



Anexo I



```
$-----  
START: NEW_RUN  
$-----CONTROL_DATA  
CONTROL_DATA  
  GEOMETRY:  3 DIMENSION  
  THERMAL:   TRANSIENT  
  DIMENSIONS:  NPOIN=41784  NELEM=40960  NNODE=8  NGAUS=8  
NSETS=3  MCURV=2  
  ACTIVATION:  OFF WELDING  
  SMOOTHING:  DIRECT  
  POST_PROCESS: BINARY  
END_CONTROL_DATA  
$-----GENERAL_DATA  
GENERAL_DATA  
  GEOMETRY: SCALE=0.001  
  INCLUDE: bs12.mesh  
  END_GEOMETRY  
$-----SETS_DATA  
$-----SET  
SETS  
$-----SET-1 CASTING  
SET=1  TYPE=2  NODES=8  
  ELEMENT_DATA:      MODEL=21  INT_RULE=2  INT_POINT=8  
TOOL=CASTING  
  MATERIAL_DATA:  NAME=Inconel_718  
  PHASE_CHANGE  
  PHASE_CHANGE=1  LATEN=2.4e+05  THOTP= 1335  TCOLD= 1260  
PSTRA=0.035  
  END_PHASE_CHANGE  
TDEPENDENT_DATA  
  DENSITY  
  20  8220  
  200  8160  
  350  8110
```



500 8050

600 7960

700 8010

800 7910

900 7860

1000 7810

END_DENSITY

SHEAT

20 424

100 434

200 448

300 463

400 480

500 500

550 511

600 525

650 541

700 560

750 582

800 605

850 625

900 630

950 630

1000 630

END_SHEAT

CONDU

20 11.45

100 12.75

200 14.36

300 15.96

400 17.6

500 19.18

550 19.98

600 20.77



```
650 21.56
700 22.36
750 23.15
800 23.95
900 25.1
950 26.83
  END_CONDU
  END_TDEPENDENT_DATA
END_SET
$-----SET-2 MOULD
SET=2 TYPE=2 NODES=8
  ELEMENT_DATA:      MODEL=21      INT_RULE=2      INT_POINT=8
TOOL=MOULD
  MATERIAL_DATA: NAME=Inconel_718_B
$ PHASE_CHANGE
$ PHASE_CHANGE=1 LATEN=2.4e+05 THOTP= 1335 TCOLD= 1260
$ END_PHASE_CHANGE
  TDEPENDENT_DATA
  DENSITY
20 8220
200 8160
350 8110
500 8050
600 7960
700 8010
800 7910
900 7860
1000 7810
  END_DENSITY
  SHEAT
20 424
100 434
200 448
300 463
```



400 480

500 500

550 511

600 525

650 541

700 560

750 582

800 605

850 625

900 630

950 630

1000 630

END_SHEAT

CONDU

20 11.45

100 12.75

200 14.36

300 15.96

400 17.6

500 19.18

550 19.98

600 20.77

650 21.56

700 22.36

750 23.15

800 23.95

900 25.1

950 26.83

END_CONDU

END_TDEPENDENT_DATA

END_SET

\$-----SET-HTC

SET=3 TYPE=24 NODES=4

ELEMENT_DATA: MODEL=82



```
MATERIAL_DATA: EMISS= 0.8
TDEPENDENT_DATA
  HTCCV
  20 25
  1000 25
  END_HTCCV
  ENVTE
  1 20
  1e+09 20
  END_ENVTE
  END_TDEPENDENT_DATA
END_SET
END_SETS
END_GENERAL_DATA
$-----INTERVAL_DATA
$-----LOOP-OVER-MD-PRE-HEATING
$-----GO
INTERVAL_DATA: DTIME= 2.58 NSTEP= 50
$-----ACTIVATION
ACTIVATION: NEW_ACTIVATION
  SET=1 OFF ! CASTING=Inconel_718
  SET=2 ON ! MOULD=Inconel_718_B
$-----SET-HTC
  SET=3 ON ! HT-Environment
END_ACTIVATION
$-----WELDING
WELDING: NEW_WELDING
  PATH: SCALE=0.001 BASE= 7.6 HIGH= 0.167 \
        SPEED= 160.968 EFFIC= 0.85 \
        VOLTA= 12.5 INTEN= 159.5
  0 43 49.214 15
  16.028 0 49.214 15
  18.829 0 41.642855 15
  34.857 43 41.642855 15
```



```
37.658 43 34.071425 15
53.686 0 34.071425 15
56.487 0 26.499995 15
72.515 43 26.499995 15
75.316 43 18.928565 15
91.344 0 18.928565 15
94.145 0 11.357135 15
110.173 43 11.357135 15
112.974 43 3.785705 15
129.002 0 3.785705 15
```

