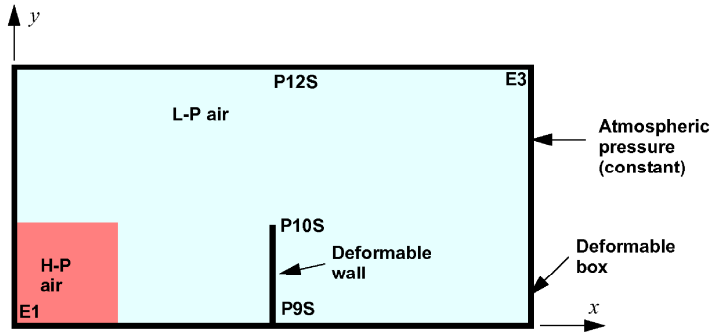
Exercise 6ter – Résumé of FSI models

(All available non-conforming techniques)



- Revisit the box problem of Exercise III-10b (**coarse** solutions with **conforming** FSI) and obtain more **accurate** solutions using all the available **non-conforming FSI** techniques:
  - With **FE** (**JRC** formulation) and either **FSA** or **FLSR**
  - With **FE** (**CEA** formulation) and either **FSA** or **FLSR**
  - With **NCFV** and either **FSA** or **FLSR** (see also Exercise IV-12b)
  - With **CCFV** and non-conforming **weak** FSI coupling or **FLSW**

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Problem description:

Revisit the box problem of Exercise III-10b (coarse solutions with conforming FSI) and obtain more accurate solutions using all the available non-conforming FSI techniques:

- With FE (JRC formulation) and either FSA or FLSR
- With FE (CEA formulation) and either FSA or FLSR
- With NCFV and either FSA or FLSR (see also Exercise IV-12b)
- With CCFV and non-conforming weak FSI coupling or FLSW

Numerical Solutions

All obtained solutions are listed in the following Table:

Fluid model / FSI model	FSA or weak (for CCFV)	Embedded: FLSR/FLSW
FE-JRC	ELFIN2	ELFIF2B
FE-CEA	ELCKN2	ELCKF2B
NCFV	VFNCN2S	VFNCF3S
CCFV	VFCCN2_O2	VFCCF2B_O2

ELFIN2

Solution with FE (JRC formulation) and FSA (non conforming). The fluid mesh is made of 3200 quadrilateral elements while the structure is made of 64 shell elements. The mesh generation file is:

```
opti echo 1;
opti titr 'ELFIN2';
opti sauv form 'elfin2.msh';
opti trac psc ftra 'elfin2_mesh.ps';
*
opti dime 2 elem qua4;
*
p1 = 0 0;
p2 = 2 0;
p3 = 2 1;
p4 = 0 1;
p5 = 0.4 0;
p6 = 0.4 0.4;
p7 = 0 0.4;
p8 = 0.4 1;
*
tol = 0.001;
*
c1 = p1 d 16 p5;
c2 = p5 d 16 p6;
c3 = p6 d 16 p7;
c4 = p7 d 16 p1;
expl = dall c1 c2 c3 c4 plan;
*
p9l = 1 0;
p9r = 1 0;
p10 = 1 0.4;
p11 = 2 0.4;
*
c1 = p5 d 24 p9l;
c2 = p9l d 16 p10;
c3 = p10 d 24 p6;
c4 = p6 d 16 p5;
air1a = dall c1 c2 c3 c4 plan;
*
c1 = p9r d 40 p2;
c2 = p2 d 16 p11;
c3 = p11 d 40 p10;
c4 = p10 d 16 p9r;
air1b = dall c1 c2 c3 c4 plan;
*
c1 = p6 d 24 p10 d 40 p11;
c2 = p11 d 24 p3;
c3 = p3 d 64 p8;
c4 = p8 d 24 p6;
air1c = dall c1 c2 c3 c4 plan;
*
elim tol (air1a et air1c);
elim tol (air1b et air1c);
air1 = air1a et air1b et air1c;
*
c1 = p7 d 16 p6;
c2 = p6 d 24 p8;
c3 = p8 d 16 p4;
c4 = p4 d 24 p7;
air2 = dall c1 c2 c3 c4 plan;
elim tol (air1c et air2);
elim tol (expl et air2);
elim tol (expl et air1a);
*
air = air1 et air2;
flui = expl et air;
*
e1 = expl elem cont p1;
e3 = air1 elem cont p3;
*
p1s = p1 plus p1;
p2s = p2 plus p1;
p3s = p3 plus p1;
p4s = p4 plus p1;
p9s = p9l plus p1;
p10s = p10 plus p1;
p12s = 1 1;
c1s = p1s d 10 p9s d 10 p2s;
c2s = p2s d 10 p3s;
c3s = p3s d 10 p12s d 10 p4s;
c4s = p4s d 10 p1s;
c5s = p9s d 4 p10s;
stru = c1s et c2s et c3s et c4s et c5s;
*
nfsa = cont flui;
*
mesh = flui et stru et e1 et e3 et nfsa;
*
sauv form mesh;
trac qual mesh;
*
list (nbel mesh);
list (nbno mesh);
*
fin;
```

The input file is:

```
ELFIN2
ECHO
!conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065
TERM
GEOM FL24 flui ED01 stru TERM
COMP EPAI 0.01 LECT stru TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
GRIL LAGR LECT stru TERM
     EULE LECT nfsa TERM
     AUTO AUTR
MATE FLUT RO 5.9485 EINT 4.20274E5 GAMM 1.4 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 expl TERM
     FLUT RO 1.1897 EINT 2.10137E5 GAMM 1.4 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 air TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
LINK COUP FSA NCFS LECT nfsa TERM
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
CALC TINI 0.0 TFIN 5.E-3
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
         face hfro
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 'dt1'     DT1
COUR  3 'p_e1'    ECRO COMP 1 ELEM LECT e1 TERM
COUR  4 'p_e3'    ECRO COMP 1 ELEM LECT e3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
*
TRAC 1   AXES 1.0 'DELTAT [S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
QUAL ECRO COMP 1 LECT e1 TERM REFE  1.56327E+5 TOLE 5.E-3
     ECRO COMP 1 LECT e3 TERM REFE  2.04496E+5 TOLE 5.E-3
*=================================================================
FIN
```

