

successive compression cycles of a 2D quasi-adiabatic cavity

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grid setup file

[data_meshgen.dat](#)

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                DATA FILE FOR THE MESH GENERATOR MESHGEN (DESCRIPTIONS OF
DATA ARE GIVEN BELOW)
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Blocks of data are associated to segments along a specific direction
(There are as many blocks as segments)
See below the TEMPLATES to select your own block of data associated to
the selected distribution law)
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I-DIRECTION
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Choice of the metric system :   in meter or dimensionless  (0)  -
angular in degrees (1)       :
&METRIC_UNIT                Type_of_Metric= 0 /
&MESH_FUNCTION_DATA Function_Name="TANH_ONE_SIDE"    Number_of_Cells= 32
Length= 0.01 Left_Cell_Size= 1.00d-04 Reverse_Ordering= .true. /
&MESH_FUNCTION_DATA Function_Name="REGULAR"          Number_of_Cells=
200 Length= 0.0200 Reverse_Ordering= .false. /
&MESH_FUNCTION_DATA Function_Name="TANH_TWO_SIDES"    Number_of_Cells=
280 Length= 0.09 Left_Cell_Size= 1.0d-04 Right_Cell_Size= 1.0d-04
Reverse_Ordering= .false. /
&MESH_FUNCTION_DATA End_of_Data_Block = .true./
-----
J-DIRECTION
-----
Choice of the metric system :   in meter or dimensionless  (0)  -
angular in degrees (1)       :
&METRIC_UNIT                Type_of_Metric= 0 /
&MESH_FUNCTION_DATA Function_Name="TANH_ONE_SIDE"    Number_of_Cells= 49
```

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Length= 0.0141 Left_Cell_Size= 6.00d-05 Reverse_Ordering= .true. /
&MESH_FUNCTION_DATA Function_Name="REGULAR" Number_of_Cells= 15
Length= 9.e-4 Reverse_Ordering= .false. /
&MESH_FUNCTION_DATA End_of_Data_Block = .true./
-----
K-DIRECTION
-----
&MESH_FUNCTION_DATA End_of_Data_Block = .true./
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DATA DESCRIPTION
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Main setup file

input3d.dat

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MAIN INPUT DATA FILE :

SUCCESSION COMPRESSION CYCLES OF A 2D QUASI-ADIABATIC CAVITY
LMN APPORACH

                                Wall Qh=0

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<---|--->
Wall Qh= 0
T= T0 |
      |
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                                Symmetric plan

DIMENSIONAL SETUP

fluid : air  at P= 101325 Pa and T= 294.146 K (initial
condition at t=0)
cavity size= 0.10m * 0.015m
volume variation : A.sin(2pi.f.t- w0)      w0= pi/2
A= 0.01 m
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f= 50 Hz

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&Version File_Version="VERSION2.0"/
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                GENERAL LAYOUT
                (DIMENSIONLESS)
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&Fluid_Properties  Variable_Density          = .true. ,
Constant_Mass_Flow      = .false. ,
                        Variable_Fluid_Volume= .true. ,
                        Molecular_Mass= 0.02896421357024561 ,
                        Heat_Transfer_Flow    = .true. ,
                        Reference_Dynamic_Viscosity = 1.795D-05,
                        Reference_Density      = 1.2 ,
                        Reference_Temperature  = 294.146 ,
                        Prandtl                = 0.726 ,
                        Reference_Heat_Capacity = 1004.7093960142244 ,
                        Heat_Capacity_Ratio    = 1.4 /

&Velocity_Initialization  I_Velocity_Reference_Value = 0.0 ,
J_Velocity_Reference_Value = 0.0 , K_Velocity_Reference_Value = 0.0 /
&Temperature_Initialization Temperature_Reference_Value= 294.146 ,
Initial_Field_Option_For_Temperature= 0 /
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                DOMAIN FEATURES
                (DIMENSIONLESS)
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====
&Domain_Features Start_Coordinate_I_Direction=-0.020 ,
End_Coordinate_I_Direction= 0.10,
                  Start_Coordinate_J_Direction= 0.00 ,
End_Coordinate_J_Direction= 0.015,
                  Start_Coordinate_K_Direction= 0.00 ,
End_Coordinate_K_Direction= 0.00,
                  Cells_Number_I_Direction= 512
,Cells_Number_J_Direction= 64 ,Cells_Number_K_Direction= 1,
                  Regular_Mesh= .false. /
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                DEFINITION OF BOUNDARY CONDITIONS
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WALL BOUNDARY CONDITION SETUP (DIMENSIONLESS)

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INLET AND OUTLET BOUNDARY CONDITIONS (DIMENSIONLESS)

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```
&Inlet_Boundary_Conditions  Type_of_BC= "INLET", Direction_Normal_Plan=
1 ,
                                Plan_Location_Coordinate= -0.0200 ,
                                Start_Coordinate_of_First_Span = 0.00 ,
End_Coordinate_of_First_Span = 0.015 ,
                                Start_Coordinate_of_Second_Span= 0.0 ,
End_Coordinate_of_Second_Span= 0.0 ,
                                Flow_Direction= 1 ,
                                Define_Velocity_Profile= 0,
                                Normal_Velocity_Reference_Value= 0.0 ,
                                Temperature_Reference_Value= 294.146 ,
                                Density_Reference_Value= 1.2 ,
                                Temperature_BC_Type="Neumann",
                                Density_BC_Type="Neumann",
                                Variable_Flowrate= 0/
                                !Time_Fct_Name= "Sinus_zero_average" ,
Time_Fct_Threshold= 0.0 ,
                                !Time_Fct_Time_Scale= 2.0E-02 ,
Time_Fct_Magnitude= 4.712 /
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IMMERSED BOUNDARY METHODS : PENALIZATION METHOD

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&Immersed_Boundary_Methods  Immersed_Boundary_Method_Type= 1 ,
                                Name_of_Solid="RECTANGLE",
                                Linked_IBM_Inlet_Number = 1 ,
                                Gravity_IBM_Enabled = .false. ,
                                StrongPenaltyForVelocity_Enabled=.true.,
                                Coordinate_Gravity_Center_At_Rest_I=-0.04 ,
Coordinate_Gravity_Center_At_Rest_J= 0.0075 ,
Coordinate_Gravity_Center_At_Rest_K= 0.0 ,
                                Coordinate_Gravity_Center_Init_I= -0.05 ,
Coordinate_Gravity_Center_Init_J= 0.0075 ,
Coordinate_Gravity_Center_Init_K= 0.0 ,
                                Coordinate_Restricted_Motion_I=-0.04 ,
Coordinate_Restricted_Motion_J= 0.0 , Coordinate_Restricted_Motion_K=
```

