NSTO 51 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 53 'i_51'  NSTO 51 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 4
SCOU 54 'q_51'  NSTO 51 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 6
SCOU 55 'vx_51' NSTO 51 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
```

```
                        VITE COMP 1
TRAC 51 AXES 1.0 'PRESS. [PA]'
LIST 51 AXES 1.0 'PRESS. [PA]'
TRAC 52 AXES 1.0 'DENS. [KG/M3]'
LIST 52 AXES 1.0 'DENS. [KG/M3]'
TRAC 53 AXES 1.0 'EINT [J/KG]'
LIST 53 AXES 1.0 'EINT [J/KG]'
TRAC 54 AXES 1.0 'PSVISC [PA]'
LIST 54 AXES 1.0 'PSVISC [PA]'
TRAC 55 AXES 1.0 'VELOC. [M/S]'
LIST 55 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
3-f) Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 21
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.00000E+01
SCEN GEOM NAVI FREE
          FACE HFRO
     ISO  FILL FIEL VITE SCAL USER PROG 65 PAS 65 910 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
          FACE HFRO
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 0.1 PAS 0.05 0.75 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

shot00.dgibi

```
opti echo 0;
opti donn 'pxordpoi.proc';
opti echo 1;
opti dime 2 elem qua4;
opti sauv form 'shot00.msh';
opti trac psc ftra 'shot00_mesh.ps';
p0 = 0 0;
p0p = p0 plus (0 0.01);
pmid = 0.5 0;
p1 = 1 0;
p1p = p1 plus (0 0.01);
pa = 0.25 0;
pb = 0.75 0;
tol = 1.E-5;
n = 800;
n2 = n / 2;
n4 = n2 / 2;
c11 = p0 d n4 pa;
c12 = pa d n4 pmid;
c1 = c11 et c12;
c21 = pmid d n4 pb;
c22 = pb d n4 p1;
c2 = c21 et c22;
bar11 = c11 tran 8 (0 0.01);
bar12 = c12 tran 8 (0 0.01);
bar1q = bar11 et bar12;
bar1 = chan tri3 bar1q;
bar21 = c21 tran 8 (0 0.01);
bar22 = c22 tran 8 (0 0.01);
bar2q = bar21 et bar22;
bar2 = chan tri3 bar2q;
bar = bar1 et bar2;
elim tol (bar et p0p et p1p et pa et pb);
ea = bar1 elem cont pa;
eb = bar2 elem cont pb;
blox1 = p0 d 8 p0p;
blox2 = p1 d 8 p1p;
blox = blox1 et blox2;
bloy1 = p0 d 800 p1;
bloy2 = p0p d 800 p1p;
bloy = bloy1 et bloy2;
elim tol (bar et blox et bloy);
xax = chan 'POI1' (c1 et c2);
xaxo = pxordpoi xax p0;
mesh = bar et ea et eb et blox et bloy et xaxo;
tass mesh;
sauv form mesh;
trac qual mesh;
trac ((cont mesh) et ea et eb);
fin;
```

shot00.epx

```
SHOT00
ECHO
!CONV win
CAST mesh
EULE DPLA
GEOM FL23 bar TERM
MATE FLUT RO 1.22 EINT 3.046E6 GAMM 1.269 PB 0 ITER 1 ALF0 1
          BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 0.1237 EINT 3.046E6 GAMM 1.269 PB 0 ITER 1 ALF0 1
          BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56 PMIN 0 NUM 1
          LECT bar2 TERM
LINK COUP BLOQ 1 LECT blox TERM
          BLOQ 2 LECT bloy TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.15E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT pa pmid pb TERM
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 0.5E-5
OPTI NOTE STEP LIBR
 csta 0.5
 log 1
CALC TINI 0. TEND 0.15E-3
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
!PERFO 'bm_flu_adap_shocktri3_00.pun'
AXTE 1.0 'Time [s]'
COUR  4 'vx_pa'   VITE COMP 1 NOEU LECT pa   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_pb'   VITE COMP 1 NOEU LECT pb   TERM
COUR 11 'p_ea'    ECRO COMP 1 ELEM LECT ea   TERM
COUR 12 'p_eb'    ECRO COMP 1 ELEM LECT eb   TERM
COUR 13 'r_ea'    ECRO COMP 2 ELEM LECT ea   TERM
COUR 14 'r_eb'    ECRO COMP 2 ELEM LECT eb   TERM
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
TRAC 11 12 AXES 1.0 'PRESS. [PA]'
LIST 11 12 AXES 1.0 'PRESS. [PA]'
TRAC 13 14 AXES 1.0 'DENS. [KG/M3]'
LIST 13 14 AXES 1.0 'DENS. [KG/M3]'
*
QUAL VITE COMP 1 LECT pa   TERM REFE  0.00000E+0 TOLE 5.E-3
     VITE COMP 1 LECT pmid TERM REFE  8.22068E+2 TOLE 5.E-3
!    VITE COMP 1 LECT pb   TERM REFE  1.17686E-3 TOLE 5.E-3
     ECRO COMP 1 LECT ea   TERM REFE  9.99636E+5 TOLE 5.E-3
     ECRO COMP 1 LECT eb   TERM REFE  1.01357E+5 TOLE 5.E-3
     ECRO COMP 2 LECT ea   TERM REFE  1.22000E+0 TOLE 5.E-3
     ECRO COMP 2 LECT eb   TERM REFE  1.23700E-1 TOLE 5.E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
!PERFO 'bm_flu_adap_shocktri3_s0.pun'
AXTE 1.0 'Time [s]'
SCOU 31 'p_31'  NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 32 'ro_31' NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 33 'i_31'  NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 4
SCOU 34 'q_31'  NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 6
SCOU 35 'vx_31' NSTO 31 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
TRAC 31 AXES 1.0 'PRESS. [PA]'
LIST 31 AXES 1.0 'PRESS. [PA]'
TRAC 32 AXES 1.0 'DENS. [KG/M3]'
LIST 32 AXES 1.0 'DENS. [KG/M3]'
TRAC 33 AXES 1.0 'EINT [J/KG]'
LIST 33 AXES 1.0 'EINT [J/KG]'
TRAC 34 AXES 1.0 'PSVISC [PA]'
LIST 34 AXES 1.0 'PSVISC [PA]'
TRAC 35 AXES 1.0 'VELOC. [M/S]'
LIST 35 AXES 1.0 'VELOC. [M/S]'
*=================================================================
FIN
```