ELCKN2

Solution with FE (CEA formulation) and FSA (non conforming). The mesh is identical to the previous example. The input file is:

```
ELCKN2
ECHO
!conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065
TERM
GEOM CAR1 flui ED01 stru TERM
COMP EPAI 0.01 LECT stru TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
GRIL LAGR LECT stru TERM
     EULE LECT nfsa TERM
     AUTO AUTR
MATE GAZP RO 5.9485 GAMMA 1.4 CV 716.75 PINI 1.E6 PREF 1.E5
          LECT expl TERM
     GAZP RO 1.1897 GAMMA 1.4 CV 716.75 PINI 1.E5 PREF 1.E5
          LECT air TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
LINK COUP FSA NCFS LECT nfsa TERM
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
     KFLU 1000
CALC TINI 0.0 TFIN 5.E-3
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 'dt1'     DT1
COUR  3 'p_e1'    ECRO COMP 1 ELEM LECT e1 TERM
COUR  4 'p_e3'    ECRO COMP 1 ELEM LECT e3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
*
TRAC 1   AXES 1.0 'DELTAT [S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
QUAL ECRO COMP 1 LECT e1 TERM REFE  1.62924E+5 TOLE 5.E-3
     ECRO COMP 1 LECT e3 TERM REFE  2.16846E+5 TOLE 5.E-3
*=================================================================
FIN
```

VFNCN2S

Solution with NCFV (new SYNC 1 time integration strategy) and FSA (non conforming). The mesh is identical to the previous example, except from the presence of an external layer of CLxx elements used to impose the external atmospheric pressure (there is no PREF parameter in the material of NCFV). The input file is:

```
VFNCN2S
ECHO
!conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065 NDVC 13072
TERM
GEOM MC24 flui ED01 stru CL22 pext TERM
COMP EPAI 0.01 LECT stru TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
          jaun LECT pext TERM
GRIL LAGR LECT stru TERM
     EULE LECT nfsa TERM
     AUTO AUTR
MATE MCGP NCOM 1 R 8.3143E3
          COMP 'Air' PM 29.0 CV1 2.07585E4 CV2 0 CV3 0
          LECT flui TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
     IMPE PIMP RO 1.1897 PRES 1.E5 PREF 0
```

```
          LECT pext TERM
INIT MCOM COMP 'Air' MFRA 1.0 LECT flui TERM
          PRES 1.E6 LECT expl TERM
          PRES 1.E5 LECT air  TERM
          TEMP 586.36 LECT expl TERM
          TEMP 293.16 LECT air  TERM
          VEL1 0.0 LECT flui TERM
          VEL2 0.0 LECT flui TERM
LINK COUP FSA NCFS LECT nfsa TERM
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO MCVA TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p4 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
     MC ORDR 2 NUFL ROE SYNC 1
CALC TINI 0.0 TFIN 5.E-3
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel mcpr scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel mcpr scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel mcpr scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 'dt1'     DT1
COUR  3 'p_e1'    MCPR COMP 1 NOEU LECT p1 TERM
COUR  4 'p_e3'    MCPR COMP 1 NOEU LECT p3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
COUR 101 'p_p4'    MCPR COMP 1 NOEU LECT p4 TERM
COUR 102 'r_p4'    MCRO COMP 1 NOEU LECT p4 TERM
COUR 103 't_p4'    MCTE COMP 1 NOEU LECT p4 TERM
COUR 104 'yl_p4'   MCMF COMP 1 NOEU LECT p4 TERM
*
TRAC 1   AXES 1.0 'DELTAT [S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
TRAC 101 AXES 1.0 'PRESS. [PA]'
TRAC 102 AXES 1.0 'DENS. [KG/M3]'
TRAC 103 AXES 1.0 'TEMP. [K]'
TRAC 104 AXES 1.0 'FRAC. [-]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
QUAL MCPR COMP 1 LECT p1 TERM REFE  1.56554E+5 TOLE 5.E-3
     MCPR COMP 1 LECT p3 TERM REFE  2.02150E+5 TOLE 5.E-3
*=================================================================
FIN
```

VFCCN2_O2

Solution with CCFV (second-order in space and time) and weak FSI coupling (non conforming). The mesh generation file is:

```
opti echo 1;
opti titr 'VFCCN2_O2';
opti sauv form 'vfccn2_o2.msh';
opti trac psc ftra 'vfccn2_o2_mesh.ps';
*
opti dime 2 elem qua4;
*
p1 = 0 0;
p2 = 2 0;
p3 = 2 1;
p4 = 0 1;
p5 = 0.4 0;
p6 = 0.4 0.4;
p7 = 0 0.4;
p8 = 0.4 1;
*
tol = 0.001;
*
c1 = p1 d 16 p5;
c2 = p5 d 16 p6;
c3 = p6 d 16 p7;
c4 = p7 d 16 p1;
expl = dall c1 c2 c3 c4 plan;
*
c1 = p5 d 64 p2;
c2 = p2 d 40 p3;
c3 = p3 d 64 p8;
c4 = p8 d 24 p6 d 16 p5;
air1 = dall c1 c2 c3 c4 plan;
*
c1 = p7 d 16 p6;
c2 = p6 d 24 p8;
c3 = p8 d 16 p4;
c4 = p4 d 24 p7;
air2 = dall c1 c2 c3 c4 plan;
*
air = air1 et air2;
flui = expl et air;
elim tol flui;
*
p9 = 1 0;
p10 = 1 0.4;
ndia = p9 d 16 p10;
elim tol (ndia et flui);
*
e1 = expl elem cont p1;
e3 = air1 elem cont p3;
*
p1s = p1 plus p1;
p2s = p2 plus p1;
p3s = p3 plus p1;
p4s = p4 plus p1;
p9s = 1 0;
p10s = 1 0.4;
p12s = 1 1;
c1s = p1s d 10 p9s d 10 p2s;
c2s = p2s d 10 p3s;
c3s = p3s d 10 p12s d 10 p4s;
c4s = p4s d 10 p1s;
c5s = p9s d 4 p10s;
stru = c1s et c2s et c3s et c4s et c5s;
*
*elim tol (flui et stru);
elim tol stru;
*
nfsa = cont flui;
nfsa = nfsa et ndia;
*
mesh = flui et stru et e1 et e3 et nfsa;
*
sauv form mesh;
trac qual mesh;
*
list (nbel mesh);
list (nbno mesh);
*
fin;
```