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0.0 ,
                                Size_Object_I= 0.08
Size_Object_J= 0.015                                , Size_Object_K= 0.0
,
                                Reference_Velocity_I= 0.0
Reference_Velocity_J= 0.0                                , Reference_Velocity_K= 0.0
,
                                Motion_Magnitude_I= 0.010
, Motion_Magnitude_J= 0.00                                , Motion_Magnitude_K= 0.0
,
                                Mass= 1.2 ,
                                Spring_Stiffness_Constant_I= 0.0
Spring_Stiffness_Constant_J= 0.0                                , Spring_Stiffness_Constant_K=
0.0
,
                                Transitional_Time= 0.00, Forced_Frequency=
5.0D+01 , OffSet= 0.5,
                                Heat_Transfer_Type= 0,
                                Reference_Temperature= 294.146 ,
Reference_Heat_Flux= 0.0 ,
                                Material_Thermal_Conductivity= 2.4841D-02 ,
Material_Mass_Heat_Capacity= 1004.7094, Material_Density= 1.2 /

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                                ENDS BOUNDARY CONDITIONS
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=====
&Border_Domain_Boundary_Conditions West_BC_Name  = "None" ,
East_BC_Name  = "None" ,
                                Back_BC_Name  = "Symmetric" ,
Front_BC_Name = "None" ,
                                North_BC_Name = "None" ,
South_BC_Name = "None" /
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                                NUMERICAL METHODS
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&Numerical_Methods
                                !!!NS_NumericalMethod= "BDF2-Scheme02",
                                NS_NumericalMethod= "CN-Scheme02",
                                !!!NS_NumericalMethod= "CN-Scheme02-
SpecialLowMachFlow",
                                !!MomentumConvection_Scheme="Centered-02-
Conservative" ,
                                MomentumConvection_Scheme="Centered-02-
Convective_2" ,
                                !!!MomentumConvection_Scheme="Upwind-01-
Convective" ,
                                TemperatureAdvection_Scheme="Centered-02-
Convective_2" ,

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!!!TemperatureAdvection_Scheme="Upwind-01-
Convective" ,
!!!TemperatureAdvection_Scheme="Centered-02-
Convective" ,
!Poisson_NumericalMethod="Home-
PartialDiagonalization" ,
!Poisson_NumericalMethod="Home-SORMultigrid-
ConstantMatrixCoef" ,
Poisson_NumericalMethod="Home-SORMultigrid-
VariableMatrixCoef" ,
Off_Set_Poisson_Source_term= .true./