END_PATH

END_WELDING

\$-----FUNCTION

FUNCTION: NEW_FUNCTION

FUNCTION 1: LINEAR START=0.0 TIME=0.0 END=1.0E+10
AMPLITUDE=1.0

FUNCTION 2: LINEAR START=0.0 TIME=0.0 END=1.0E+10
AMPLITUDE=1.0

END_FUNCTION

\$-----LOAD

LOAD: NEW_LOAD

FUNCTION: 1, ABSOLUTE

GRAVITY_LOAD: GX=0, GY=0, GZ=-1 GRAVY=9.81

END_LOAD

\$-----BOUNDARY

BOUNDARY: NEW_BOUNDARY

FUNCTION: 2, ABSOLUTE

END_BOUNDARY

\$-----INITIAL_DATA

INITIAL_DATA

TEMPERATURE

SET=1 1335 ! CASTING=Inconel_718

SET=2 20 ! MOULD=Inconel_718_B

END_TEMPERATURE



END_INITIAL_DATA

\$-----STRATEGY-DATA-BLOCK

STRATEGY: NEW_STRATEGY

SOLVER: ITERATIVE SYMMETRIC

ALGORITHM: UPDATE FULL

LINE_SEARCH: ON

CONVERGENCE: TEMPERATURE TOLER= 0.1 MITER= 15

\$-----POST-PROCESS

POST_PROCESS: TEMPERATURE STEP= 1

\$-----PLOTS

PLOT: NEW_PLOT

END_PLOT

END_STRATEGY

END_INTERVAL_DATA

\$-----BACK

INTERVAL_DATA: DTIME=2.58 NSTEP=50

\$-----ACTIVATION

ACTIVATION: OLD_ACTIVATION

\$-----WELDING

WELDING: NEW_WELDING

PATH: SCALE=0.001 BASE= 7.6 HIGH= 0.167 \

SPEED= 160.968 EFFIC= 0.85 \

VOLTA= 12.5 INTEN= 159.5

129.002 0 3.785705 15.167

145.03 43 3.785705 15.167

147.831 43 11.357135 15.167

163.859 0 11.357135 15.167

166.66 0 18.928565 15.167

182.688 43 18.928565 15.167

185.489 43 26.499995 15.167

201.517 0 26.499995 15.167

204.318 0 34.071425 15.167

220.346 43 34.071425 15.167

223.147 43 41.642855 15.167



239.175	0	41.642855	15.167
241.976	0	49.214	15.167
258.004	43	49.214	15.167

END_PATH

END_WELDING

\$-----FUNCTION

FUNCTION: OLD_FUNCTION

\$-----LOAD

LOAD: OLD_LOAD

\$-----BOUNDARY

BOUNDARY: OLD_BOUNDARY

\$-----STRATEGY-DATA-BLOCK

STRATEGY: OLD_STRATEGY

END_INTERVAL_DATA

\$-----GO

INTERVAL_DATA: DTIME= 2.58 NSTEP= 50

\$-----ACTIVATION

ACTIVATION: OLD_ACTIVATION

\$-----WELDING

WELDING: NEW_WELDING

PATH: SCALE=0.001 BASE= 7.6 HIGH= 0.167 \

SPEED= 160.968 EFFIC= 0.85 \

VOLTA= 12.5 INTEN= 159.5

258.004	43	49.214	15.334
274.032	0	49.214	15.334
276.833	0	41.642855	15.334
292.861	43	41.642855	15.334
295.662	43	34.071425	15.334
311.69	0	34.071425	15.334
314.491	0	26.499995	15.334
330.519	43	26.499995	15.334
333.32	43	18.928565	15.334
349.348	0	18.928565	15.334
352.149	0	11.357135	15.334



368.177	43	11.357135	15.334
370.978	43	3.785705	15.334
387.006	0	3.785705	15.334

```

END_PATH
END_WELDING
$-----FUNCTION
FUNCTION: OLD_FUNCTION
$-----LOAD
LOAD: OLD_LOAD
$-----BOUNDARY
BOUNDARY: OLD_BOUNDARY
$-----STRATEGY-DATA-BLOCK
STRATEGY: OLD_STRATEGY
END_INTERVAL_DATA
$-----BACK
INTERVAL_DATA: DTIME= 2.58 NSTEP= 50
$-----ACTIVATION
ACTIVATION: OLD_ACTIVATION
$-----WELDING
WELDING: NEW_WELDING
PATH: SCALE=0.001 BASE= 7.6 HIGH= 0.167 \
SPEED= 160.968 EFFIC= 0.85 \
VOLTA= 12.5 INTEN= 159.5
387.006 0 3.785705 15.501
403.034 43 3.785705 15.501
405.835 43 11.357135 15.501
421.863 0 11.357135 15.501
424.664 0 18.928565 15.501
440.692 43 18.928565 15.501
443.493 43 26.499995 15.501
459.521 0 26.499995 15.501

```



462.322	0	34.071425	15.501
478.35	43	34.071425	15.501
481.151	43	41.642855	15.501
497.179	0	41.642855	15.501
499.98	0	49.214	15.501
516.008	43	49.214	15.501