shot01.epx

```
SHOT01
ECHO
!CONV win
EULE DPLA
DIME
  ADAP NPOI 671 FL23 1516 ENDA
TERM
GEOM LIBR POIN 202 FL23 200 TERM
 0.00 0.00  0.01 0.00  0.02 0.00  0.03 0.00  0.04 0.00  0.05 0.00
            0.06 0.00  0.07 0.00  0.08 0.00  0.09 0.00  0.10 0.00
            0.11 0.00  0.12 0.00  0.13 0.00  0.14 0.00  0.15 0.00
            0.16 0.00  0.17 0.00  0.18 0.00  0.19 0.00  0.20 0.00
            0.21 0.00  0.22 0.00  0.23 0.00  0.24 0.00  0.25 0.00
            0.26 0.00  0.27 0.00  0.28 0.00  0.29 0.00  0.30 0.00
            0.31 0.00  0.32 0.00  0.33 0.00  0.34 0.00  0.35 0.00
            0.36 0.00  0.37 0.00  0.38 0.00  0.39 0.00  0.40 0.00
            0.41 0.00  0.42 0.00  0.43 0.00  0.44 0.00  0.45 0.00
            0.46 0.00  0.47 0.00  0.48 0.00  0.49 0.00  0.50 0.00
            0.51 0.00  0.52 0.00  0.53 0.00  0.54 0.00  0.55 0.00
            0.56 0.00  0.57 0.00  0.58 0.00  0.59 0.00  0.60 0.00
            0.61 0.00  0.62 0.00  0.63 0.00  0.64 0.00  0.65 0.00
            0.66 0.00  0.67 0.00  0.68 0.00  0.69 0.00  0.70 0.00
            0.71 0.00  0.72 0.00  0.73 0.00  0.74 0.00  0.75 0.00
            0.76 0.00  0.77 0.00  0.78 0.00  0.79 0.00  0.80 0.00
            0.81 0.00  0.82 0.00  0.83 0.00  0.84 0.00  0.85 0.00
            0.86 0.00  0.87 0.00  0.88 0.00  0.89 0.00  0.90 0.00
            0.91 0.00  0.92 0.00  0.93 0.00  0.94 0.00  0.95 0.00
            0.96 0.00  0.97 0.00  0.98 0.00  0.99 0.00  1.00 0.00
 0.00 0.01  0.01 0.01  0.02 0.01  0.03 0.01  0.04 0.01  0.05 0.01
            0.06 0.01  0.07 0.01  0.08 0.01  0.09 0.01  0.10 0.01
            0.11 0.01  0.12 0.01  0.13 0.01  0.14 0.01  0.15 0.01
            0.16 0.01  0.17 0.01  0.18 0.01  0.19 0.01  0.20 0.01
            0.21 0.01  0.22 0.01  0.23 0.01  0.24 0.01  0.25 0.01
            0.26 0.01  0.27 0.01  0.28 0.01  0.29 0.01  0.30 0.01
            0.31 0.01  0.32 0.01  0.33 0.01  0.34 0.01  0.35 0.01
            0.36 0.01  0.37 0.01  0.38 0.01  0.39 0.01  0.40 0.01
            0.41 0.01  0.42 0.01  0.43 0.01  0.44 0.01  0.45 0.01
            0.46 0.01  0.47 0.01  0.48 0.01  0.49 0.01  0.50 0.01
            0.51 0.01  0.52 0.01  0.53 0.01  0.54 0.01  0.55 0.01
            0.56 0.01  0.57 0.01  0.58 0.01  0.59 0.01  0.60 0.01
            0.61 0.01  0.62 0.01  0.63 0.01  0.64 0.01  0.65 0.01
            0.66 0.01  0.67 0.01  0.68 0.01  0.69 0.01  0.70 0.01
            0.71 0.01  0.72 0.01  0.73 0.01  0.74 0.01  0.75 0.01
            0.76 0.01  0.77 0.01  0.78 0.01  0.79 0.01  0.80 0.01
            0.81 0.01  0.82 0.01  0.83 0.01  0.84 0.01  0.85 0.01
            0.86 0.01  0.87 0.01  0.88 0.01  0.89 0.01  0.90 0.01
```

```
           0.91 0.01  0.92 0.01  0.93 0.01  0.94 0.01  0.95 0.01
           0.96 0.01  0.97 0.01  0.98 0.01  0.99 0.01  1.00 0.01
  1   2 103
103 102   1
  2   3 103
104 103   3
  3   4 105
105 104   3
  4   5 105
106 105   5
  5   6 107
107 106   5
  6   7 107
108 107   7
  7   8 109
109 108   7
  8   9 109
110 109   9
  9  10 111
111 110   9
 10  11 111
112 111  11
 11  12 113
113 112  11
 12  13 113
114 113  13
 13  14 115
115 114  13
 14  15 115
116 115  15
 15  16 117
117 116  15
 16  17 117
118 117  17
 17  18 119
119 118  17
 18  19 119
120 119  19
 19  20 121
121 120  19
 20  21 121
122 121  21
 21  22 123
123 122  21
 22  23 123
124 123  23
 23  24 125
125 124  23
 24  25 125
126 125  25
 25  26 127
127 126  25
 26  27 127
128 127  27
 27  28 129
129 128  27
 28  29 129
130 129  29
 29  30 131
131 130  29
 30  31 131
132 131  31
 31  32 133
133 132  31
 32  33 133
134 133  33
 33  34 135
135 134  33
 34  35 135
136 135  35
 35  36 137
137 136  35
 36  37 137
138 137  37
 37  38 139
139 138  37
 38  39 139
140 139  39
 39  40 141
141 140  39
 40  41 141
142 141  41
 41  42 143
143 142  41
 42  43 143
144 143  43
 43  44 145
145 144  43
 44  45 145
146 145  45
 45  46 147
147 146  45
 46  47 147
148 147  47
 47  48 149
149 148  47
 48  49 149
150 149  49
 49  50 151
151 150  49
 50  51 151
152 151  51
 51  52 153
153 152  51
 52  53 153
154 153  53
 53  54 155
155 154  53
 54  55 155
156 155  55
 55  56 157
157 156  55
 56  57 157
158 157  57
 57  58 159
159 158  57
 58  59 159
160 159  59
 59  60 161
161 160  59
 60  61 161
162 161  61
 61  62 163
163 162  61
 62  63 163
164 163  63
 63  64 165
165 164  63
 64  65 165
166 165  65
 65  66 167
167 166  65
 66  67 167
168 167  67
 67  68 169
169 168  67
 68  69 169
170 169  69
 69  70 171
171 170  69
 70  71 171
172 171  71
 71  72 173
173 172  71
 72  73 173
174 173  73
 73  74 175
175 174  73
 74  75 175
176 175  75
 75  76 177
177 176  75
 76  77 177
178 177  77
 77  78 179
179 178  77
 78  79 179
180 179  79
 79  80 181
181 180  79
 80  81 181
182 181  81
 81  82 183
183 182  81
 82  83 183
184 183  83
 83  84 185
185 184  83
 84  85 185
186 185  85
 85  86 187
187 186  85
 86  87 187
188 187  87
 87  88 189
189 188  87
 88  89 189
190 189  89
 89  90 191
191 190  89
 90  91 191
192 191  91
 91  92 193
193 192  91
 92  93 193
194 193  93
 93  94 195
195 194  93
 94  95 195
196 195  95
 95  96 197
197 196  95
 96  97 197
198 197  97
 97  98 199
199 198  97
 98  99 199
200 199  99
 99 100 201
201 200  99
100 101 201
202 201 101
COMP GROU 5 'bar1' LECT   1 PAS 1 100 TERM
            'bar2' LECT 101 PAS 1 200 TERM
            'bar'  LECT bar1 bar2 TERM
            'ea'   LECT  50 TERM
            'eb'   LECT 150 TERM
     NGRO 7 'p0'   LECT   1 TERM
            'p0p'  LECT 102 TERM
            'p1'   LECT 101 TERM
            'p1p'  LECT 202 TERM
            'pa'   LECT  26 TERM
            'pmid' LECT  51 TERM
            'pb'   LECT  76 TERM
WAVE 4 PLAN X 0.5 Y 0 NX 1 NY 0 T0 0 C 1672  ! shock wave
            MAXL 4 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX 1 NY 0 T0 0 C 925.4 ! contact discont. wave
            MAXL 4 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX 1 NY 0 T0 0 C 30.12 ! rarefaction wave (right)
            MAXL 4 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 NX -1 NY 0 T0 0 C 1020 ! rarefaction wave (left)
            MAXL 4 H1 0.015 H2 0.05
MATE FLUT RO 1.22 EINT 3.046E6 GAMM 1.269 PB 0 ITER 1 ALF0 1
          BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 0.1237 EINT 3.046E6 GAMM 1.269 PB 0 ITER 1 ALF0 1
          BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56 PMIN 0 NUM 1
          LECT bar2 _fl23 TERM
LINK COUP BLOQ 2 LECT bar TERM ! don't use "tous" here !!!
                               ! setting links on non-base nodes is NOT allowed
          BLOQ 1 LECT p0 p0p p1 p1p TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.15E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT pa pmid pb TERM
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 0.5E-5
```

```
OPTI NOTE STEP LIBR
 csta 0.5
 log 1
CALC TINI 0. TEND 0.15E-3
*=================================================================
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
SCEN GEOM NAVI FREE
          FACE HFRO
     ISO  FILL FIEL VITE SCAL USER PROG 65 PAS 65 910 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH AVI NOCL NFTO 31 FPS  5 KFRE 10
                                                  COMP -1 REND
FREQ 0 TFRE 0.005E-3
GOTR LOOP 29 OFFS SIZE 1400 400 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 1400 400 FICH AVI CONT REND
ENDPLAY
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
!PERFO 'bm_flu_adap_shocktri3_01.pun'
AXTE 1.0 'Time [s]'
COUR  4 'vx_pa'   VITE COMP 1 NOEU LECT pa   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_pb'   VITE COMP 1 NOEU LECT pb   TERM
COUR 11 'p_ea'    ECRO COMP 1 ELEM LECT ea   TERM
COUR 12 'p_eb'    ECRO COMP 1 ELEM LECT eb   TERM
COUR 13 'r_ea'    ECRO COMP 2 ELEM LECT ea   TERM
COUR 14 'r_eb'    ECRO COMP 2 ELEM LECT eb   TERM
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
TRAC 11 12 AXES 1.0 'PRESS. [PA]'
LIST 11 12 AXES 1.0 'PRESS. [PA]'
TRAC 13 14 AXES 1.0 'DENS. [KG/M3]'
LIST 13 14 AXES 1.0 'DENS. [KG/M3]'
!RCOU 24 'vx_pa'   FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'vx_pa_00'
!RCOU 25 'vx_pmid' FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'vx_pmid_00'
!RCOU 26 'vx_pb'   FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'vx_pb_00'
!RCOU 31 'p_ea'    FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'p_ea_00'
!RCOU 32 'p_eb'    FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'p_eb_00'
!RCOU 33 'r_ea'    FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'r_ea_00'
!RCOU 34 'r_eb'    FICH 'bm_flu_adap_shocktri3_00.pun'
!                  RENA 'r_eb_00'
!TRAC 4 5 6 24 25 26 AXES 1.0 'VELOC. [M/S]'
!COLO noir noir noir roug roug roug
!TRAC 11 12 31 32 AXES 1.0 'PRESS. [PA]'
!COLO noir noir roug roug
!TRAC 13 14 33 34 AXES 1.0 'DENS. [KG/M3]'
!COLO noir noir roug roug
*
QUAL VITE COMP 1 LECT pa   TERM REFE  0.00000E+0 TOLE 5.E-3
     VITE COMP 1 LECT pmid TERM REFE  9.38818E+2 TOLE 5.E-3
     ECRO COMP 1 LECT ea   TERM REFE  9.99636E+5 TOLE 5.E-3
! following value is in a base element which is inactive at the final time!
! the qualif is done on the average over the active descendents of the elem
     ECRO COMP 1 LECT eb   TERM REFE  1.09335E+5 TOLE 5.E-3
     ECRO COMP 2 LECT ea   TERM REFE  1.22000E+0 TOLE 5.E-3
! following value is in a base element which is inactive at the final time!
! the qualif is done on the average over the active descendents of the elem
     ECRO COMP 2 LECT eb   TERM REFE  1.31058E-1 TOLE 5.E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
COMP NGRO 1 'xaxo' LECT 1 PAS 1 101 TERM
SORT GRAP
!PERFO 'bm_flu_adap_shocktri3_s1.pun'
AXTE 1.0 'Time [s]'
SCOU 31 'p_31'  NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 32 'ro_31' NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 33 'i_31'  NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 4
SCOU 34 'q_31'  NSTO 31 SAXE 1.0 'current_abscissa' LECT xaxo TERM
                        ECRO COMP 6
SCOU 35 'vx_31' NSTO 31 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
TRAC 31 AXES 1.0 'PRESS. [PA]'
LIST 31 AXES 1.0 'PRESS. [PA]'
TRAC 32 AXES 1.0 'DENS. [KG/M3]'
LIST 32 AXES 1.0 'DENS. [KG/M3]'
TRAC 33 AXES 1.0 'EINT [J/KG]'
LIST 33 AXES 1.0 'EINT [J/KG]'
TRAC 34 AXES 1.0 'PSVISC [PA]'
LIST 34 AXES 1.0 'PSVISC [PA]'
TRAC 35 AXES 1.0 'VELOC. [M/S]'
LIST 35 AXES 1.0 'VELOC. [M/S]'
!RCOU 21 'p_31'  FICH 'bm_flu_adap_shocktri3_s0.pun'
!                RENA 'p_31_00'
!RCOU 22 'ro_31' FICH 'bm_flu_adap_shocktri3_s0.pun'
!                RENA 'ro_31_00'
!RCOU 23 'i_31'  FICH 'bm_flu_adap_shocktri3_s0.pun'
!                RENA 'i_31_00'
!RCOU 24 'q_31'  FICH 'bm_flu_adap_shocktri3_s0.pun'
!                RENA 'q_31_00'
!RCOU 25 'vx_31' FICH 'bm_flu_adap_shocktri3_s0.pun'
!                RENA 'vx_31_00'
!TRAC 31 21 AXES 1.0 'PRESS. [PA]'
!COLO noir roug
!TRAC 32 22 AXES 1.0 'DENS. [KG/M3]'
!COLO noir roug
!TRAC 33 23 AXES 1.0 'EINT [J/KG]'
!COLO noir roug
!TRAC 34 24 AXES 1.0 'PSVISC [PA]'
!COLO noir roug
!TRAC 35 25 AXES 1.0 'VELOC. [M/S]'
!COLO noir roug
*=================================================================
SUIT
Post treatment (visualization from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
SCEN GEOM NAVI FREE
          FACE HFRO
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 0.1 PAS 0.05 0.75 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH AVI NOCL NFTO 31 FPS  5 KFRE 10
                                                  COMP -1 REND
FREQ 1
GOTR LOOP 29 OFFS SIZE 1400 400 FICH AVI CONT NOCL REND
GO
TRAC OFFS SIZE 1400 400 FICH AVI CONT REND
ENDPLAY
*=================================================================
FIN

BEGIN DESCRIPTION

This test verifies JRC fluids (FE) in adaptivity in a simple
2D shock tube problem. The element employed is FL24.

The mesh refinement and de-refinement is not automatic (no true
adaptivity) but is piloted by the WAVE directive. Several
waves are prescribed, corresponding to the shock, the contact
discontinuity and the rarefaction wave. The wave speeds are taken
from the analytical solution to the shock tube problem.

The shock tube problem is solved twice:

1) Uniform fine mesh solution (800 x 8 elements) without adaptivity.

2) Coarse base mesh solution (100 x 1 elements) with adaptivity.

The results of the two solutions are compared and are in
relatively good agreement.


END DESCRIPTION
```

tead01.epx

```
TEAD01
ECHO
 CONV win
LAGR TRID
DIME
  ADAP NPOI 6 TETR 8 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 4 TETR 1 TERM
 0 0 0  1 0 0  0 1 0  0 0 1
 1 2 3 4
COMP GROU 2 'dext' LECT 2 PAS 1 5 TERM
            'dint' LECT 6 PAS 1 9 TERM
MATE LINE RO 8000 YOUN 2.E11 NU 0
          LECT 1 _tetr TERM
LINK COUP BLOQ 1 LECT 1 2 3 4 TERM
               2 LECT 1 2 3 4 TERM
               3 LECT 1 2 3 4 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP CHEC
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 2
*=======================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC OBJE LECT dext TERM REND
TRAC OBJE LECT dint TERM REND
TRAC ELEM 1 10000 REND
GO
ADAP
  USPL 1
TERM
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

tead02.epx