The input file is:

```
VFCCN2_O2
ECHO
!conv win
CAST mesh
```

```
DPLA ALE
DIME
 NALE 154 NBLE 3321
TERM
GEOM Q4VF flui ED01 stru TERM
COMP EPAI 0.01 LECT stru TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
GRIL LAGR LECT stru TERM
     AUTO AUTR
MATE GAZP RO 5.9485 GAMMA 1.4 CV 716.75 PINI 1.E6 PREF 1.E5
          LECT expl TERM
     GAZP RO 1.1897 GAMMA 1.4 CV 716.75 PINI 1.E5 PREF 1.E5
          LECT air TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00666
          LECT stru TERM
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
     VFCC FCON 6    ! Solveur HLLC
          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)
          CRNE      ! Correction de l'energie interne
          NCFS LECT nfsa TERM
CALC TINI 0.0 TFIN 5.E-3
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vcvi scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vcvi scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
SUIT
Post treatment
```

```
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vcvi scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 11 'dt1'     DT1
COUR  1 'vcvi_e1' VCVI NORM ELEM LECT e1 TERM
COUR  2 'vcvi_e3' VCVI NORM ELEM LECT e3 TERM
COUR  3 'p_e1'    ECRO COMP 1 ELEM LECT e1 TERM
COUR  4 'p_e3'    ECRO COMP 1 ELEM LECT e3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
*
TRAC 11  AXES 1.0 'DELTAT [S]'
TRAC 1 2 AXES 1.0 'VELOC. [M/S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
LIST 1 2 AXES 1.0 'VELOC. [M/S]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
! J'ai l'impression che la qualification de VCVi ne marche pas ...
!QUAL VCVI COMP 1 LECT e1 TERM REFE  0.00000E+0 TOLE 5.E-3
!     VCVI COMP 2 LECT e3 TERM REFE  0.00000E+0 TOLE 5.E-3
QUAL ECRO COMP 1 LECT e1 TERM REFE  1.59613E+5 TOLE 5.E-3
     ECRO COMP 1 LECT e3 TERM REFE  2.08017E+5 TOLE 5.E-3
*=================================================================
FIN
```

ELFIF2B

Solution with FE (JRC formulation) and FLSR (embedded structural mesh). The “extended” fluid mesh is made of 5376 quadrilateral elements while the structure is made of 64 shell elements. A layer of 304 elements CLxx is used around the external fluid boundary to specify absorbing conditions. The mesh generation file is:

```
opti echo 1;
opti titr 'ELFIF2B';
opti sauv form 'elfif2b.msh';
opti trac psc ftra 'elfif2b_mesh.ps';
*
opti dime 2 elem qua4;
*
p1 = 0 0;
p2 = 2 0;
p3 = 2 1;
p4 = 0 1;
p5 = 0.4 0;
p6 = 0.4 0.4;
p7 = 0 0.4;
p8 = 0.4 1;
*
pa = -0.2 -0.2;
pb =  2.2 -0.2;
pc =  2.2  1.2;
pd = -0.2  1.2;
*
tol = 0.001;
*
c1 = pa d 96 pb;
c2 = pb d 56 pc;
c3 = pc d 96 pd;
c4 = pd d 56 pa;
flui = dall c1 c2 c3 c4 plan;
elim tol (flui et p1 et p2 et p3 et p4 et p5 et p6 et p7 et p8);
```

```
abso = c1 et c2 et c3 et c4;
*
el1 = flui elem appu larg p1;
el3 = flui elem appu larg p3;
*
p9s = 1 0;
p10s = 1 0.4;
p11s = 2 0.4;
p12s = 1 1;
p1s = p1 plus p1;
p2s = p2 plus p1;
p3s = p3 plus p1;
p4s = p4 plus p1;
c1s = p1s d 10 p9s d 10 p2s;
c2s = p2s d 10 p3s;
c3s = p3s d 10 p12s d 10 p4s;
c4s = p4s d 10 p1s;
c5s = p9s d 4 p10s;
stru = c1s et c2s et c3s et c4s et c5s;
*
mesh = flui et stru et abso et el1 et el3;
*
sauv form mesh;
trac qual mesh;
*
list (nbel mesh);
list (nbno mesh);
*
fin;
```

The input file is:

```
ELFIF2B
ECHO
!conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065
TERM
GEOM FL24 flui ED01 stru CL22 abso TERM
COMP EPAI 0.01 LECT stru TERM
     GROU 5 'expl' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 0.4 DY 0.4
            'flin' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 2.0 DY 1.0
            'air'  LECT flui TERM COND COMP LECT expl TERM
            'e1'   LECT flin INTR el1 TERM
            'e3'   LECT flin INTR el3 TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
          jaun LECT abso TERM
GRIL LAGR LECT stru TERM
MATE FLUT RO 5.9485 EINT 4.20274E5 GAMM 1.4 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 expl TERM
     FLUT RO 1.1897 EINT 2.10137E5 GAMM 1.4 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 air TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
     IMPE ABSI LECT abso TERM
LINK COUP FLSR STRU LECT stru TERM
               FLUI LECT flui TERM
               R    0.018
               HGRI 0.110
               DGRI
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
CALC TINI 0.0 TFIN 5.E-3
*=====================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=====================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=====================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=====================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=====================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 'dt1'     DT1
COUR  3 'p_e1'    ECRO COMP 1 ELEM LECT e1 TERM
COUR  4 'p_e3'    ECRO COMP 1 ELEM LECT e3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
*
TRAC 1   AXES 1.0 'DELTAT [S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
!QUAL ECRO COMP 1 LECT e1 TERM REFE  1.56327E+5 TOLE 5.E-3
!     ECRO COMP 1 LECT e3 TERM REFE  2.04496E+5 TOLE 5.E-3
*=====================================================================
FIN
```

