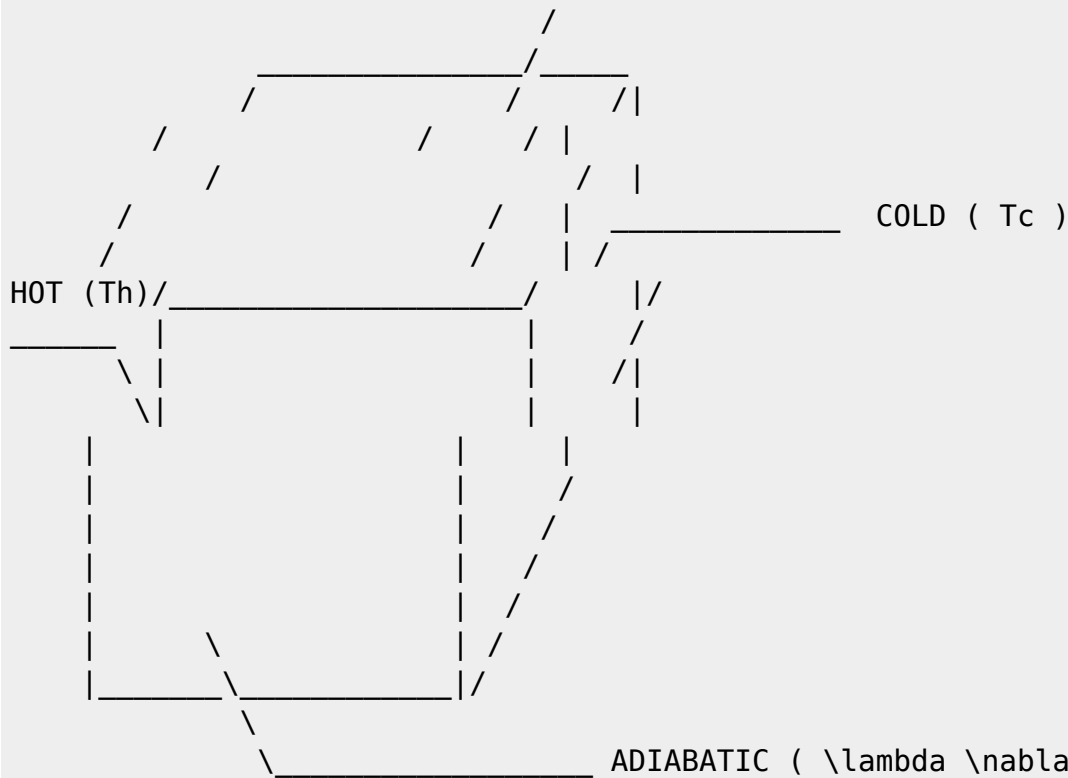


```
=====
=====
MAIN INPUT DATA FILE : 3D HEAT-DRIVEN CAVITY FLOW PROBLEM
IN DIMENSIONAL UNITS
COUPLED WITH WALL AND GAS RADIATION
=====
=====
```

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 /

```

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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. /

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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 = 6)

```
&Heat_Wall_Boundary_Condition_Setup
    West_Heat_BC_Option = 0 , East_Heat_BC_Option = 0 ,
    Back_Heat_BC_Option = 6 , Front_Heat_BC_Option = 6 , South_Heat_BC_Option =
    6 , North_Heat_BC_Option = 6,
    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 ,
    End_of_Data_Block= .true. /
```

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BORDER BOUNDARY CONDITIONS

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THE BORDER BOUNDARY CONDITIONS HAVE ALREADY BEEN DEFINED ==> Border = 0

```
&Border_Domain_Boundary_Conditions West_Border= 0 , East_Border= 0 ,
    Back_Border= 0 , Front_Border= 0 , North_Border = 0 , South_Border = 0 /
```

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NUMERICAL METHODS

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PARTIAL DIAGONALISATION TECHNIQUE IS EMPLOYED FOR THE POISSON PROBLEM ==>
Numerical_Method_Poisson_Equation = 3

```
&Numerical_Methods Numerical_Scheme= 1 ,
    Convective_Flux_Discretization_Type = 1 ,
    Temperature_Advective_Flux_Discretization_Type = 1 ,
    Species_Advective_Flux_Discretization_Type= 1 ,
    Explicit_Solving_of_Density = 0 ,
    Velocity_Correction_Enabled = .true.,
    Numerical_Method_Poisson_Equation = 3 ,
    Iterative_Method_Selection = 1 ,
```

```

        Number_max_Grid= 4
Number_max_Cycle= 10 , Number_Iteration= 15,
        Relaxation_Coefficient = 1.80 ,
Convergence_Criterion = 1.D-08 /
+++++
++
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
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=
&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. , End_of_Data_Block= .true. / momentum divergence

From:

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

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https://sunfluidh.lisn.upsaclay.fr/doku.php?id=sunfluidh:3d_heat_driven_cavity_incomp_flow_gasrad&rev=1481637438

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