```
TEAD02
ECHO
 CONV win
LAGR TRID
```

```
DIME
  ADAP NPOI 9 TETR 16 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 5 TETR 2 TERM
 0 0 0  1 0 0  0 1 0  0 0 1
 0 -1 0
 1 2 3 4
 2 1 5 4
COMP GROU 10 'e1' LECT 1 TERM
             'e2' LECT 2 TERM
             'e3' LECT 3 TERM
             'e4' LECT 4 TERM
             'e5' LECT 5 TERM
             'e6' LECT 6 TERM
             'e7' LECT 7 TERM
             'e8' LECT 8 TERM
             'e9' LECT 9 TERM
             'e10' LECT 10 TERM
MATE LINE RO 8000 YOUN 2.E11 NU 0
          LECT 1 2 _tetr TERM
LINK COUP BLOQ 1 LECT 1 2 3 4 5 TERM
               2 LECT 1 2 3 4 5 TERM
               3 LECT 1 2 3 4 5 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP CHEC
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 4
*=======================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
ADAP
  SPLI 2
TERM
GO
TRAC REND
ADAP
  USPL 1
TERM
GO
TRAC REND
ADAP
  USPL 2
TERM
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

tead03.epx

```
TEAD03
ECHO
 CONV win
LAGR TRID
GEOM LIBR POIN 4 TETR 1 CL3I 1 TERM
 0 0 0  1 0 0  0 1 0  0 0 1
 1 2 3 4
 1 4 2
MATE LINE RO 8000 YOUN 2.E11 NU 0
          LECT 1 TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT 2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
!    ADAP DUMP CHEC
!    LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 4
FIN
*=======================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
ADAP
  SPLI 2
TERM
GO
TRAC REND
ADAP
  USPL 1
TERM
GO
TRAC REND
ADAP
  USPL 2
TERM
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

tead04.epx

```
TEAD04
ECHO
 CONV win
LAGR TRID
DIME
  ADAP NPOI 100 TETR 100 CL3I 20 ENDA
TERM
GEOM LIBR POIN 4 TETR 1 CL3I 1 TERM
 0 0 0  1 0 0  0 1 0  0 0 1
 1 2 3 4
 1 4 2
COMP GROU 2 'bar'  LECT 1 TERM
            'clpr' LECT 2 TERM
     COUL VERT LECT bar TERM
          JAUN LECT clpr TERM
MATE LINE RO 8000 YOUN 2.E11 NU 0
          LECT 1 _tetr TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT 2 _cl3i TERM
LINK COUP
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP CHEC
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 2
*=======================================================================
PLAY
TRAC REND
TRAC OBJE LECT clpr TERM REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
TRAC OBJE LECT clpr TERM REND
ADAP
  SPLI 3
TERM
GO
TRAC REND
TRAC OBJE LECT clpr TERM REND
ENDPLAY
*=======================================================================
FIN
```

tead05.epx

```
TEAD05
ECHO
 CONV win
LAGR TRID
DIME
  ADAP NPOI 100 TETR 100 CL3I 20 ENDA
TERM
GEOM LIBR POIN 6 TETR 4 CL3I 4 TERM
 0 0 0  0 0 1  0 1 1  0 1 0  1 .5 .5  0 .5 .5
 1 4 6 5
 4 3 6 5
 3 2 6 5
 2 1 6 5
 1 4 6
 4 3 6
 3 2 6
 2 1 6
COMP GROU 2 'bar'  LECT 1 2 3 4 TERM
            'clpr' LECT 5 6 7 8 TERM
     COUL VERT LECT bar TERM
          JAUN LECT clpr TERM
MATE LINE RO 8000 YOUN 2.E11 NU 0
          LECT bar _tetr TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT clpr _cl3i TERM
LINK COUP
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP CHEC
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 2
*=======================================================================
PLAY
TRAC REND
TRAC OBJE LECT clpr TERM REND
ADAP
  SPLI 1
  SPLI 2
  SPLI 3
  SPLI 4
TERM
TRAC REND
TRAC OBJE LECT clpr TERM REND
ENDPLAY
*=======================================================================
FIN
```

tead11.epx

```
TEAD11
ECHO
!CONV win
EULE TRID
DIME
  ADAP NPOI 12 NVFI 48 TEVF 16 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 4 TEVF 1 TERM
 0 0 0  1 0 0  0 1 0  0 0 1
 1 2 3 4
!COMP GROU 2 'dext' LECT 2 PAS 1 5 TERM
!            'dint' LECT 6 PAS 1 9 TERM
MATE GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT 1 _tevf TERM
!LINK COUP BLOQ 1 LECT 1 2 3 4 TERM
!               2 LECT 1 2 3 4 TERM
!               3 LECT 1 2 3 4 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC FREQ 1
```

```
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP CHEC
!    LNKS STAT DUMP
 CSTA 0.5
 LOG 1
!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
CALC TINI 0. TEND 50.0E-3 NMAX 4
*=======================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
GO
ADAP
  SPLI 2
TERM
TRAC REND
GO
ADAP
  USPL 2
TERM
TRAC REND
GO
ADAP
  USPL 1
TERM
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

tes401.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TES401';
opti sauv form 'tes401.msh';
opti trac psc ftra 'tes401_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes401.epx

```
TES401
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 3 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                         X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT bar2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
 MOMT 2 DTML
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes401.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT na   TERM REFE  9.87244E+0 TOLE 2.E-2
     VITE COMP 1 LECT nb   TERM REFE  2.95611E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.62835E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81434E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.75031E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.94570E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes401t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

tes411.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TES411';
opti sauv form 'tes411.msh';
opti trac psc ftra 'tes411_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
```

```
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes411.epx

```
TES411
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 7 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                           X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
            'p02'  LECT bar TERM COND NEAR POIN 1 0 0
            'p12'  LECT bar TERM COND NEAR POIN 1 0.01 0
            'p22'  LECT bar TERM COND NEAR POIN 1 0.01 0.01
            'p32'  LECT bar TERM COND NEAR POIN 1 0 0.01
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 0.5 BET0 0.2 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 0.5 BET0 0.2 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar2 TERM
LINK COUP BLOQ 23 LECT tous TERM
          BLOQ 1 LECT p0 p1 p2 p3 p02 p12 p22 p32 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes411.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT nb   TERM REFE  2.93755E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.94976E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.84205E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.96648E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93530E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes411t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

tes412.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TES412';
opti sauv form 'tes412.msh';
opti trac psc ftra 'tes412_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes412.epx

```
TES412
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 7 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                           X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
            'p02'  LECT bar TERM COND NEAR POIN 1 0 0
            'p12'  LECT bar TERM COND NEAR POIN 1 0.01 0
            'p22'  LECT bar TERM COND NEAR POIN 1 0.01 0.01
            'p32'  LECT bar TERM COND NEAR POIN 1 0 0.01
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 1 BET0 1 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 1 BET0 1 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar2 TERM
LINK COUP BLOQ 23 LECT tous TERM
          BLOQ 1 LECT p0 p1 p2 p3 p02 p12 p22 p32 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
```

```
     FICH ALIC TFRE 1.0E-5
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes412.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT nb   TERM REFE  2.93755E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.94976E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.84205E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.96648E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93530E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes412t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

tes413.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TES413';
opti sauv form 'tes413.msh';
opti trac psc ftra 'tes413_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes413.epx

```
TES413
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 1648 FL34 7872 ENDA
TERM
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 7 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                           X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
            'p02'  LECT bar TERM COND NEAR POIN 1 0 0
            'p12'  LECT bar TERM COND NEAR POIN 1 0.01 0
            'p22'  LECT bar TERM COND NEAR POIN 1 0.01 0.01
            'p32'  LECT bar TERM COND NEAR POIN 1 0 0.01
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 2 H1 0.015 H2 0.05
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 1 BET0 1 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 1 BET0 1 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar2 _f134 TERM
LINK COUP BLOQ 23 LECT bar TERM ! don't use "tous" here !!!
                                ! setting links on non-base nodes is NOT allowed
          BLOQ 1 LECT p0 p1 p2 p3 p02 p12 p22 p32 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes413.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT nb   TERM REFE  2.93755E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.94976E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.84205E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.96648E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93530E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes413t.pun'
AXTE 1.0 'Time [s]'
```

```
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*===============================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*===============================================================
FIN
```

tes418.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TES418';
opti sauv form 'tes418.msh';
opti trac psc ftra 'tes418_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes418.epx

```
TES418
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 1648 FL34 7872 ENDA
TERM
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 7 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                         X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
            'p02'  LECT bar TERM COND NEAR POIN 1 0 0
            'p12'  LECT bar TERM COND NEAR POIN 1 0.01 0
            'p22'  LECT bar TERM COND NEAR POIN 1 0.01 0.01
            'p32'  LECT bar TERM COND NEAR POIN 1 0 0.01
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 2 H1 0.015 H2 0.05
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 0.5 BET0 0.2 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 0.5 BET0 0.2 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar2 _fl34 TERM
LINK COUP BLOQ 23 LECT bar TERM ! don't use "tous" here !!!
                                ! setting links on non-base nodes is NOT allowed
          BLOQ 1 LECT p0 p1 p2 p3 p02 p12 p22 p32 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 0.60E-3
*===============================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes418.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT nb   TERM REFE  2.93755E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.94976E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.84205E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.96648E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93530E+0 TOLE 2.E-2
*===============================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes418t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*===============================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*===============================================================
FIN
```

tes419.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti titr 'TES419';
opti sauv form 'tes419.msh';
opti trac psc ftra 'tes419_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2t2 cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes419.epx

```
TES419
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 5000 FL34 20000 ENDA
TERM
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 9 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                         X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
            'p02'  LECT bar TERM COND NEAR POIN 1 0 0
            'p12'  LECT bar TERM COND NEAR POIN 1 0.01 0
            'p22'  LECT bar TERM COND NEAR POIN 1 0.01 0.01
            'p32'  LECT bar TERM COND NEAR POIN 1 0 0.01
            'pc0'  LECT bar TERM COND NEAR POIN 0 0.005 0.005
            'pc2'  LECT bar TERM COND NEAR POIN 1 0.005 0.005
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 2 H1 0.015 H2 0.05
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 0.5 BET0 0.2 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 0.5 BET0 0.2 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar2 _fl34 TERM
LINK COUP BLOQ 23 LECT bar TERM ! don't use "tous" here !!!
                               ! setting links on non-base nodes is NOT allowed
          BLOQ 1 LECT p0 p1 p2 p3 p02 p12 p22 p32 pc0 pc2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes419.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                  TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                  TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                  TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT nb   TERM REFE  2.93755E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.94976E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.84205E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.96648E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93530E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes419t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!         LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