ELCKF2B

Solution with FE (CEA formulation) and FLSR (embedded structural mesh). The mesh is identical to the previous example. The input file is:

```
ELCKF2B
ECHO
!conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065
TERM
GEOM CAR1 flui ED01 stru CL22 abso TERM
COMP EPAI 0.01 LECT stru TERM
     GROU 5 'expl' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 0.4 DY 0.4
            'flin' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 2.0 DY 1.0
            'air'  LECT flui TERM COND COMP LECT expl TERM
            'e1'   LECT flin INTR el1 TERM
            'e3'   LECT flin INTR el3 TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
          jaun LECT abso TERM
GRIL LAGR LECT stru TERM
MATE GAZP RO 5.9485 GAMMA 1.4 CV 716.75 PINI 1.E6 PREF 1.E5
          LECT expl TERM
     GAZP RO 1.1897 GAMMA 1.4 CV 716.75 PINI 1.E5 PREF 1.E5
          LECT air TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
     IMPE ABSI LECT abso TERM
LINK COUP FLSR STRU LECT stru TERM
               FLUI LECT flui TERM
               R    0.018
               HGRI 0.110
               DGRI
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
     KFLU 1000
CALC TINI 0.0 TFIN 5.E-3
*=====================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=====================================================================
SUIT
Post treatment
```

```
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*===============================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
```

```
*===============================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 'dt1'     DT1
COUR  3 'p_e1'    ECRO COMP 1 ELEM LECT e1 TERM
COUR  4 'p_e3'    ECRO COMP 1 ELEM LECT e3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
*
TRAC 1   AXES 1.0 'DELTAT [S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
!QUAL ECRO COMP 1 LECT e1 TERM REFE  1.56327E+5 TOLE 5.E-3
!     ECRO COMP 1 LECT e3 TERM REFE  2.04496E+5 TOLE 5.E-3
*===============================================================
FIN
```

VFNCF3S

Solution with NCFV and FLSR (embedded structural mesh). The mesh is identical to the previous example. The input file is:

```
VFNCF3S
ECHO
 conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065 NDVC 21808
TERM
GEOM MC24 flui ED01 stru CL22 abso TERM
COMP EPAI 0.01 LECT stru TERM
     GROU 3 'expl' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 0.4 DY 0.4
            'flin' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 2.0 DY 1.0
            'air'  LECT flui TERM COND COMP LECT expl TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
          jaun LECT abso TERM
GRIL LAGR LECT stru TERM
MATE MCGP NCOM 1 R 8.3143E3
          COMP 'Air' PM 29.0 CV1 2.07585E4 CV2 0 CV3 0
          LECT flui TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
     MCFF BDFO 1 TEMP 293.16 PRES 1.E5
          VEL1 0. VEL2 0.
          COMP 'Air'       MFRA 1.
          LECT abso TERM
INIT MCOM COMP 'Air' MFRA 1.0 LECT flui TERM
          PRES 1.E6 LECT expl TERM
          PRES 1.E5 LECT air  TERM
          TEMP 586.36 LECT expl TERM
          TEMP 293.16 LECT air  TERM
          VEL1 0.0 LECT flui TERM
          VEL2 0.0 LECT flui TERM
LINK COUP FLSR STRU LECT stru TERM
               FLUI LECT flui TERM
               R    0.036 ! = gamma*delta*h_fluide = 1.01*1.41*0.025
!fc            R    0.018 ! = gamma*delta*h_fluide = 1.01*1.41*0.025
                          !   [delta = sqrt(2) en 2D, = sqrt(3) en 3D]
               HGRI 0.110
               DGRI
               MCFL 1 MCCP 1
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO
     MCVC MCVS MCFL MCEF MCMU MCVM TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p4 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
OPTI NOTE LOG 1
     CSTA 0.5
     MC ORDR 2 NUFL ROE SYNC 1
CALC TINI 0.0 TFIN 5.E-3
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*===============================================================
SUIT
```

```
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel mcpr scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*===============================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel mcpr scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vite scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*===============================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*===============================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  5.03115E+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
```

```
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel mcpr scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 'dt1'     DT1
COUR  3 'p_e1'    MCPR COMP 1 NOEU LECT p1 TERM
COUR  4 'p_e3'    MCPR COMP 1 NOEU LECT p3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
COUR 101 'p_p4'    MCPR COMP 1 NOEU LECT p4 TERM
COUR 102 'r_p4'    MCRO COMP 1 NOEU LECT p4 TERM
COUR 103 't_p4'    MCTE COMP 1 NOEU LECT p4 TERM
COUR 104 'yl_p4'   MCMF COMP 1 NOEU LECT p4 TERM
*
TRAC 1   AXES 1.0 'DELTAT [S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
TRAC 101 AXES 1.0 'PRESS. [PA]'
TRAC 102 AXES 1.0 'DENS. [KG/M3]'
TRAC 103 AXES 1.0 'TEMP. [K]'
TRAC 104 AXES 1.0 'FRAC. [-]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
QUAL MCPR COMP 1 LECT p1 TERM REFE  1.00000E+5 TOLE 5.E-3
     MCPR COMP 1 LECT p3 TERM REFE  1.00000E+5 TOLE 5.E-3
*=================================================================
FIN
```

