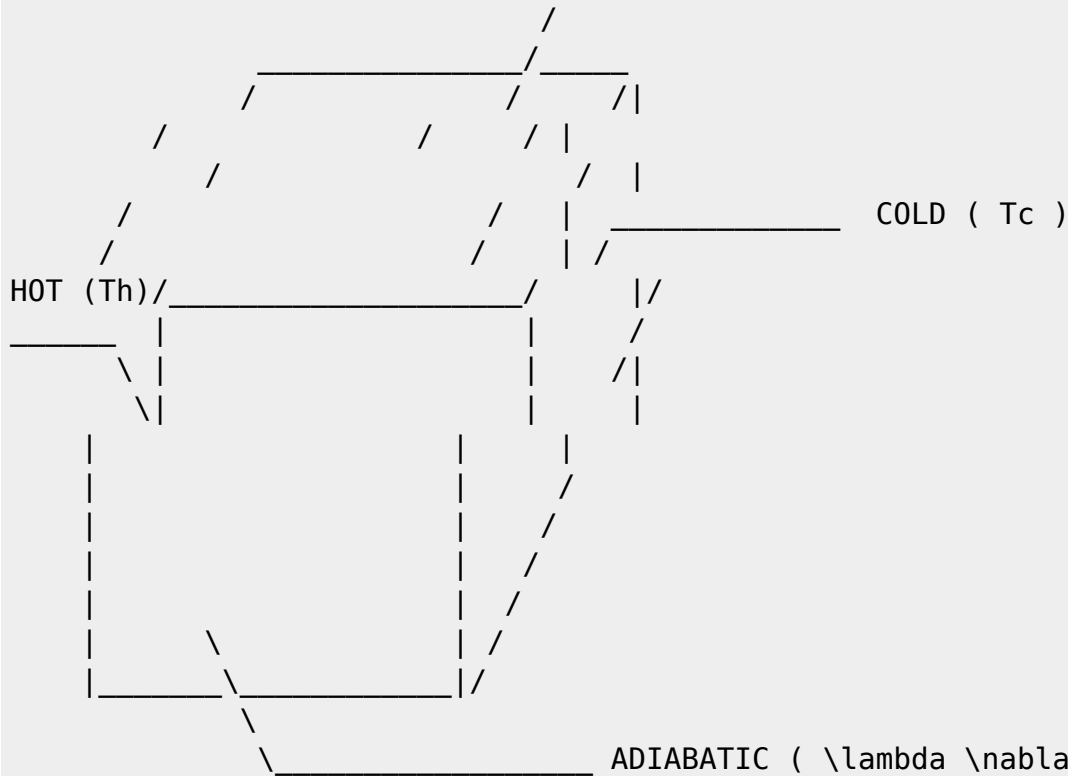


```

=====
=====
MAIN INPUT DATA FILE : 3D HEAT-DRIVEN CAVITY FLOW PROBLEM
IN DIMENSIONAL UNITS
COUPLED WITH WALL AND GAS RADIATION
=====
=====

```

ADIABATIC (  $\lambda \nabla T \cdot \vec{n} + Q_{\text{radiation}} = 0$  )



+  $Q_{\text{radiation}} = 0$  )

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```
=====
INCOMPRESSIBLE FLUID FLOW --> Constant Density
HEAT DRIVEN FLOW          --> Activation of Heat Transfer
BOUSSINESQ ASSUMPTION     --> Thermal Expansion Coefficient = 1/T0 ( here
beta = 0 ==> beta = 1/T0 )

&Fluid_Properties   Variable_Density   = .false.   , Constant_Mass_Flow =
.true. , Heat_Transfer_Flow = .true. ,
                    Heat_Capacity_Ratio = 1.4 , Reference_Density= 1.225,
Reference_Dynamic_Viscosity= 1.852D-05,
                    Reference_Temperature= 300.0 , Prandtl = 0.707,
Reference_Heat_Capacity = 1004.D0 , Thermal_Expansion_coefficient = 0.0/
=====
    INITIALIZATION OF THE VELOCITY COMPONENTS, THE TEMPERATURE AND SPECIES
=====
START FROM FLOW AT REST
AND UNIFORM TEMPERATURE at T0 = 300 K

&Velocity_Initialization   I_Velocity_Reference_Value = 0.0 ,
J_Velocity_Reference_Value = 0.0 , K_Velocity_Reference_Value = 0.0 ,
                    Initial_Field_Option_For_Velocity_I = 0,
Initial_Field_Option_For_Velocity_J = 0 ,
Initial_Field_Option_For_Velocity_K = 0/

&Temperature_Initialization   Temperature_Reference_Value = 300.0,
Initial_Field_Option_For_Temperature = 0 /

=====
                        GRAVITY
=====
FORCE GRAVITY ALONG THE VERTICAL AXIS POINTING DOWNWARD ( i.e. gravity = -
g.\vec{z} )
CONSIDERING DIMENSIONAL PARAMETER g = 9.81 m/s^2