tes420.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti titr 'TES420';
opti sauv form 'tes420.msh';
opti trac psc ftra 'tes420_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2t2 cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tes420.epx

```
TES420
```

```
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 5000 FL34 20000 ENDA
TERM
GEOM FL34 bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb'   LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 9 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                          X2 1 Y2 0 Z2 0 TOL 1.E-4
            'na'   LECT bar TERM COND NEAR POIN 0.25 0 0
            'nb'   LECT bar TERM COND NEAR POIN 0.75 0 0
            'p02'  LECT bar TERM COND NEAR POIN 1 0 0
            'p12'  LECT bar TERM COND NEAR POIN 1 0.01 0
            'p22'  LECT bar TERM COND NEAR POIN 1 0.01 0.01
            'p32'  LECT bar TERM COND NEAR POIN 1 0 0.01
            'pc0'  LECT bar TERM COND NEAR POIN 0 0.005 0.005
            'pc2'  LECT bar TERM COND NEAR POIN 1 0.005 0.005
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 2 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 2 H1 0.015 H2 0.05
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 1 BET0 1 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ALF0 1 BET0 1 CL 0.5 CQ 2.56
          ITER 1 KINT 0 AHGF 0 PMIN 0 NUM 1
          LECT bar2 _fl34 TERM
LINK COUP BLOQ 23 LECT bar TERM ! don't use "tous" here !!!
                                ! setting links on non-base nodes is NOT allowed
          BLOQ 1 LECT p0 p1 p2 p3 p02 p12 p22 p32 pc0 pc2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
          POIN LECT na nb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes420.pun'
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VITE COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VITE COMP 1 LECT nb   TERM REFE  2.93755E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.94976E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.84205E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.96648E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93530E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tes420t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_na' VITE COMP 1 NOEU LECT na TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_nb' VITE COMP 1 NOEU LECT nb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VITE SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

tes421.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti titr 'TES421';
opti sauv form 'tes421.msh';
opti trac psc ftra 'tes421_mesh.ps';
p1 = 0 0 0;
p2 = 1 0 0;
p3 = 2 0 0;
p4 = 0 1 0;
p5 = 1 1 0;
p6 = 2 1 0;
p7 = 0 0 1;
p8 = 1 0 1;
p9 = 2 0 1;
p10 = 0 1 1;
p11 = 1 1 1;
p12 = 2 1 1;
tol = 0.01;
c1 = manu cub8 p1 p2 p5 p4 p7 p8 p11 p10;
c2 = manu cub8 p2 p3 p6 p5 p8 p9 p12 p11;
t1 = pxhex2t2 c1;
t2 = pxhex2t2 c2;
mesh = t1 et t2;
elim tol mesh;
*tass mesh;
sauv form mesh;
trac qual cach mesh;
trac qual cach (c1 et c2);
fin;
```

tes421.epx

```
TES421
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM FL34 t1 t2 TERM
COMP NGRO 2 'nc0' LECT t1 TERM COND NEAR POIN 0 0.5 0.5
            'nc2' LECT t2 TERM COND NEAR POIN 2 0.5 0.5
     COUL ROUG LECT t1 TERM
          VERT LECT t2 TERM
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT t1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT t2 TERM
LINK COUP BLOQ 23 LECT t1 t2 TERM
          BLOQ 1 LECT p1 p3 p4 p6 p7 p9 p10 p12 nc0 nc2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 1.0E-3
*=================================================================
SUIT
Post-treatment (time curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes421.pun'
AXTE 1.0 'Time [s]'
COUR 1 'vx_p2' VITE COMP 1 NOEU LECT p2 TERM
COUR 2 'vx_p5' VITE COMP 1 NOEU LECT p5 TERM
COUR 3 'vx_p8' VITE COMP 1 NOEU LECT p8 TERM
COUR 4 'vx_p11' VITE COMP 1 NOEU LECT p11 TERM
TRAC 1 2 3 4 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG VERT TURQ
*=================================================================
FIN
```

tes422.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti titr 'TES422';
opti sauv form 'tes422.msh';
```

```
opti trac psc ftra 'tes422_mesh.ps';
p1 = 0 0 0;
p2 = 1 0 0;
p3 = 2 0 0;
p4 = 0 1 0;
p5 = 1 1 0;
p6 = 2 1 0;
p7 = 0 0 1;
p8 = 1 0 1;
p9 = 2 0 1;
p10 = 0 1 1;
p11 = 1 1 1;
p12 = 2 1 1;
tol = 0.01;
c1 = manu cub8 p1 p2 p5 p4 p7 p8 p11 p10;
c2 = manu cub8 p2 p3 p6 p5 p8 p9 p12 p11;
t1 = pxhex2t2 c1;
t2 = pxhex2t2 c2;
mesh = t1 et t2;
elim tol mesh;
*tass mesh;
sauv form mesh;
trac qual cach mesh;
trac qual cach (c1 et c2);
fin;
```

tes422.epx

```
TES422
ECHO
!CONV win
CAST mesh
EULE TRID
DIME ADAP NPOI 92 FL34 384 ENDA TERM
GEOM FL34 t1 t2 TERM
COMP NGRO 2 'nc0' LECT t1 TERM COND NEAR POIN 0 0.5 0.5
            'nc2' LECT t2 TERM COND NEAR POIN 2 0.5 0.5
     COUL ROUG LECT t1 TERM
          VERT LECT t2 TERM
WAVE 1 PLAN X 1 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 0
            MAXL 2 H1 1.0 H2 5.0
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT t1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT t2 _fl34 TERM
LINK COUP BLOQ 23 LECT t1 t2 TERM
          BLOQ 1 LECT p1 p3 p4 p6 p7 p9 p10 p12 nc0 nc2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 1.0E-3
*-----------------------------------------------------------------
!PLAY
!ADAP
!  SPLI 1
!  SPLI 2
!  SPLI 3
!  SPLI 4
!  SPLI 5
!  SPLI 6
!  SPLI 7
!  SPLI 8
!  SPLI 9
!  SPLI 10
!  SPLI 11
!  SPLI 12
!  SPLI 13
!  SPLI 14
!  SPLI 15
!  SPLI 16
!  SPLI 17
!  SPLI 18
!  SPLI 19
!  SPLI 20
!  SPLI 21
!  SPLI 22
!  SPLI 23
!  SPLI 24
!  SPLI 25
!  SPLI 26
!  SPLI 27
!  SPLI 28
!  SPLI 29
!  SPLI 30
!  SPLI 31
!  SPLI 32
!  SPLI 33
!  SPLI 34
!  SPLI 35
!  SPLI 36
!  SPLI 37
!  SPLI 38
!  SPLI 39
!  SPLI 40
!  SPLI 41
!  SPLI 42
!  SPLI 43
!  SPLI 44
!  SPLI 45
!  SPLI 46
!  SPLI 47
!  SPLI 48
!TERM
!FREQ 0 TFRE 1.E-3
!GO
!ENDPLAY
*=================================================================
SUIT
Post-treatment (time curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes422.pun'
AXTE 1.0 'Time [s]'
COUR 1 'vx_p2' VITE COMP 1 NOEU LECT p2 TERM
COUR 2 'vx_p5' VITE COMP 1 NOEU LECT p5 TERM
COUR 3 'vx_p8' VITE COMP 1 NOEU LECT p8 TERM
COUR 4 'vx_p11' VITE COMP 1 NOEU LECT p11 TERM
TRAC 1 2 3 4 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG VERT TURQ
*=================================================================
FIN
```

tes423.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti titr 'TES423';
opti sauv form 'tes423.msh';
opti trac psc ftra 'tes423_mesh.ps';
p1 = 0 0 0;
p2 = 1 0 0;
p3 = 2 0 0;
p4 = 0 1 0;
p5 = 1 1 0;
p6 = 2 1 0;
p7 = 0 0 1;
p8 = 1 0 1;
p9 = 2 0 1;
p10 = 0 1 1;
p11 = 1 1 1;
p12 = 2 1 1;
tol = 0.01;
c1 = manu cub8 p1 p2 p5 p4 p7 p8 p11 p10;
c2 = manu cub8 p2 p3 p6 p5 p8 p9 p12 p11;
t1 = pxhex2t2 c1;
t2 = pxhex2t2 c2;
mesh = t1 et t2;
elim tol mesh;
*tass mesh;
sauv form mesh;
trac qual cach mesh;
trac qual cach (c1 et c2);
fin;
```

tes423.epx

```
TES423
ECHO
!CONV win
CAST mesh
EULE TRID
DIME ADAP NPOI 42 FL34 128 ENDA TERM
GEOM FL34 t1 t2 TERM
COMP NGRO 2 'nc0' LECT t1 TERM COND NEAR POIN 0 0.5 0.5
            'nc2' LECT t2 TERM COND NEAR POIN 2 0.5 0.5
     COUL ROUG LECT t1 TERM
          VERT LECT t2 TERM
WAVE 1 PLAN X 1 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 0
            MAXL 2 H1 0.5 H2 0.5
MATE FLUT RO 10 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT t1 TERM
     FLUT RO 1 EINT 2.E5 GAMM 1.5 PB 0 PREF 1.E5
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT t2 _fl34 TERM
LINK COUP BLOQ 23 LECT t1 t2 TERM
          BLOQ 1 LECT p1 p3 p4 p6 p7 p9 p10 p12 nc0 nc2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE
 CSTA 0.5
 LOG 1
 NF34
CALC TINI 0. TEND 1.0E-3
*-----------------------------------------------------------------
!PLAY
!ADAP
!  SPLI 1
!  SPLI 2
!  SPLI 3
!  SPLI 4
!  SPLI 5
!  SPLI 6
!  SPLI 7
!  SPLI 8
!  SPLI 9
!  SPLI 10
!  SPLI 11
!  SPLI 12
!  SPLI 13
!  SPLI 14
!  SPLI 15
!  SPLI 16
!  SPLI 17
!  SPLI 18
!  SPLI 19
!  SPLI 20
!  SPLI 21
!  SPLI 22
!  SPLI 23
!  SPLI 24
!  SPLI 25
!  SPLI 26
!  SPLI 27
!  SPLI 28
!  SPLI 29
!  SPLI 30
!  SPLI 31
```

```
!  SPLI 32
!  SPLI 33
!  SPLI 34
!  SPLI 35
!  SPLI 36
!  SPLI 37
!  SPLI 38
!  SPLI 39
!  SPLI 40
!  SPLI 41
!  SPLI 42
!  SPLI 43
!  SPLI 44
!  SPLI 45
!  SPLI 46
!  SPLI 47
!  SPLI 48
!TERM
!FREQ 0 TFRE 1.E-3
!GO
!ENDPLAY
*===================================================================
SUIT
Post-treatment (time curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
PERF 'tes423.pun'
AXTE 1.0 'Time [s]'
COUR 1 'vx_p2' VITE COMP 1 NOEU LECT p2 TERM
COUR 2 'vx_p5' VITE COMP 1 NOEU LECT p5 TERM
COUR 3 'vx_p8' VITE COMP 1 NOEU LECT p8 TERM
COUR 4 'vx_p11' VITE COMP 1 NOEU LECT p11 TERM
TRAC 1 2 3 4 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG VERT TURQ
*===================================================================
FIN
```

tesh01.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TESH01';
opti sauv form 'tesh01.msh';
opti trac psc ftra 'tesh01_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tesh01.epx

```
TESH01
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM TEVF bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea' LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb' LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                          X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
CALC TINI 0. TEND 0.60E-3
*===================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  9.87244E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95611E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.62835E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81434E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.75031E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.94570E+0 TOLE 2.E-2
*===================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tesh01t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*===================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*===================================================================
FIN
```

tesh07.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TESH07';
opti sauv form 'tesh07.msh';
opti trac psc ftra 'tesh07_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
```