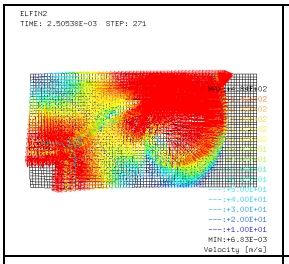
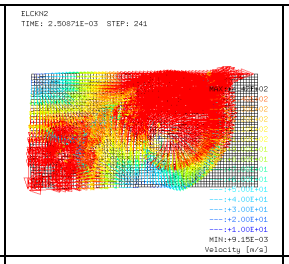
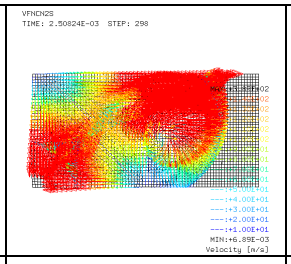
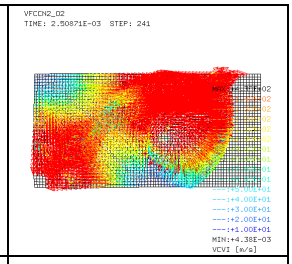
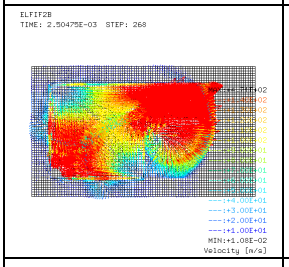
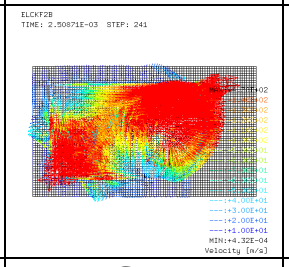
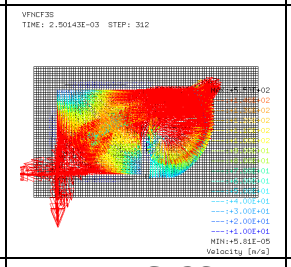
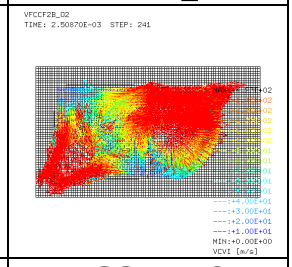
VFCCF2B_O2

Solution with CCFV and FLSW (embedded structural mesh, weak formulation). The mesh is identical to the previous example. The input file is:

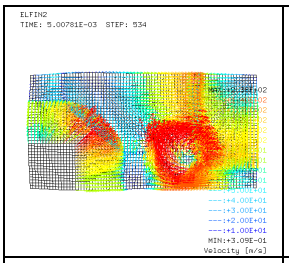
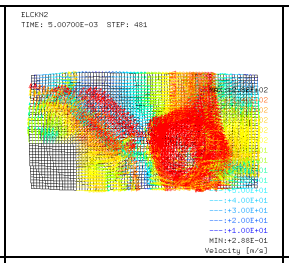
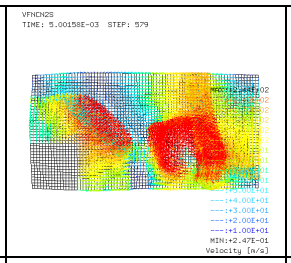
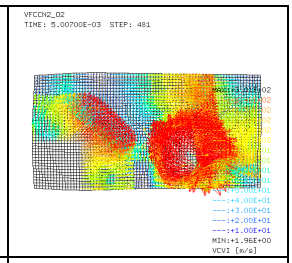
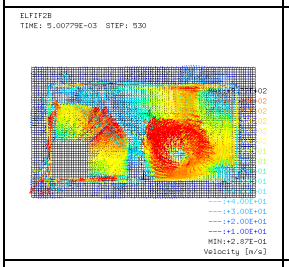
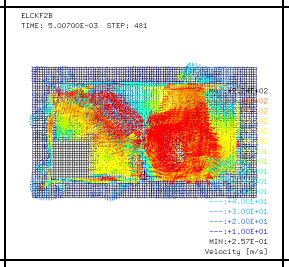
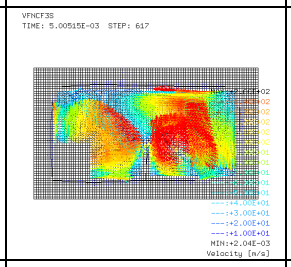
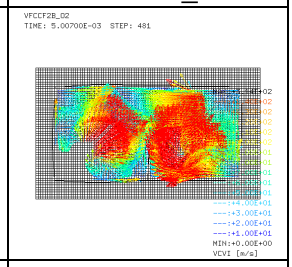
```
VFCCF2B_O2
ECHO
!conv win
CAST mesh
DPLA ALE
DIME
 NALE 148 NBLE 3065
TERM
GEOM Q4VF flui ED01 stru CL22 abso TERM
COMP EPAI 0.01 LECT stru TERM
     GROU 5 'expl' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 0.4 DY 0.4
            'flin' LECT flui TERM COND BOX X0 0.0 Y0 0.0 DX 2.0 DY 1.0
            'air'  LECT flui TERM COND COMP LECT expl TERM
            'e1'   LECT flin INTR el1 TERM
            'e3'   LECT flin INTR el3 TERM
     COUL turq LECT air  TERM
          roug LECT expl TERM
          bleu LECT stru TERM
          jaun LECT abso TERM
GRIL LAGR LECT stru TERM
MATE GAZP RO 5.9485 GAMMA 1.4 CV 716.75 PINI 1.E6 PREF 1.E5
          LECT expl TERM
     GAZP RO 1.1897 GAMMA 1.4 CV 716.75 PINI 1.E5 PREF 1.E5
          LECT air TERM
     VM23 RO 7800. YOUNG 1.6E11 NU 0.333 ELAS 1.05E8
          TRAC 2 1.05E8 .656256E-3 1.6105E10 1.00066
          LECT stru TERM
     IMPE ABSI LECT abso TERM
LINK DECO FLSW STRU LECT stru TERM
               FLUI LECT flui TERM
               R    0.018
               HGRI 0.110
               DGRI
               BFLU 2 FSCP 1
ECRI DEPL VITE ACCE FINT FEXT CONT ECRO TFRE 1.E-3
          POIN LECT p1 p5 p6 p7 p3 TERM
          ELEM LECT e1 e3 TERM
     FICH ALIC TFRE 5.E-5
     FICH ALIC TEMP FREQ 1
          POIN LECT p1 p5 p6 p7 p3 p1s p2s p3s p4s p9s p10s p12s TERM
          ELEM LECT e1 e3 TERM
OPTI NOTE LOG 1
     CSTA 0.5
     VFCC FCON 6    ! Solveur HLLC
          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 0.0 TFIN 5.E-3
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
          face hfro
     vect scco fiel vcvi scal user prog 10 pas 10 140 term
          SUPP LECT air  TERM
     text vsca
     colo pape
freq 0 tfre 2.5e-3
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vcvi scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
trac offs fich avi     nocl nfto 101 fps 10 kfre 10 comp -1 rend
freq 1
gotr loop 99 offs fich avi cont nocl rend
go
trac offs fich avi cont rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     vect scco fiel vcvi scal user prog 10 pas 10 140 term
          SUPP LECT flui TERM
     text vsca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp rend
ENDPLAY
*=================================================================
SUIT
Post treatment
ECHO
 conv win
RESU ALIC GARD PSCR
OPTI PRIN
SORT VISU NSTO 1
*=================================================================
PLAY
CAME   1 EYE   1.00000E+00  5.00000E-01  6.11268E+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
sler cam1 1 nfra 1
scen geom navi free
     iso  fili fiel ecro 1 scal user prog 0.61E5 pas 0.2E5 3.21E5 term
          SUPP LECT flui TERM
     text isca
     colo pape
freq 50
go
trac offs fich bmp rend
go
trac offs fich bmp 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 11 'dt1'     DT1
COUR  1 'vcvi_e1' VCVI NORM ELEM LECT e1 TERM
COUR  2 'vcvi_e3' VCVI NORM ELEM LECT e3 TERM
COUR  3 'p_e1'    ECRO COMP 1 ELEM LECT e1 TERM
COUR  4 'p_e3'    ECRO COMP 1 ELEM LECT e3 TERM
COUR  5 'dx_p10s' DEPL COMP 1 POIN LECT p10s TERM
COUR  6 'dy_p12s' DEPL COMP 2 POIN LECT p12s TERM
COUR  7 'dx_p9s'  DEPL COMP 1 POIN LECT p9s TERM
COUR  8 'dy_p9s'  DEPL COMP 2 POIN LECT p9s TERM
TRAC 11  AXES 1.0 'DELTAT [S]'
TRAC 1 2 AXES 1.0 'VELOC. [M/S]'
TRAC 3 4 AXES 1.0 'PRESS [PA]'
TRAC 5 6 AXES 1.0 'DISPL. [M]'
TRAC 7 8 AXES 1.0 'DISPL. [M]'
LIST 1 2 AXES 1.0 'VELOC. [M/S]'
LIST 3 4 AXES 1.0 'PRESS [PA]'
LIST 5 6 AXES 1.0 'DISPL. [M]'
LIST 7 8 AXES 1.0 'DISPL. [M]'
*
!QUAL ECRO COMP 1 LECT e1 TERM REFE  1.56327E+5 TOLE 5.E-3
!     ECRO COMP 1 LECT e3 TERM REFE  2.04496E+5 TOLE 5.E-3
*=================================================================
FIN
```