&Gravity   Gravity_Enabled= .true. , Gravity_Angle_IJ= 90.0 ,
Gravity_Angle_IK= 0.0 , Reference_Gravity_Constant= 9.81 /

=====
                        RADIATION
=====
AS RADIATION IS CONSIDERED :
- ACTIVATE THE RADIATIVE SOLVER [default = .false.] ( ONLY FOR 3D CARTESIAN
PROBLEMS !! )
- SOLVE THE RADIATIVE PROBLEM EVERY 5 CONVECTIVE TIMESTEP ( LIMIT TIME
CONSUMPTION , KEEP THIS PARAMETER LOWER THAN 5~8 FOR STABILITY ... )
[default = 1]
- IF STARTED FROM SCRATCH, FORCE THE SOLVER TO ITERATE OVER
FirstIterations=200 LOCAL ITERATIONS FOR INCIDENT FLUXES CONVERGENCES
AT WALLS AND VOLUMIC RADIATIVE SOURCE TERM [default = 20]
- FOR EACH RADIATIVE PROBLEM SOLVING STEPS, ITERATE OVER
```

```

RadiativeLocalIterations=20 SUB-ITERATIONS OR UNTIL
RadiativeConvergenceTolerance=5.E-05 RESIDUAL
  ERROR IS REACHED [default = 1.E-15]
  - WallRadCoeff AND VolRadCoeff ARE FOR DEVELOPPEMENT ONLY ... [default = 1]
  - CONSIDER THE "LATHROP" SCHEME TO INTERPOLATE THE CELL-FACES RADIATIVE
  INTENSITY [default = STEP]
  - CONSIDER THE ANGULAR DISCRETISATION WITH S10 LEVEL SYMMETRIC QUADRATURES
  Squad = 10 ( 120 DIRECTIONS IN VOLUMES, 60 DIRECTIONS ON WALLS) [default =
  8]
  - CONSIDER BLACK WALLS ON DIRICHLET WALLS AND REFLECTIVE WALLS ON THE
  OTHERS [default = 0.1]
  - CONSIDER THE MEDIUM AS A REAL GAS MIXTURE :
    + ACTIVATE THE SLW MODEL ActivateGas=.true. [default = .false.]
    + SPLIT THE ABSORPTION COEFFICIENT DOMAIN IN 8 WEIGHTED SUM OF GRAY-GASES
  NbGas = 8 [default = 1]
    + ka_min AND ka_max REPRESENTS THE MINIMUM AND MAXIMUM RANGE OF THE
  ABSORPTION COEFFICIENT DOMAIN in m^{-1} [default = 0]
    + CONSIDERS THE MEDIUM AS AN AIR-H2O GAS MIXTURE WITH UNIFORM MOLAR
  FRACTION x = 0.02 [default = 0.07]

```

```

&Radiative_Heat_Transfer_DOM    activateRadiation=.true. , RadiativePeriod =
5, FirstIterations=200,
    RadiativeLocalIterations=20, RadiativeConvergenceTolerance =
5.E-05,
    WallRadcoeff = 1.0 , VolRadCoeff = 1.0, RadiativeScheme =
"LATHROP",
    ActivateGas=.true., NbGas = 8, ka_max=570., ka_min=6.3e-07,
    Pref=101325.0, Href = 1.0, spec='H2O',xaref=0.02,
xaUniform=0.02,
    Squad = 10, WallEmissivity = 1.0 1.0 0.0 0.0 0.0 0.0 /

```

#### =====

#### DOMAIN FEATURES

#### =====

```

- CONSIDER HERE A CUBICAL CAVITY WITH WALL REFINED CELLS GIVEN IN SEPARATE
MESH FILES
- WE CONSIDERS AN MPI DOMAIN DECOMPOSITION PROBLEM ON 2x2x3 MPI PROCESSES

```

```

&Domain_Features Start_Coordinate_I_Direction= 0.00 ,
End_Coordinate_I_Direction= 1.00,
    Start_Coordinate_J_Direction= 0.00 ,
End_Coordinate_J_Direction= 1.00,
    Start_Coordinate_K_Direction= 0.00 ,
End_Coordinate_K_Direction= 1.00,
    Cells_Number_I_Direction= 40 ,Cells_Number_J_Direction= 40
,Cells_Number_K_Direction= 30,
    Number_OMP_Threads= 1,
    MPI_Cartesian_Topology= .true. ,
    Total_Number_MPI_Processes= 12,
    Max_Number_MPI_Proc_I_Direction= 2 ,
Max_Number_MPI_Proc_J_Direction= 2, Max_Number_MPI_Proc_K_Direction= 3,

```

Regular\_Mesh= .false. /

++++  
++

## DEFINITION OF BOUNDARY CONDITIONS

++++  
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=====

=

## WALL BOUNDARY CONDITION SETUP

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=  
- WE CONSIDER DIRICHLET TEMPERATURE CONDITION ON HOT AND COLD WALLS  
(Heat\_BC\_Option = 0)  
- AND WALL CONVECTION-RADIATION COUPLING AT THE OTHER WALLS (Heat\_BC\_Option  
= 5)