```
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tesh07.epx

```
TESH07
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 1648 NVFI 16912 TEVF 7872 ENDA
TERM
GEOM TEVF bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea' LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb' LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                           X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
            MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
            MAXL 3 H1 0.015 H2 0.05
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 _tevf TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1

!ADAP CHEC ! temporary !!!

!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
CALC TINI 0. TEND 0.60E-3
*=================================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
RCOU 11 'p_61'  FICH 'tesh01.pun' RENA 'p_61_01'
RCOU 12 'ro_61' FICH 'tesh01.pun' RENA 'ro_61_01'
RCOU 15 'vx_61' FICH 'tesh01.pun' RENA 'vx_61_01'
TRAC 11 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR VERT ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 12 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR VERT ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 15 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR VERT ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  2.49628E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95498E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.90500E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81363E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.93654E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.93478E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tesh07t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
RCOU 11 'p_ea'  FICH 'tesh01t.pun' RENA 'p_ea_01'
RCOU 12 'ro_ea' FICH 'tesh01t.pun' RENA 'ro_ea_01'
RCOU 13 'vx_ea' FICH 'tesh01t.pun' RENA 'vx_ea_01'
RCOU 14 'p_eb'  FICH 'tesh01t.pun' RENA 'p_eb_01'
RCOU 15 'ro_eb' FICH 'tesh01t.pun' RENA 'ro_eb_01'
RCOU 16 'vx_eb' FICH 'tesh01t.pun' RENA 'vx_eb_01'
TRAC 1 4 11 14 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR VERT VERT
TRAC 2 5 12 15 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR VERT VERT
TRAC 3 6 13 16 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR VERT VERT
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

tesh11.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TESH11';
opti sauv form 'tesh11.msh';
opti trac psc ftra 'tesh11_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tesh11.epx

```
TESH11
ECHO
!CONV win
CAST mesh
EULE TRID
GEOM TEVF bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea' LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb' LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                           X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 TERM
```

```
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1
!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
      ORDR 2    ! Ordre 2 en espace
      OTPS 2    ! Ordre 2 en temps
      RECO 1    ! Reconstruction de type Green-Gauss
      LMAS 3    ! k-limiteur de Dubois (eq. masse)
      LQDM 3    ! k-limiteur de Dubois (eq. QDM)
      LENE 3    ! k-limiteur de Dubois (eq. energie)
      KMAS 0.75 ! Coefficient de limitation (eq. masse)
      KQDM 0.75 ! Coefficient de limitation (eq. QDM)
      KENE 0.75 ! Coefficient de limitation (eq. energie)
      CENE      ! Correction de l'energie interne
CALC TINI 0. TEND 0.60E-3
*==============================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                        VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                     TIME 0.60E-3 NRAR 30 VARI 5
TRAC 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  2.58277E+0 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95387E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.90036E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81280E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.93344E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.92747E+0 TOLE 2.E-2
*==============================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tesh11t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
TRAC 1 4 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR
TRAC 2 5 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR
TRAC 3 6 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*==============================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*==============================================================
FIN
```

tesh17.dgibi

```
opti echo 1;
opti donn 'pxhex2te.proc';
opti dime 3 elem cub8;
opti titr 'TESH17';
opti sauv form 'tesh17.msh';
opti trac psc ftra 'tesh17_mesh.ps';
p0 = 0 0 0;
dd = 0.01;
n = 100;
tol = 0.0001;
p1 = 0 dd 0;
p2 = 0 dd dd;
p3 =  0 0 dd;
c1 = p0 d 1 p1;
c2 = p1 d 1 p2;
c3 = p2 d 1 p3;
c4 = p3 d 1 p0;
base = dall c1 c2 c3 c4 plan;
bar8 = base volu n tran ((n*dd) 0 0);
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  cubei = bar8 elem i;
  tt = pxhex2te cubei;
  si (ega i 1);
    bar = tt;
  sinon;
    bar = bar et tt;
  finsi;
fin loop1;
elim tol bar;
mesh = bar;
tass mesh;
sauv form mesh;
trac qual cach mesh;
fin;
```

tesh17.epx

```
TESH17
ECHO
!CONV win
CAST mesh
EULE TRID
DIME
  ADAP NPOI 1648 NVFI 16912 TEVF 7872 ENDA
TERM
GEOM TEVF bar TERM
COMP GROU 4 'bar1' LECT bar TERM COND XB LT 0.5
            'bar2' LECT bar DIFF bar1 TERM
            'ea' LECT bar TERM COND NEAR POIN 0.25 0 0
            'eb' LECT bar TERM COND NEAR POIN 0.75 0 0
     NGRO 1 'xaxo' LECT bar TERM COND LINE X1 0 Y1 0 Z1 0
                                           X2 1 Y2 0 Z2 0 TOL 1.E-4
     COUL ROUG LECT bar1 TERM
          VERT LECT bar2 TERM
WAVE 4 PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 613.568783589856 ! shock wave
          MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 295.278289836459 ! c.d. wave
          MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 18.2004723251679 ! r.wave (ri.)
          MAXL 3 H1 0.015 H2 0.05
       PLAN X 0.5 Y 0 Z 0 NX -1 NY 0 NZ 0 T0 0 C 387.298334620742 ! r. wav (le.)
          MAXL 3 H1 0.015 H2 0.05
MATE GAZP RO 10 GAMM 1.5 PINI 1.E6 PREF 1.E5
          LECT bar1 TERM
     GAZP RO  1 GAMM 1.5 PINI 1.E5 PREF 1.E5
          LECT bar2 _tevf TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO VFCC TFRE 0.3E-3
     FICH ALIC TEMP FREQ 1
          ELEM LECT ea eb TERM
     FICH ALIC TFRE 1.0E-5
OPTI NOTE STEP IO
 CSTA 0.5
 LOG 1

!ADAP CHEC ! temporary !!!

!VFCC FCON 1              ! OK
!VFCC FCON 2 VISC 0.75    ! OK
 VFCC FCON 3              ! OK
!VFCC FCON 4              ! OK
!VFCC FCON 5              ! OK
!VFCC FCON 6              ! OK
!VFCC FCON 7              ! OK
!VFCC FCON 8              ! OK
!VFCC FCON 9              ! OK
!VFCC FCON 10             ! OK
!VFCC FCON 11             ! OK
!VFCC FCON 12             ! OK
      ORDR 2    ! Ordre 2 en espace
      OTPS 2    ! Ordre 2 en temps
      RECO 1    ! Reconstruction de type Green-Gauss
      LMAS 3    ! k-limiteur de Dubois (eq. masse)
      LQDM 3    ! k-limiteur de Dubois (eq. QDM)
      LENE 3    ! k-limiteur de Dubois (eq. energie)
      KMAS 0.75 ! Coefficient de limitation (eq. masse)
      KQDM 0.75 ! Coefficient de limitation (eq. QDM)
      KENE 0.75 ! Coefficient de limitation (eq. energie)
      CENE      ! Correction de l'energie interne
CALC TINI 0. TEND 0.60E-3
*==============================================================
SUIT
Post-treatment (space curves from alice file)
ECHO
RESU ALIC GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
SCOU 61 'p_61'  NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
```

```
                         ECRO COMP 1
SCOU 62 'ro_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                         ECRO COMP 2
SCOU 65 'vx_61' NSTO 61 SAXE 1.0 'curr_abscissa' LECT xaxo TERM
                         VCVI COMP 1
DCOU 71 'p_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                      TIME 0.60E-3 NRAR 30 VARI 1
DCOU 72 'r_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                      TIME 0.60E-3 NRAR 30 VARI 2
DCOU 75 'v_ana' SHTU GAMM 1.5 ROM 10 ROP 1 EINT 2.0E5 LENM 0.5 LENP 0.5
                      TIME 0.60E-3 NRAR 30 VARI 5
RCOU 11 'p_61'  FICH 'tesh11.pun' RENA 'p_61_11'
RCOU 12 'ro_61' FICH 'tesh11.pun' RENA 'ro_61_11'
RCOU 15 'vx_61' FICH 'tesh11.pun' RENA 'vx_61_11'
TRAC 11 61 71 AXES 1.0 'PRESS. [PA]'
COLO NOIR VERT ROUG
LIST 61 AXES 1.0 'PRESS. [PA]'
TRAC 12 62 72 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR VERT ROUG
LIST 62 AXES 1.0 'DENS. [KG/M3]'
TRAC 15 65 75 AXES 1.0 'VELOC. [M/S]'
COLO NOIR VERT ROUG
LIST 65 AXES 1.0 'VELOC. [M/S]'
*
QUAL VCVI COMP 1 LECT ea   TERM REFE  1.10169E-1 TOLE 2.E-2
     VCVI COMP 1 LECT eb   TERM REFE  2.95387E+2 TOLE 2.E-2
     ECRO COMP 1 LECT ea   TERM REFE  9.99569E+5 TOLE 2.E-2
     ECRO COMP 1 LECT eb   TERM REFE  2.81270E+5 TOLE 2.E-2
     ECRO COMP 2 LECT ea   TERM REFE  9.99713E+0 TOLE 2.E-2
     ECRO COMP 2 LECT eb   TERM REFE  1.92813E+0 TOLE 2.E-2
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
PERF 'tesh17t.pun'
AXTE 1.0 'Time [s]'
COUR 1 'p_ea'  ECRO COMP 1 ELEM LECT ea TERM
COUR 2 'ro_ea' ECRO COMP 2 ELEM LECT ea TERM
COUR 3 'vx_ea' VCVI COMP 1 ELEM LECT ea TERM
COUR 4 'p_eb'  ECRO COMP 1 ELEM LECT eb TERM
COUR 5 'ro_eb' ECRO COMP 2 ELEM LECT eb TERM
COUR 6 'vx_eb' VCVI COMP 1 ELEM LECT eb TERM
RCOU 11 'p_ea'  FICH 'tesh11t.pun' RENA 'p_ea_11'
RCOU 12 'ro_ea' FICH 'tesh11t.pun' RENA 'ro_ea_11'
RCOU 13 'vx_ea' FICH 'tesh11t.pun' RENA 'vx_ea_11'
RCOU 14 'p_eb'  FICH 'tesh11t.pun' RENA 'p_eb_11'
RCOU 15 'ro_eb' FICH 'tesh11t.pun' RENA 'ro_eb_11'
RCOU 16 'vx_eb' FICH 'tesh11t.pun' RENA 'vx_eb_11'
TRAC 1 4 11 14 AXES 1.0 'PRESS. [PA]'
COLO NOIR NOIR VERT VERT
TRAC 2 5 12 15 AXES 1.0 'DENS. [KG/M3]'
COLO NOIR NOIR VERT VERT
TRAC 3 6 13 16 AXES 1.0 'VELOC. [M/S]'
COLO NOIR NOIR VERT VERT
LIST 1 4 AXES 1.0 'PRESS. [PA]'
LIST 2 5 AXES 1.0 'DENS. [KG/M3]'
LIST 3 6 AXES 1.0 'VELOC. [M/S]'
*=================================================================
SUIT
Post treatment (BMPs from alice file)
ECHO
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 61
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-03  3.00015E-01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   5.25000E+01
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL VCVI SCAL USER PROG 20 PAS 20 280 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
SCEN GEOM NAVI FREE
!        LINE HEOU
     ISO  FILL FIEL ECRO 2 SCAL USER PROG 1 PAS 0.6 8.8 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS SIZE 1400 400 FICH BMP REND
ENDPLAY
*=================================================================
FIN
```

test10qua.dgibi

```
opti echo 1;
opti dime 2 elem qua4;
opti sauv form 'test10qua.msh';
opti trac psc ftra 'test10qua_mesh.ps';
p0 = 0 0;
p1 = 10 0;
p2 = 10 10;
p3 = 0 10;
c1 = p0 d 10 p1;
c2 = p1 d 10 p2;
c3 = p2 d 10 p3;
c4 = p3 d 10 p0;
mesh = dall c1 c2 c3 c4 plan;
tass mesh;
sauv form mesh;
trac qual mesh;
fin;
```

test10qua.epx

```
TEST10QUA
ECHO
!CONV win
CAST mesh
LAGR DPLA
DIME
  ADAP NPOI 3669 FL24 4588 ENDA
TERM
!opti dump dpma
GEOM FL24 mesh TERM
COMP NGRO 4 'bx1' LECT mesh TERM COND X LT 0.01
            'bx2' LECT mesh TERM COND X gT 9.99
            'by1' LECT mesh TERM COND Y LT 0.01
            'by2' LECT mesh TERM COND Y gT 9.99
WAVE 2 SPHE X  0 Y  0 T0 0 C 500 MAXL 4 H1 1.5 H2 5
       SPHE X 10 Y 10 T0 0 C 500 MAXL 4 H1 1.5 H2 5
MATE FLUT RO 1.2 EINT 2.0833E5 GAMM 1.4 PB 0
          ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
          CQ 2.56 PMIN 0 NUM 1
          LECT mesh _fl24 TERM
LINK COUP BLOQ 1 LECT bx1 bx2 TERM
               2 LECT by1 by2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 100
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
 log 1
CALC TINI 0. TEND 50.0E-3
*=================================================================
PLAY
CAME   1 EYE   5.00000E+00  5.00000E+00  2.82843E+01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
scen geom navi free
          face hfro
         !line sfre !heou
     colo pape
sler cam1 1 nfra 1
trac offs fich avi nocl nfto 115 fps 25 kfre 10 comp -1 rend
freq 1
gotr loop 113 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
QUAL DEPL COMP 1 LECT 1 TERM REFE  0.00000E+0 TOLE 5.E-3
FIN

BEGIN DESCRIPTION

This test verifies mesh refinement and de-refinement ("adaptivity").
A square region is subjected to two (user-defined)
circular wavefronts that traverse the region.