Comparison of solutions

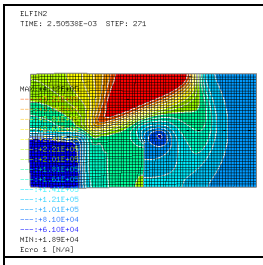
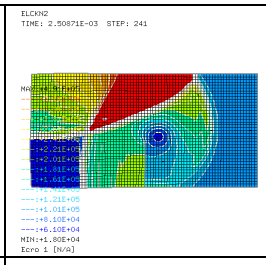
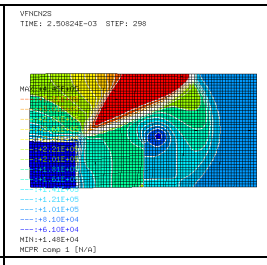
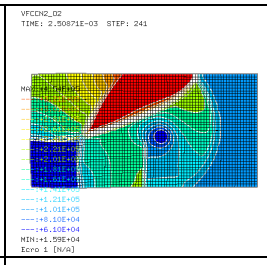
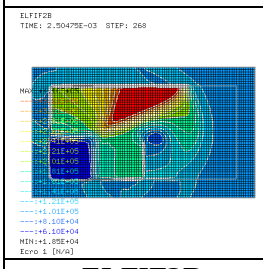
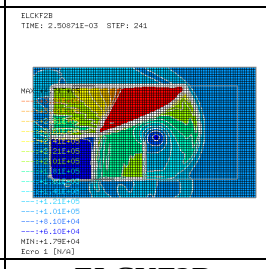
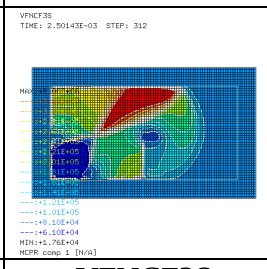
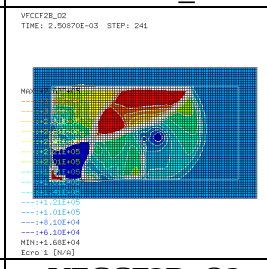
The fluid velocity fields at 2.5 ms in the various solutions are:

			
ELFIN2	ELCKN2	VFNCN2S	VFCCN2_O2
			
ELFIF2B	ELCKF2B	VFNCF3S	VFCCF2B_O2

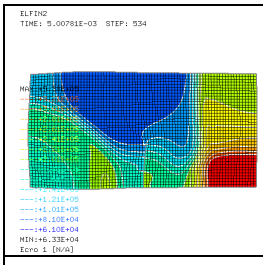
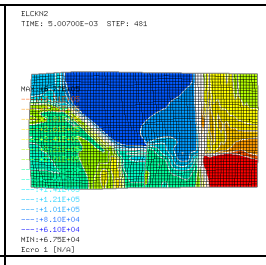
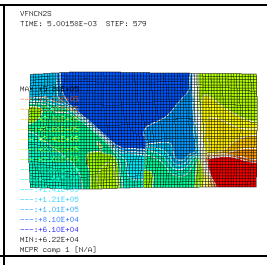
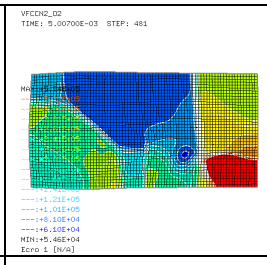
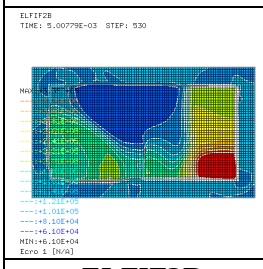
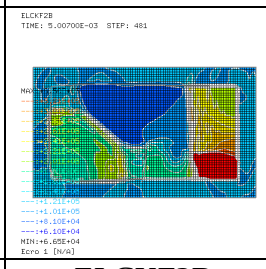
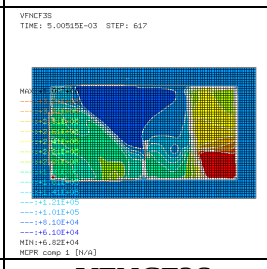
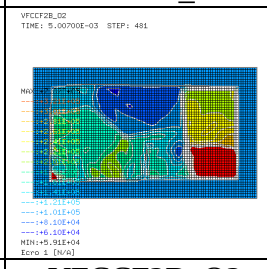
The fluid velocity fields at 5.0 ms in the various solutions are:

			
ELFIN2	ELCKN2	VFNCN2S	VFCCN2_O2
			
ELFIF2B	ELCKF2B	VFNCF3S	VFCCF2B_O2

The fluid pressure fields at 2.5 ms in the various solutions are:

			
ELFIN2	ELCKN2	VFNCN2S	VFCCN2_O2
			
ELFIF2B	ELCKF2B	VFNCF3S	VFCCF2B_O2

The fluid pressure fields at 5.0 ms in the various solutions are:

			
ELFIN2	ELCKN2	VFNCN2S	VFCCN2_O2
			
ELFIF2B	ELCKF2B	VFNCF3S	VFCCF2B_O2

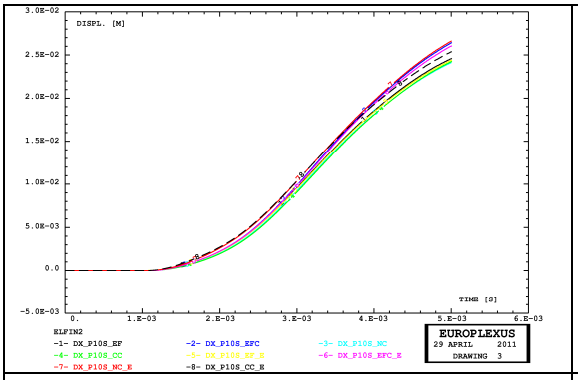
Comparison of structural displacements

EFVFC1

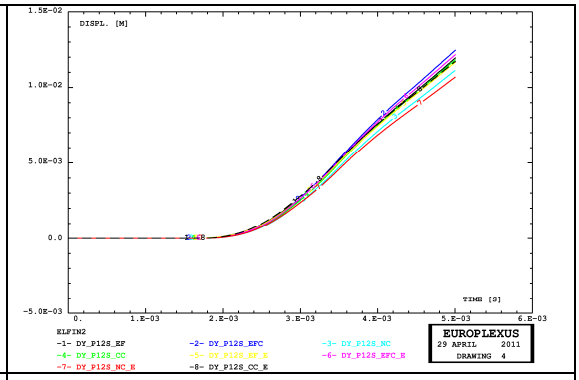
This input is used to compare the different solutions:

```
EFVFC1
ECHO
*
RESU ALIC TEMP 'elfin2.alt' GARD PSCR
*
SORT GRAP
*
AXTE 1.0 'Time [s]'
*
COUR 13 'p_e1_ef'    ECRO COMP 1 ELEM LECT e1 TERM
COUR 14 'p_e3_ef'    ECRO COMP 1 ELEM LECT e3 TERM
COUR 15 'dx_p10s_ef' DEPL COMP 1 POIN LECT p10s TERM
COUR 16 'dy_p12s_ef' DEPL COMP 2 POIN LECT p12s TERM
COUR 17 'dx_p9s_ef'  DEPL COMP 1 POIN LECT p9s TERM
COUR 18 'dy_p9s_ef'  DEPL COMP 2 POIN LECT p9s TERM
*
RCOU 23 'p_e1'    FICH 'elckn2.pun' RENA 'p_e1_efc'
RCOU 24 'p_e3'    FICH 'elckn2.pun' RENA 'p_e3_efc'
RCOU 25 'dx_p10s' FICH 'elckn2.pun' RENA 'dx_p10s_efc'
RCOU 26 'dy_p12s' FICH 'elckn2.pun' RENA 'dy_p12s_efc'
RCOU 27 'dx_p9s'  FICH 'elckn2.pun' RENA 'dx_p9s_efc'
RCOU 28 'dy_p9s'  FICH 'elckn2.pun' RENA 'dy_p9s_efc'
*
RCOU 33 'p_e1'    FICH 'vfncn2s.pun' RENA 'p_e1_nc'
RCOU 34 'p_e3'    FICH 'vfncn2s.pun' RENA 'p_e3_nc'
RCOU 35 'dx_p10s' FICH 'vfncn2s.pun' RENA 'dx_p10s_nc'
RCOU 36 'dy_p12s' FICH 'vfncn2s.pun' RENA 'dy_p12s_nc'
RCOU 37 'dx_p9s'  FICH 'vfncn2s.pun' RENA 'dx_p9s_nc'
RCOU 38 'dy_p9s'  FICH 'vfncn2s.pun' RENA 'dy_p9s_nc'
*
RCOU 43 'p_e1'    FICH 'vfccn2_o2.pun' RENA 'p_e1_cc'
RCOU 44 'p_e3'    FICH 'vfccn2_o2.pun' RENA 'p_e3_cc'
RCOU 45 'dx_p10s' FICH 'vfccn2_o2.pun' RENA 'dx_p10s_cc'
RCOU 46 'dy_p12s' FICH 'vfccn2_o2.pun' RENA 'dy_p12s_cc'
RCOU 47 'dx_p9s'  FICH 'vfccn2_o2.pun' RENA 'dx_p9s_cc'
RCOU 48 'dy_p9s'  FICH 'vfccn2_o2.pun' RENA 'dy_p9s_cc'
*
RCOU 53 'p_e1'    FICH 'elfif2b.pun' RENA 'p_e1_ef_e'
RCOU 54 'p_e3'    FICH 'elfif2b.pun' RENA 'p_e3_ef_e'
RCOU 55 'dx_p10s' FICH 'elfif2b.pun' RENA 'dx_p10s_ef_e'
RCOU 56 'dy_p12s' FICH 'elfif2b.pun' RENA 'dy_p12s_ef_e'
RCOU 57 'dx_p9s'  FICH 'elfif2b.pun' RENA 'dx_p9s_ef_e'
RCOU 58 'dy_p9s'  FICH 'elfif2b.pun' RENA 'dy_p9s_ef_e'
*
RCOU 63 'p_e1'    FICH 'elckf2b.pun' RENA 'p_e1_efc_e'
RCOU 64 'p_e3'    FICH 'elckf2b.pun' RENA 'p_e3_efc_e'
RCOU 65 'dx_p10s' FICH 'elckf2b.pun' RENA 'dx_p10s_efc_e'
RCOU 66 'dy_p12s' FICH 'elckf2b.pun' RENA 'dy_p12s_efc_e'
RCOU 67 'dx_p9s'  FICH 'elckf2b.pun' RENA 'dx_p9s_efc_e'
RCOU 68 'dy_p9s'  FICH 'elckf2b.pun' RENA 'dy_p9s_efc_e'
*
RCOU 73 'p_e1'    FICH 'vfncf3s.pun' RENA 'p_e1_nc_e'
RCOU 74 'p_e3'    FICH 'vfncf3s.pun' RENA 'p_e3_nc_e'
RCOU 75 'dx_p10s' FICH 'vfncf3s.pun' RENA 'dx_p10s_nc_e'
RCOU 76 'dy_p12s' FICH 'vfncf3s.pun' RENA 'dy_p12s_nc_e'
RCOU 77 'dx_p9s'  FICH 'vfncf3s.pun' RENA 'dx_p9s_nc_e'
RCOU 78 'dy_p9s'  FICH 'vfncf3s.pun' RENA 'dy_p9s_nc_e'
*
RCOU 83 'p_e1'    FICH 'vfccf2b_o2.pun' RENA 'p_e1_cc_e'
RCOU 84 'p_e3'    FICH 'vfccf2b_o2.pun' RENA 'p_e3_cc_e'
RCOU 85 'dx_p10s' FICH 'vfccf2b_o2.pun' RENA 'dx_p10s_cc_e'
RCOU 86 'dy_p12s' FICH 'vfccf2b_o2.pun' RENA 'dy_p12s_cc_e'
RCOU 87 'dx_p9s'  FICH 'vfccf2b_o2.pun' RENA 'dx_p9s_cc_e'
RCOU 88 'dy_p9s'  FICH 'vfccf2b_o2.pun' RENA 'dy_p9s_cc_e'
*
TRAC 13 23 33 43 53 63 73 83 AXES 1.0 'PRESS [PA]'
     COLO noir bleu turq vert jaun rose roug noir
     DASH 0    0    0    0    0    0    0    1
TRAC 14 24 34 44 54 64 74 84 AXES 1.0 'PRESS [PA]'
     COLO noir bleu turq vert jaun rose roug noir
     DASH 0    0    0    0    0    0    0    1
TRAC 15 25 35 45 55 65 75 85 AXES 1.0 'DISPL. [M]'
     COLO noir bleu turq vert jaun rose roug noir
     DASH 0    0    0    0    0    0    0    1
TRAC 16 26 36 46 56 66 76 86 AXES 1.0 'DISPL. [M]'
     COLO noir bleu turq vert jaun rose roug noir
     DASH 0    0    0    0    0    0    0    1
TRAC 17 27 37 47 57 67 77 87 AXES 1.0 'DISPL. [M]'
     COLO noir bleu turq vert jaun rose roug noir
     DASH 0    0    0    0    0    0    0    1
TRAC 18 28 38 48 58 68 78 88 AXES 1.0 'DISPL. [M]'
     COLO noir bleu turq vert jaun rose roug noir
     DASH 0    0    0    0    0    0    0    1
*=============================================================
FIN
```

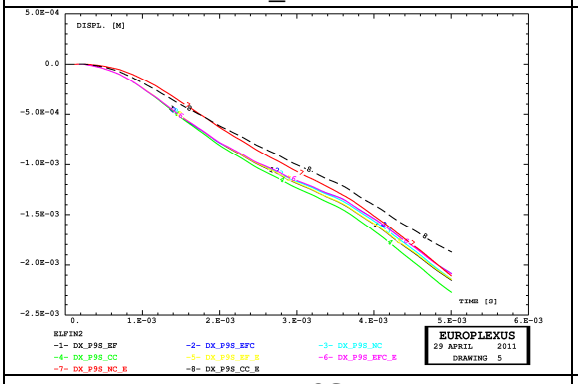
The structural displacements at the various points indicated in the problem definition figure are (all 8 solutions are shown together):



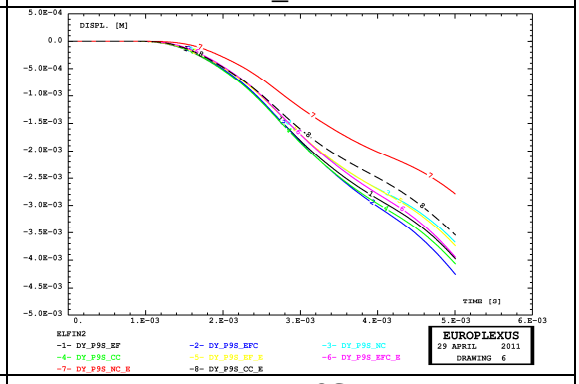
DX_P10S



DY_P12S



DX_P9S



DY_P9S