!HomeData_PoissonSolver
  Direction_1= 2,
  Direction_2= 1,
  Direction_3= 3/

&HomeData_PoissonSolver SolverName="SOR" ,!Successive Over-
Relaxation (SOR) method based on the red-black algorithm
  MultiGrid_Type="V_Cycle",
  Relaxation_Coefficient= 1.45 ,!Relaxation
coefficient of the SOR method ( 1 <= Relaxation_Coefficient < 2)
  Number_max_Grid= 7 ,!Number of grid
levels
  Number_max_Cycle= 9
  Number_Iteration_FineToCoarseGrid=3 ,!number
of SOR iterations applied on any grid level during the restriction step
(before the coarsest grid computation)
  Number_Iteration_CoarseToFineGrid= 15 ,!number
of SOR iterations applied on any grid level during the prolongation
step (after the Coarsest grid computation)
  Number_Iteration_CoarsestGrid= 30 ,!number of
SOR iterations applied on the coarsest grid
  ResidualNormalisation_Enabled= .true.,
  ConvergenceStrengthening_Enabled= .true. ,
  Convergence_Criterion= 1.D-04
/!convergence tolerance on the residu of the Poisson's equation

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SIMULATION MANAGEMENT

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The numerical time step is dynamic and is estimated by the constant CFL
coefficient

&Simulation_Management Restart_Parameter= 0 ,
Steady_Flow_Stopping_Criterion_Enabled =
.true. , Steady_Flow_Stopping_Criterion = 1.D-16,
Temporal_Iterations_Number = 4000000

```

```

, Final_Time = 4.00D-00 ,
                        TimeStep_Type      = 0 ,
                        TimeStep_Max       = 1.0D-05,
                        CFL_Max            = 0.3 ,
                        Simulation_Backup_Rate = 1000
, Simulation_Checking_Rate = 101 /
=====
=====
                        PROBES MANAGEMENT
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&Simulation_Management   Probe_Recording_Rate = 100      /

&Probe_Quantities_Enabled Temporal_Series_For_Quantity_Enabled(:)=
.true. , .true., .false., .false., .false., .false. /

&Probe_Location   Xi=-0.011 , Xj= 0.007 , Xk= 0.0 /

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                        FIELDS RECORDING DECLARATION
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!-----
!--- Instantaneous fields
!-----

&Field_Recording_Setup   Precision_On_Instantaneous_Fields= 1 /
&Simulation_Management   InstantaneousFields_TimeRecordingRate =
1.0D-03 InstantaneousFields_RecordingStartTime=0.0 /

&Instantaneous_Fields_Listing Name_of_Field = "U      " /      First
velocity component
&Instantaneous_Fields_Listing Name_of_Field = "V      " /      Second
velocity component
&Instantaneous_Fields_Listing Name_of_Field = "P      " /
&Instantaneous_Fields_Listing Name_of_Field = "T      " /
&Instantaneous_Fields_Listing Name_of_Field = "TRACE " /
&Instantaneous_Fields_Listing Name_of_Field = "RHO  " /
!Instantaneous_Fields_Listing Name_of_Field = "divU  " /
!Instantaneous_Fields_Listing Name_of_Field = "divRU " /
!Instantaneous_Fields_Listing Name_of_Field = "PHI   " /
!Instantaneous_Fields_Listing Name_of_Field = "drho  " /
!Instantaneous_Fields_Listing Name_of_Field = "SRC_P  " /

!-----
!--- Statistic fields
!-----

```

```
&Simulation_Management    Start_Time_For_Statistics= 2.D-01
, Time_Range_Statistic_Calculation = 3.8D-01  /

&Statistical_Fields_Listing  Name_of_Field = "<U>"  /
&Statistical_Fields_Listing  Name_of_Field = "<V>"  /
&Statistical_Fields_Listing  Name_of_Field = "<T>"  /
&Statistical_Fields_Listing  Name_of_Field = "<P>"  /
&Statistical_Fields_Listing  Name_of_Field = "<Rho>" /

!-----
!--- Time series
!-----
&Time_Series_Data Title= "MassFlowBalance" , Filename= "check_mass.dat"
, iter_rec= 10 ,
                Time_Start_Mean_Calculation= 40.
,Range_Mean_Calculation= 80.
                Restart_Enabled= .false. /

&Time_Series_Data Title= "VolumeFlowBalance" , Filename=
"check_vol.dat" , iter_rec= 10 ,
                Time_Start_Mean_Calculation= 40.
,Range_Mean_Calculation= 80.
                Restart_Enabled= .false. /

&Time_Series_Data Title= "LMN_Data" , Filename= "check_lmndata.dat" ,
iter_rec= 10 ,
                Time_Start_Mean_Calculation= 40.
,Range_Mean_Calculation= 80.
                Restart_Enabled= .false. /

&Time_Series_Data Title= "KE_Average" , Filename=
"check_kin_energy.dat" , iter_rec= 10 ,
                Time_Start_Mean_Calculation= 40.
,Range_Mean_Calculation= 80.
                Restart_Enabled= .false. /
```

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