The mesh is refined near the wavefronts and de-refined when
the wavefronts have passed.

This test verifies only the geomtrical aspects of "adaptivity"
and is not a true adaptive calculation, since the wavefronts
are purely geometrical entities specified by the user
and do not induce any stress in the structure.

The geometrical part of the adaptivity algorithm behaves es expected.
The graphical production of an animation in the presence
of adaptivity is also tested here.

END DESCRIPTION
```

test10tri.dgibi

```
opti echo 1;
opti dime 2 elem qua4;
opti sauv form 'test10tri.msh';
opti trac psc ftra 'test10tri_mesh.ps';
p0 = 0 0;
p1 = 10 0;
p2 = 10 10;
p3 = 0 10;
c1 = p0 d 10 p1;
c2 = p1 d 10 p2;
c3 = p2 d 10 p3;
c4 = p3 d 10 p0;
meshq = dall c1 c2 c3 c4 plan;
mesh = chan tri3 meshq;
tass mesh;
sauv form mesh;
trac qual mesh;
fin;
```

test10tri.epx

```
TEST10TRI
ECHO
!CONV win
CAST mesh
LAGR DPLA
DIME
  ADAP NPOI 10000 FL23 10000 ENDA
TERM
!opti dump dpma
GEOM FL23 mesh TERM
COMP NGRO 4 'bx1' LECT mesh TERM COND X LT 0.01
            'bx2' LECT mesh TERM COND X gT 9.99
            'by1' LECT mesh TERM COND Y LT 0.01
            'by2' LECT mesh TERM COND Y gT 9.99
WAVE 2 SPHE X  0 Y  0 T0 0 C 500 MAXL 4 H1 1.5 H2 5
       SPHE X 10 Y 10 T0 0 C 500 MAXL 4 H1 1.5 H2 5
MATE FLUT RO 1.2 EINT 2.0833E5 GAMM 1.4 PB 0
```

```
         ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
         CQ 2.56 PMIN 0 NUM 1
         LECT mesh _fl23 TERM
LINK COUP BLOQ 1 LECT bx1 bx2 TERM
              2 LECT by1 by2 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 100
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
 CSTA 0.5
 log 1
CALC TINI 0. TEND 50.0E-3
*=================================================================
PLAY
CAME   1 EYE   5.00000E+00  5.00000E+00  2.82843E+01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
scen geom navi free
          face hfro
         !line sfre !heou
     colo pape
sler cam1 1 nfra 1
trac offs fich avi nocl nfto 183 fps 25 kfre 10 comp -1 rend
freq 1
gotr loop 181 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
QUAL DEPL COMP 1 LECT 1 TERM REFE  0.00000E+0 TOLE 5.E-3
FIN

BEGIN DESCRIPTION

This test verifies mesh refinement and de-refinement ("adaptivity").
A square region is subjected to two (user-defined)
circular wavefronts that traverse the region.

The mesh is refined near the wavefronts and de-refined when
the wavefronts have passed.

This test verifies only the geomtrical aspects of "adaptivity"
and is not a true adaptive calculation, since the wavefronts
are purely geometrical entities specified by the user
and do not induce any stress in the structure.

The geometrical part of the adaptivity algorithm behaves es expected.
The graphical production of an animation in the presence
of adaptivity is also tested here.

END DESCRIPTION
```

test10triv.epx

```
TEST10TRIV
ECHO
RESU ALIC 'test10tri.ali' GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   5.00000E+00  5.00000E+00  2.82843E+01
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
scen geom navi free
          face hfro
         !line sfre !heou
     VECT SCCO FIEL VITE SCAL USER PROG 0.05 PAS 0.05 0.70 TERM
     TEXT VSCA
     colo pape
sler cam1 1 nfra 1
trac offs fich avi nocl nfto 183 fps 25 kfre 10 comp -1 rend
freq 1
gotr loop 181 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
FIN
```

trad01.epx

```
TRAD01
ECHO
 CONV win
LAGR DPLA
DIME
  ADAP NPOI 3 FL23 4 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 4 FL23 2 TERM
 0 0  1 0  0 1  1 1
 1 2 3
 2 4 3
MATE FLUT RO 1.0 EINT 2.5E5 GAMM 1.4 PB 0
         ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
         CQ 2.56 PMIN 0 NUM 1
         LECT 1 2 _fl23 TERM
LINK COUP BLOQ 1 LECT 1 2 3 4 TERM
              2 LECT 1 2 3 4 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 2
*=======================================================================
PLAY
TRAC REND
ADAP
  SPLI 1
TERM
GO
TRAC REND
ADAP
  USPL 1
TERM
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

trad02.epx

```
TRAD02
ECHO
 CONV win
LAGR DPLA
DIME
  ADAP NPOI 5 FL23 8 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 4 FL23 2 TERM
 0 0  1 0  0 1  1 1
 1 2 3
 2 4 3
MATE FLUT RO 1.0 EINT 2.5E5 GAMM 1.4 PB 0
         ITER 1 ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5
         CQ 2.56 PMIN 0 NUM 1
         LECT 1 2 _fl23 TERM
LINK COUP BLOQ 1 LECT 1 2 3 4 TERM
              2 LECT 1 2 3 4 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 4
*=======================================================================
PLAY
TRAC REND
ADAP SPLI 1 TERM
GO
TRAC REND
ADAP SPLI 2 TERM
GO
TRAC REND
ADAP USPL 1 TERM
GO
TRAC REND
ADAP USPL 2 TERM
GO
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

trad03.epx

```
TRAD03
ECHO
 CONV win
LAGR DPLA
DIME
  ADAP NPOI 20 TRIA 20 CL2D 10 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 4 TRIA 2 CL2D 1 TERM
 0 0  1 0  0 1  1 1
 1 2 4
 1 4 3
 3 1
MATE LINE RO 8000 YOUN 2.E11 NU 0
         LECT 1 2 _tria TERM
     IMPE PIMP RO 8000. PRES 0
         LECT 3 _cl2d TERM
LINK COUP
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 4
*=======================================================================
PLAY
TRAC REND
ADAP SPLI 1 TERM
GO
TRAC REND
ADAP SPLI 2 TERM
GO
TRAC REND
ADAP SPLI 10 TERM
GO
TRAC REND
ADAP SPLI 8 TERM
GO
TRAC REND
ENDPLAY
*=======================================================================
FIN
```

trad04.epx

```
TRAD04
ECHO
```

```
 CONV win
LAGR DPLA
DIME
  ADAP NPOI 20 TRIA 20 CL2D 10 ENDA
TERM
opti dump dpma
GEOM LIBR POIN 3 TRIA 1 CL2D 1 TERM
 0 0  1 0  0 1
 1 2 3
 1 2
MATE LINE RO 8000 YOUN 2.E11 NU 0
          LECT 1 _tria TERM
     IMPE PIMP RO 8000. PRES 0
          LECT 2 _cl2d TERM
LINK COUP
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO FREQ 1
     FICH ALIC FREQ 1
OPTI NOTE STEP LIBR
     ADAP DUMP
     LNKS STAT DUMP
 log 1
CALC TINI 0. TEND 50.0E-3 NMAX 3
*=====================================================================
PLAY
TRAC REND
ADAP SPLI 1 TERM
GO
TRAC REND
ADAP SPLI 3 TERM
GO
TRAC REND
ADAP SPLI 4 TERM
GO
TRAC REND
ENDPLAY
*=====================================================================
FIN
```

tube42.epx

```
TUBE - 42
ECHO
!CONV win
TRID EULE
DIME
PT3L 24 FL38 4 FL35 2 FL34 2 CL3Q 2 ZONE 4
NALE 1 BLOQ 48 ELVC 50
TERM
GEOM LIBR POIN 24
     FL38 4 FL35 2 FL34 2 CL3Q 2 TERM
 0 0 0  1 0 0  2 0 0  3 0 0  4 0 0  5 0 0
 0 0 1  1 0 1  2 0 1  3 0 1  4 0 1  5 0 1
 0 1 0  1 1 0  2 1 0  3 1 0  4 1 0  5 1 0
 0 1 1  1 1 1  2 1 1  3 1 1  4 1 1  5 1 1
 2 3 15 14 8 9 21 20
 3 4 16 15 9 10 22 21
 4 5 17 16 10 11 23 22
 5 6 18 17 11 12 24 23
 1 13 19 7 2
 2 8 20 14 19
 13 14 19 2
 2 7 8 19
 1 13 19 7
 6 18 24 12
 OPTI DPMA
MATE FLUT RO 1.0 EINT 4.E6 GAMM 1.5 PB 0 ITER 1
          ALF0 1 BET0 1 KINT 0 AHGF 0 CL 0.5 CQ 2.56
          PMIN 0 NUM 1 VXFF 1.0
          LECT 1 PAS 1 10 TERM
LIAI BLOQ 23 TOUS
INIT VITE 1 1.0 TOUS
ECRI VITE FINT FEXT ACCE ECRO TFRE 10.E-3
!    TRAC XPLO DESC 'TUBE42'
!              TFRE 5.E-3 POIN LECT 1 PAS 1 6 TERM
     FICH ALIC TEMP FREQ 1 POIN LECT 1 6 TERM ELEM LECT 4 5 TERM

OPTION STEP IO
OPTI NOTE csta 0.5
     CLMT FARF 1
CALCUL TINI 0. TEND 20.E-3
*====================================================================
SUIT
Post-treatment (bande alice temps)
ECHO
*
RESU ALIC TEMP GARD PSCR
*
SORT GRAP
*
AXTE 1000.0 'Time [ms]'
*
COUR  1 'vx_1'    VITE  COMP 1 LECT  1 TERM
COUR  2 'vx_6'    VITE  COMP 1 LECT  6 TERM
COUR  3 'p_4'     ECRO  COMP 1 LECT  4 TERM
COUR  4 'p_5'     ECRO  COMP 1 LECT  5 TERM
*
TRAC 1 2 AXES 1.0 'VEL. [M/S]'
TRAC 3 4 AXES 1.0 'PRES. [PA]'
*
QUAL VITE COMP 1 LECT   1 TERM REFE  1.00000E+0 TOLE 5.E-3
     VITE COMP 1 LECT   6 TERM REFE  1.00000E+0 TOLE 5.E-3
     ECRO COMP 1 LECT   4 TERM REFE  2.00000E+6 TOLE 5.E-3
     ECRO COMP 1 LECT   5 TERM REFE  2.00000E+6 TOLE 5.E-3
*====================================================================
FIN
```

twad21.dgibi