```
&Heat_Wall_Boundary_Condition_Setup
  Wall_BC_DataSetName = "Set1",
  West_Heat_BC_Option = 0 , East_Heat_BC_Option = 0 ,
Back_Heat_BC_Option = 5 , Front_Heat_BC_Option = 5 , South_Heat_BC_Option =
5 , North_Heat_BC_Option = 5,
  West_Wall_BC_Value= 300.005 , East_Wall_BC_Value= 299.995 ,
Back_Wall_BC_Value= 0.0 , Front_Wall_BC_Value= 0.0 , South_Wall_BC_Value=
0.0 , North_Wall_BC_Value= 0.0 /
```

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## BORDER BOUNDARY CONDITIONS

=====

!--- No new boundary conditions are defined at the ends of the domain :  
walls by default are preserved, the inlet and outlet previously are defined  
above)  
!--- As "None" is the default setting for this namelist, it can be removed

```
&Border_Domain_Boundary_Conditions West_BC_Name= "None" , East_BC_Name=
"None" , Back_BC_Name= "None" , Front_BC_Name= "None" , North_BC_Name=
"None" , South_BC_Name= "None" /
```

++++  
++

## NUMERICAL METHODS

++++  
++

PARTIAL DIAGONALISATION TECHNIQUE IS EMPLOYED FOR THE POISSON PROBLEM ==>  
Numerical\_Method\_Poisson\_Equation = 3

```
&Numerical_Methods NS_NumericalMethod= "BDF2-Scheme02" ,
!--- BDF2 + 2nd order centered scheme
MomentumConvection_Scheme="Centered-02-Conservative" ,
!--- conservative form for solving the velocity (momentum) equation
```

```

        TemperatureConvection_Scheme="Centered-02-Conservative",
!--- conservative form for solving the temperature (enthalpy) equation
        Poisson_NumericalMethod="Home-PartialDiagonalization" /
!--- Partial Diagonalization for Poisson's equation
+++++
++
        SIMULATION MANAGEMENT
+++++
++
- START FROM SCRATCH IF Restart_Parameter= 0 OR FROM EXISTING FILES IF
Restart_Parameter= 3
- WE CONSIDERS THAT THE PROBLEM WILL REACH A STEADY STATE AND WILL EVOLVE
IN TIME WITH FIXED CFL PARAMETER

&Simulation_Management      Restart_Parameter= 3 ,
                             Steady_Flow_Stopping_Criterion_Enabled = .true. ,
Steady_Flow_Stopping_Criterion = 1.D-14,
                             Temporal_Iterations_Number = 100 , Final_Time =
3.D+04 ,
                             TimeStep_Type = 1 ,
                             CFL_Min      = 0.3 , CFL_Max      = 0.3 ,
                             Timestep_Min = 1.D-03 , Timestep_Max = 1.D+01 ,
                             Iterations_For_Timestep_Linear_Progress= 1,
                             Probe_Recording_Rate      = 1000
,
                             Simulation_Backup_Rate     = 5000 ,
Simulation_Checking_Rate = 20 /

=====
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        PROBES MANAGEMENT
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        FIELDS RECORDING DECLARATION
=====
=
&Field_Recording_Setup      Check_Special_Features=
"NOHeat_Driven_Cavity_Flow" /
&Simulation_Management      Fields_Recording_Rate = 5.D+02 /
&Instantaneous_Fields_Listing Name_of_Field = "U" , Recording_Enabled
= .true. /      First velocity component
&Instantaneous_Fields_Listing Name_of_Field = "V" , Recording_Enabled
= .true. /      Second velocity component
&Instantaneous_Fields_Listing Name_of_Field = "W" , Recording_Enabled
= .true. /      Third velocity component
&Instantaneous_Fields_Listing Name_of_Field = "T" , Recording_Enabled
= .true. /      Temperature
&Instantaneous_Fields_Listing Name_of_Field = "P" , Recording_Enabled
= .true. /      Pressure

```

&Instantaneous\_Fields\_Listing Name\_of\_Field = "divU " , Recording\_Enabled  
= .true. / Momentum divergence

From:

<https://sunfluidh.lisn.upsaclay.fr/> - Documentation du code de simulation numérique SUNFLUIDH

Permanent link:

[https://sunfluidh.lisn.upsaclay.fr/doku.php?id=sunfluidh:3d\\_heat\\_driven\\_cavity\\_incomp\\_flow\\_gasrad&rev=1506956630](https://sunfluidh.lisn.upsaclay.fr/doku.php?id=sunfluidh:3d_heat_driven_cavity_incomp_flow_gasrad&rev=1506956630)

Last update: **2017/10/02 17:03**