END_PATH

END_WELDING

\$-----FUNCTION

FUNCTION: OLD_FUNCTION

\$-----LOAD

LOAD: OLD_LOAD

\$-----BOUNDARY

BOUNDARY: OLD_BOUNDARY

\$-----STRATEGY-DATA-BLOCK

STRATEGY: OLD_STRATEGY

END_INTERVAL_DATA

\$-----GO

INTERVAL_DATA: DTIME= 2.58 NSTEP= 50

\$-----ACTIVATION

ACTIVATION: OLD_ACTIVATION

\$-----WELDING

WELDING: NEW_WELDING

PATH: SCALE=0.001 BASE= 7.6 HIGH= 0.167 \

SPEED= 160.968 EFFIC= 0.85 \

VOLTA= 12.5 INTEN= 159.5

516.008	43	49.214	15.668
532.036	0	49.214	15.668
534.837	0	41.642855	15.668
550.865	43	41.642855	15.668
553.666	43	34.071425	15.668
569.694	0	34.071425	15.668
572.495	0	26.499995	15.668
588.523	43	26.499995	15.668



591.324	43	18.928565	15.668
607.352	0	18.928565	15.668
610.153	0	11.357135	15.668
626.181	43	11.357135	15.668
628.982	43	3.785705	15.668
645.01	0	3.785705	15.668

END_PATH

END_WELDING

\$-----FUNCTION

FUNCTION: OLD_FUNCTION

\$-----LOAD

LOAD: OLD_LOAD

\$-----BOUNDARY

BOUNDARY: OLD_BOUNDARY

\$-----STRATEGY-DATA-BLOCK

STRATEGY: OLD_STRATEGY

END_INTERVAL_DATA

\$-----BACK

INTERVAL_DATA: DTIME= 2.58 NSTEP= 50

\$-----ACTIVATION

ACTIVATION: OLD_ACTIVATION

\$-----WELDING

WELDING: NEW_WELDING

PATH: SCALE=0.001 BASE= 7.6 HIGH= 0.167 \

SPEED= 160.968 EFFIC= 0.85 \

VOLTA= 12.5 INTEN= 159.5

645.01 0 3.785705 15.835

661.038 43 3.785705 15.835

663.839 43 11.357135 15.835

679.867 0 11.357135 15.835

682.668 0 18.928565 15.835

698.696 43 18.928565 15.835

701.497 43 26.499995 15.835

717.525 0 26.499995 15.835



720.326	0	34.071425	15.835
736.354	43	34.071425	15.835
739.155	43	41.642855	15.835
755.183	0	41.642855	15.835
757.984	0	49.214	15.835
774.012	43	49.214	15.835

```

END_PATH
END_WELDING
$-----FUNCTION
FUNCTION: OLD_FUNCTION
$-----LOAD
LOAD: OLD_LOAD
$-----BOUNDARY
BOUNDARY: OLD_BOUNDARY
$-----STRATEGY-DATA-BLOCK
STRATEGY: OLD_STRATEGY
END_INTERVAL_DATA
$-----LOOP-OVER-MD-LAYERS
$-----GO
INTERVAL_DATA: DTIME= 2.5599 NSTEP= 50
$-----ACTIVATION
ACTIVATION: OLD_ACTIVATION
$-----WELDING
WELDING: NEW_WELDING
PATH: SCALE=0.001 BASE= 7.6 HIGH= 1.5 \
SPEED= 162.234 EFFIC= 0.4 \
VOLTA= 12.5 INTEN= 159.5 \
SFEEED= 1600 DFEEED= 1
774.012 43 49.214 16
789.915 0 49.214 16
792.694 0 41.642855 16
808.597 43 41.642855 16
811.376 43 34.071425 16

```



827.279	0	34.071425	16
830.058	0	26.499995	16
845.961	43	26.499995	16
848.74	43	18.928565	16
864.643	0	18.928565	16
867.422	0	11.357135	16
883.325	43	11.357135	16
886.104	43	3.785705	16
902.007	0	3.785705	16

```

END_PATH
END_WELDING
$-----FUNCTION
FUNCTION: OLD_FUNCTION
$-----LOAD
LOAD: OLD_LOAD
$-----BOUNDARY
BOUNDARY: OLD_BOUNDARY
$-----STRATEGY-DATA-BLOCK
STRATEGY: OLD_STRATEGY
END_INTERVAL_DATA
$-----COOLING-PHASE
INTERVAL_DATA: DTMIN= 5.224 DTMAX= 5.5 NSTEP=500
$-----ACTIVATION
ACTIVATION: OLD_ACTIVATION
$-----WELDING
WELDING: OFF
$-----FUNCTION
FUNCTION: OLD_FUNCTION
$-----LOAD
LOAD: OLD_LOAD
$-----BOUNDARY
BOUNDARY: OLD_BOUNDARY
$-----STRATEGY-DATA-BLOCK

```



```
STRATEGY: NEW_STRATEGY
LOAD_INCREM: COOLR=20
TERMINATION: END_TIME= 2600
SOLVER: ITERATIVE SYMMETRIC
ALGORITHM: UPDATE FULL
LINE_SEARCH: ON
CONVERGENCE: TEMPERATURE TOLER= 0.1 MITER= 15
$-----POST-PROCESS
  POST_PROCESS: TEMPERATURE STEP= 5
END_STRATEGY
END_INTERVAL_DATA
STOP
$=====
=====
$----- Copyright @CIMNE-07-MAY-2009 -----
$=====
=====
```