```
opti echo 1;
opti dime 2 elem qua4;
opti sauv form 'twad21.msh';
opti trac psc ftra 'twad21_mesh.ps';
p0 = 0 0;
p0p = p0 plus (0 0.1);
pmid = 0.5 0;
p1 = 1 0;
p1p = p1 plus (0 0.1);
tol = 1.E-5;
n = 10;
c1 = p0 d n p1;
bar4 = c1 tran 1 (0 0.1);
bar = chan tri3 bar4;
clpr = p0p d 1 p0;
elim tol (bar et p0p et p1p et pmid et clpr);
mesh = bar et clpr;
tass mesh;
sauv form mesh;
trac qual mesh;
fin;
```

twad21.epx

```
TWAD21
ECHO
!CONV win
CAST mesh
LAGR CPLA
DIME
  ADAP NPOI 172 TRIA 388 CL22 14 ENDA
TERM
GEOM TRIA bar CL22 clpr TERM
WAVE 1 PLAN X 0 Y 0 NX 1 NY 0 T0 0 C 5000 MAXL 4 H1 0.15 H2 0.5
!COMP EPAI 1.E-2 LECT bar _tria TERM
MATE VM23 RO 8000. YOUN 2.E11 NU 0.0 ELAS 2.E11
          TRAC 1 2.E11 1.D0
          LECT 1 PAS 1 10 SUIT bar _tria TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT clpr _cl22 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO
     !freq 1
     TFRE 1.E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT p0 pmid p1 p0p TERM
LINK COUP BLOQ 1 LECT p1 p1p TERM
OPTI NOTE STEP LIBR
 LOG 1 DPMA LNKS STAT
!ADAP CHEC
CALC TINI 0. TEND 1.E-3
*=================================================================
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-02  2.51247E+00
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
SCEN GEOM NAVI FREE
     FACE HFRO
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS FICH AVI NOCL NFTO 229 FPS 25 KFRE 10 COMP -1 REND
FREQ 1
GOTR LOOP 227 OFFS FICH AVI CONT NOCL REND
GO
TRAC OFFS FICH AVI CONT REND
ENDPLAY
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
COUR  7 'vx_p0p'  VITE COMP 1 NOEU LECT p0p  TERM
!RCOU 11 'dx_p0'   FICH 'twod01.pun' RENA 'dx_p0_01'
!RCOU 12 'dx_pmid' FICH 'twod01.pun' RENA 'dx_pmid_01'
!RCOU 13 'dx_p1'   FICH 'twod01.pun' RENA 'dx_p1_01'
!RCOU 14 'vx_p0'   FICH 'twod01.pun' RENA 'vx_p0_01'
!RCOU 15 'vx_pmid' FICH 'twod01.pun' RENA 'vx_pmid_01'
!RCOU 16 'vx_p1'   FICH 'twod01.pun' RENA 'vx_p1_01'
!RCOU 41 'dx_p0'   FICH 'twod04.pun' RENA 'dx_p0_04'
!RCOU 42 'dx_pmid' FICH 'twod04.pun' RENA 'dx_pmid_04'
!RCOU 43 'dx_p1'   FICH 'twod04.pun' RENA 'dx_p1_04'
!RCOU 44 'vx_p0'   FICH 'twod04.pun' RENA 'vx_p0_04'
!RCOU 45 'vx_pmid' FICH 'twod04.pun' RENA 'vx_pmid_04'
!RCOU 46 'vx_p1'   FICH 'twod04.pun' RENA 'vx_p1_04'
TRAC 1 2 3 AXES 1.0 'DISPL. [M]'
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 1 2 3 AXES 1.0 'DISPL. [M]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 2.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 2.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 4.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 4.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 6.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 6.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
TRAC 4 7 AXES 1.0 'VELOC. [M/S]' ! symmetry check
```

```
  COLO NOIR ROUG
*=================================================================
FIN
```

twad21b.epx

```
TWAD11B
ECHO
RESU ALIC TEMP 'twad11.alt' GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
RCOU 11 'dx_p0'   FICH 'onad01.pun' RENA 'dx_p0_1D'
RCOU 12 'dx_pmid' FICH 'onad01.pun' RENA 'dx_pmid_1D'
RCOU 13 'dx_p1'   FICH 'onad01.pun' RENA 'dx_p1_1D'
RCOU 14 'vx_p0'   FICH 'onad01.pun' RENA 'vx_p0_1D'
RCOU 15 'vx_pmid' FICH 'onad01.pun' RENA 'vx_pmid_1D'
RCOU 16 'vx_p1'   FICH 'onad01.pun' RENA 'vx_p1_1D'
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
*=================================================================
FIN
```

twad22.dgibi

```
opti echo 1;
opti donn 'pxq42t34.proc';
opti dime 2 elem qua4;
opti sauv form 'twad22.msh';
opti trac psc ftra 'twad22_mesh.ps';
p0 = 0 0;
p0p = p0 plus (0 0.1);
pmid = 0.5 0;
p1 = 1 0;
p1p = p1 plus (0 0.1);
tol = 1.E-5;
n = 10;
c1 = p0 d n p1;
bar4 = c1 tran 1 (0 0.1);
*
i = 0;
repe loop1 (nbel bar4);
  i = i + 1;
  qi = bar4 elem i;
  tria = pxq42t34 qi;
  si (ega i 1);
    bar = tria;
  sinon;
    bar = bar et tria;
  finsi;
fin loop1;
*
clpr = p0p d 1 p0;
elim tol (bar et p0p et p1p et pmid et clpr);
mesh = bar et clpr;
tass mesh;
sauv form mesh;
trac qual mesh;
fin;
```

twad22.epx

```
TWAD22
ECHO
!CONV win
CAST mesh
LAGR CPLA
DIME
  ADAP NPOI 316 TRIA 760 CL22 14 ENDA
TERM
GEOM TRIA bar CL22 clpr TERM
WAVE 1 PLAN X 0 Y 0 NX 1 NY 0 T0 0 C 5000 MAXL 4 H1 0.15 H2 0.5
!COMP EPAI 1.E-2 LECT bar _tria TERM
MATE VM23 RO 8000. YOUN 2.E11 NU 0.0 ELAS 2.E11
          TRAC 1 2.E11 1.D0
          LECT 1 PAS 1 10 SUIT bar _tria TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT clpr _cl22 TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO
     !freq 1
     TFRE 1.E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT p0 pmid p1 p0p TERM
LINK COUP BLOQ 1 LECT p1 p1p TERM
OPTI NOTE STEP LIBR
 LOG 1 DPMA LNKS STAT
!ADAP CHEC
CALC TINI 0. TEND 1.E-3
*=================================================================
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-02  2.51247E+00
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
SCEN GEOM NAVI FREE
     FACE HFRO
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS FICH AVI NOCL NFTO 324 FPS 25 KFRE 10 COMP -1 REND
FREQ 1
GOTR LOOP 322 OFFS FICH AVI CONT NOCL REND
GO
TRAC OFFS FICH AVI CONT REND
ENDPLAY
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
COUR  7 'vx_p0p'  VITE COMP 1 NOEU LECT p0p  TERM
!RCOU 11 'dx_p0'   FICH 'twod01.pun' RENA 'dx_p0_01'
!RCOU 12 'dx_pmid' FICH 'twod01.pun' RENA 'dx_pmid_01'
!RCOU 13 'dx_p1'   FICH 'twod01.pun' RENA 'dx_p1_01'
!RCOU 14 'vx_p0'   FICH 'twod01.pun' RENA 'vx_p0_01'
!RCOU 15 'vx_pmid' FICH 'twod01.pun' RENA 'vx_pmid_01'
!RCOU 16 'vx_p1'   FICH 'twod01.pun' RENA 'vx_p1_01'
!RCOU 41 'dx_p0'   FICH 'twod04.pun' RENA 'dx_p0_04'
!RCOU 42 'dx_pmid' FICH 'twod04.pun' RENA 'dx_pmid_04'
!RCOU 43 'dx_p1'   FICH 'twod04.pun' RENA 'dx_p1_04'
!RCOU 44 'vx_p0'   FICH 'twod04.pun' RENA 'vx_p0_04'
!RCOU 45 'vx_pmid' FICH 'twod04.pun' RENA 'vx_pmid_04'
!RCOU 46 'vx_p1'   FICH 'twod04.pun' RENA 'vx_p1_04'
TRAC 1 2 3 AXES 1.0 'DISPL. [M]'
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 1 2 3 AXES 1.0 'DISPL. [M]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 2.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 2.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 4.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 4.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 6.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 6.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
TRAC 4 7 AXES 1.0 'VELOC. [M/S]' ! symmetry check
  COLO NOIR ROUG
*=================================================================
FIN
```

twad22b.epx

```
TWAD11B
ECHO
RESU ALIC TEMP 'twad11.alt' GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
RCOU 11 'dx_p0'   FICH 'onad01.pun' RENA 'dx_p0_1D'
RCOU 12 'dx_pmid' FICH 'onad01.pun' RENA 'dx_pmid_1D'
RCOU 13 'dx_p1'   FICH 'onad01.pun' RENA 'dx_p1_1D'
RCOU 14 'vx_p0'   FICH 'onad01.pun' RENA 'vx_p0_1D'
RCOU 15 'vx_pmid' FICH 'onad01.pun' RENA 'vx_pmid_1D'
RCOU 16 'vx_p1'   FICH 'onad01.pun' RENA 'vx_p1_1D'
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
```

```
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
*=================================================================
FIN
```

twad30.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti sauv form 'twad30.msh';
opti trac psc ftra 'twad30_mesh.ps';
p0 = 0 0 0;
p0p = p0 plus (0 0.1 0);
pmid = 0.5 0 0;
p1 = 1 0 0;
p1p = p1 plus (0 0.1 0);
p2 = 0 0 0.1;
p2p = p2 plus (0 0.1 0);
p3 = 1 0 0.1;
p3p = p3 plus (0 0.1 0);
tol = 1.E-5;
n = 10;
c1 = p0 d n p1;
base = c1 tran 1 (0 0.1 0);
bar8 = base volu tran 1 (0 0 0.1);
elim tol (bar8 et p0p et p1p et p2 et p2p et p3 et p3p);
*
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  hi = bar8 elem i;
  tetr = pxhex2t2 hi;
  si (ega i 1);
    bar = tetr;
  sinon;
    bar = bar et tetr;
  finsi;
fin loop1;
*
pc = 0 0.05 0.05;
cl1 = manu tri3  p0 pc  p2;
cl2 = manu tri3  p2 pc p2p;
cl3 = manu tri3 p2p pc p0p;
cl4 = manu tri3 p0p pc  p0;
clpr = cl1 et cl2 et cl3 et cl4;
elim tol (bar et pc et pmid);
mesh = bar et clpr;
tass mesh;
sauv form mesh;
trac qual cach mesh;
trac qual clpr;
fin;
```

twad30.epx

```
TWAD30
ECHO
!CONV win
CAST mesh
LAGR TRID
GEOM TETR bar CL3I clpr TERM
COMP COUL VERT LECT bar TERM
          JAUN LECT clpr TERM
MATE VM23 RO 8000. YOUN 2.E11 NU 0.0 ELAS 2.E11
          TRAC 1 2.E11 1.D0
          LECT 1 PAS 1 10 SUIT bar TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT clpr TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO
     TFRE 1.E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT p0 pmid p1 p0p p1p p2 p2p p3 p3p TERM
LINK COUP BLOQ 1 LECT p1 p1p p3 p3p TERM
OPTI NOTE STEP LIBR
 LOG 1 DPMA LNKS STAT
 ADAP DUMP CHEC
CALC TINI 0. TEND 1.E-3
*=================================================================
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-02  2.51247E+00
!        Q      1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
SCEN GEOM NAVI FREE
     ISO FILL FIEL VITE SCAL USER PROG 0.002 PAS 0.002 0.028 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS FICH AVI NOCL NFTO 178 FPS 25 KFRE 10 COMP -1 REND
FREQ 1
GOTR LOOP 176 OFFS FICH AVI CONT NOCL REND
GO
TRAC OFFS FICH AVI CONT REND
ENDPLAY
*=================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
COUR  7 'vx_p0p'  VITE COMP 1 NOEU LECT p0p  TERM
COUR  8 'vx_p2'   VITE COMP 1 NOEU LECT p2   TERM
COUR  9 'vx_p2p'  VITE COMP 1 NOEU LECT p2p  TERM
TRAC 1 2 3 AXES 1.0 'DISPL. [M]'
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 1 2 3 AXES 1.0 'DISPL. [M]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
TRAC 4 7 8 9 AXES 1.0 'VELOC. [M/S]' ! symmetry check
  COLO NOIR ROUG VERT TURQ
*=================================================================
FIN
```

twad30b.epx

```
TWAD11B
ECHO
RESU ALIC TEMP 'twad11.alt' GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
RCOU 11 'dx_p0'   FICH 'onad01.pun' RENA 'dx_p0_1D'
RCOU 12 'dx_pmid' FICH 'onad01.pun' RENA 'dx_pmid_1D'
RCOU 13 'dx_p1'   FICH 'onad01.pun' RENA 'dx_p1_1D'
RCOU 14 'vx_p0'   FICH 'onad01.pun' RENA 'vx_p0_1D'
RCOU 15 'vx_pmid' FICH 'onad01.pun' RENA 'vx_pmid_1D'
RCOU 16 'vx_p1'   FICH 'onad01.pun' RENA 'vx_p1_1D'
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
*=================================================================
FIN
```

twad31.dgibi

```
opti echo 1;
opti donn 'pxhex2t2.proc';
opti dime 3 elem cub8;
opti sauv form 'twad31.msh';
opti trac psc ftra 'twad31_mesh.ps';
p0 = 0 0 0;
p0p = p0 plus (0 0.1 0);
pmid = 0.5 0 0;
p1 = 1 0 0;
p1p = p1 plus (0 0.1 0);
p2 = 0 0 0.1;
p2p = p2 plus (0 0.1 0);
p3 = 1 0 0.1;
p3p = p3 plus (0 0.1 0);
tol = 1.E-5;
n = 10;
c1 = p0 d n p1;
base = c1 tran 1 (0 0.1 0);
bar8 = base volu tran 1 (0 0 0.1);
elim tol (bar8 et p0p et p1p et p2 et p2p et p3 et p3p);
*
i = 0;
repe loop1 (nbel bar8);
  i = i + 1;
  hi = bar8 elem i;
  tetr = pxhex2t2 hi;
  si (ega i 1);
    bar = tetr;
  sinon;
    bar = bar et tetr;
  finsi;
fin loop1;
*
pc = 0 0.05 0.05;
cl1 = manu tri3  p0 pc  p2;
cl2 = manu tri3  p2 pc p2p;
cl3 = manu tri3 p2p pc p0p;
cl4 = manu tri3 p0p pc  p0;
clpr = cl1 et cl2 et cl3 et cl4;
elim tol (bar et pc et pmid);
mesh = bar et clpr;
tass mesh;
sauv form mesh;
trac qual cach mesh;
trac qual clpr;
fin;
```

twad31.epx

```
TWAD31
ECHO
!CONV win
CAST mesh
LAGR TRID
DIME
  ADAP NPOI 120 TETR 480 CL3I 16 ENDA
```

```
TERM
!opti dump dpma
GEOM TETR bar CL3I clpr TERM
WAVE 1 PLAN X 0 Y 0 Z 0 NX 1 NY 0 NZ 0 T0 0 C 5000
       MAXL 2 H1 0.15 H2 0.5
COMP COUL VERT LECT bar TERM
          JAUN LECT clpr TERM
MATE VM23 RO 8000. YOUN 2.E11 NU 0.0 ELAS 2.E11
          TRAC 1 2.E11 1.D0
          LECT 1 PAS 1 10 SUIT bar _tetr TERM
     IMPE PIMP RO 8000. PRES -1.E6
          LECT clpr _cl3i TERM
ECRI COOR DEPL VITE ACCE FINT FEXT CONT ECRO
     TFRE 1.E-3
     FICH ALIC TEMP FREQ 1
          POIN LECT p0 pmid p1 p0p p1p p2 p2p p3 p3p TERM
LINK COUP BLOQ 1 LECT p1 p1p p3 p3p TERM
OPTI NOTE STEP LIBR
 LOG 1 DPMA LNKS STAT
!ADAP DUMP CHEC
CALC TINI 0. TEND 1.E-3
*==================================================================
PLAY
CAME   1 EYE   5.00000E-01  5.00000E-02  2.51247E+00
!        Q     1.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00
         VIEW  0.00000E+00  0.00000E+00 -1.00000E+00
         RIGH  1.00000E+00  0.00000E+00  0.00000E+00
         UP    0.00000E+00  1.00000E+00  0.00000E+00
         FOV   2.48819E+01
SCEN GEOM NAVI FREE
     ISO FILL FIEL VITE SCAL USER PROG 0.002 PAS 0.002 0.028 TERM
     TEXT ISCA
     COLO PAPE
SLER CAM1 1 NFRA 1
TRAC OFFS FICH AVI NOCL NFTO 218 FPS 25 KFRE 10 COMP -1 REND
FREQ 1
GOTR LOOP 216 OFFS FICH AVI CONT NOCL REND
GO
TRAC OFFS FICH AVI CONT REND
ENDPLAY
*==================================================================
SUIT
Post-treatment (time curves from alice temps file)
ECHO
RESU ALIC TEMP GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
COUR  7 'vx_p0p'  VITE COMP 1 NOEU LECT p0p  TERM
COUR  8 'vx_p2'   VITE COMP 1 NOEU LECT p2   TERM
COUR  9 'vx_p2p'  VITE COMP 1 NOEU LECT p2p  TERM
!RCOU 11 'dx_p0'   FICH 'twod01.pun' RENA 'dx_p0_01'
!RCOU 12 'dx_pmid' FICH 'twod01.pun' RENA 'dx_pmid_01'
!RCOU 13 'dx_p1'   FICH 'twod01.pun' RENA 'dx_p1_01'
!RCOU 14 'vx_p0'   FICH 'twod01.pun' RENA 'vx_p0_01'
!RCOU 15 'vx_pmid' FICH 'twod01.pun' RENA 'vx_pmid_01'
!RCOU 16 'vx_p1'   FICH 'twod01.pun' RENA 'vx_p1_01'
!RCOU 41 'dx_p0'   FICH 'twod04.pun' RENA 'dx_p0_04'
!RCOU 42 'dx_pmid' FICH 'twod04.pun' RENA 'dx_pmid_04'
!RCOU 43 'dx_p1'   FICH 'twod04.pun' RENA 'dx_p1_04'
!RCOU 44 'vx_p0'   FICH 'twod04.pun' RENA 'vx_p0_04'
!RCOU 45 'vx_pmid' FICH 'twod04.pun' RENA 'vx_pmid_04'
!RCOU 46 'vx_p1'   FICH 'twod04.pun' RENA 'vx_p1_04'
TRAC 1 2 3 AXES 1.0 'DISPL. [M]'
TRAC 4 5 6 AXES 1.0 'VELOC. [M/S]'
LIST 1 2 3 AXES 1.0 'DISPL. [M]'
LIST 4 5 6 AXES 1.0 'VELOC. [M/S]'
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  COLO noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 2.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 2.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 4.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 4.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 1 2 3 11 12 13 41 42 43 AXES 1.0 'DISPL. [M]'
!  XMIN 0.E0 XMAX 6.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
!TRAC 4 5 6 14 15 16 44 45 46 AXES 1.0 'VELOC. [M/S]'
!  XMIN 0.E0 XMAX 6.E-4 NX 10
!  COLO noir noir noir roug roug roug vert vert vert
TRAC 4 7 8 9 AXES 1.0 'VELOC. [M/S]' ! symmetry check
  COLO NOIR ROUG VERT TURQ
*==================================================================
FIN
```

twad31b.epx

```
TWAD11B
ECHO
RESU ALIC TEMP 'twad11.alt' GARD PSCR
SORT GRAP
AXTE 1.0 'Time [s]'
COUR  1 'dx_p0'   DEPL COMP 1 NOEU LECT p0   TERM
COUR  2 'dx_pmid' DEPL COMP 1 NOEU LECT pmid TERM
COUR  3 'dx_p1'   DEPL COMP 1 NOEU LECT p1   TERM
COUR  4 'vx_p0'   VITE COMP 1 NOEU LECT p0   TERM
COUR  5 'vx_pmid' VITE COMP 1 NOEU LECT pmid TERM
COUR  6 'vx_p1'   VITE COMP 1 NOEU LECT p1   TERM
RCOU 11 'dx_p0'   FICH 'onad01.pun' RENA 'dx_p0_1D'
RCOU 12 'dx_pmid' FICH 'onad01.pun' RENA 'dx_pmid_1D'
RCOU 13 'dx_p1'   FICH 'onad01.pun' RENA 'dx_p1_1D'
RCOU 14 'vx_p0'   FICH 'onad01.pun' RENA 'vx_p0_1D'
RCOU 15 'vx_pmid' FICH 'onad01.pun' RENA 'vx_pmid_1D'
RCOU 16 'vx_p1'   FICH 'onad01.pun' RENA 'vx_p1_1D'
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 2.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 4.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 1 2 3 11 12 13 AXES 1.0 'DISPL. [M]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
TRAC 4 5 6 14 15 16 AXES 1.0 'VELOC. [M/S]'
  XMIN 0.E0 XMAX 6.E-4 NX 10
  COLO noir noir noir roug roug roug
*==================================================================
FIN
```

List of input files

European Commission
EUR 26630 – Joint Research Centre – Institute for the Protection and Security of the Citizen

Title: Adaptivity with Simplex Elements in EUROPLEXUS

Author(s): Folco Casadei, Martin Larcher, Georgios Valsamos

Luxembourg: Publications Office of the European Union

2014 – 111 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424

JRC89894
ISBN 978-92-79-37966-6
DOI 10.2788/70220

Abstract

This report is a sequel to reports and publications on mesh adaptivity in fast transient dynamics and presents the formulation and implementation of mesh adaptivity for simplex elements (triangles in 2D, tetrahedra in 3D) in fast transient dynamics. The algorithms are implemented in the EUROPLEXUS code.
The present work extends mesh adaptivity to simplex element shapes, i.e. the 3-node triangle (TRI3) in 2D and the 4-node tetrahedron (TET4) in 3D. These elements are useful in fully general unstructured meshing of complex geometries.

z

LB-NA-26630-EN-N

JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

Serving society
Stimulating innovation
Supporting legislation

Publications Office

ISBN 978-92-79-37966-6
DOI 10.2788/70220