

# Inlet\_Boundary\_Condition

This data setup are used to define the inflow condition features. The inflow geometry is restricted to rectangular/line forms in 3D/2D configuration. In the particular case of cylindrical geometries, the inlets can be circular, annular or bowed rectangular. In fact, the geometry of the inlet fits the grid topology.

## Full data set of the namelist

```
&Inlet_Boundary_Conditions
  Type_of_BC= "INLET", Direction_Normal_Plan= 1 ,
  Plan_Location_Coordinate= -0.05 ,
  Start_Coordinate_of_First_Span = -0.01, End_Coordinate_of_First_Span =
0.01,
  Start_Coordinate_of_Second_Span= 0.0 , End_Coordinate_of_Second_Span=
0.0 ,
  Flow_Direction= 1 ,
  Normal_Velocity_Reference_Value= 1.5E-3 ,
  Temperature_Reference_Value= 293.0 ,
  Density_Reference_Value= 1.66328E-1,
  Define_Velocity_profile= 0 ,
  Species_Boundary_Condition_Type= 0 , Define_Mass_Fraction_profile= 0 ,
  Temporal_Variation_For_Each_Species= 0 0 0 ,
  Species_Reference_Value= 0.2 0.3 0.5 , !--- Here we suppose 3 species
  Time_Fct_Name= "Sinus" , Time_Fct_Threshold= 0.0 ,
  Time_Fct_Time_Scale= 1.0 , Time_Fct_Magnitude= 0.0 ,
  End_of_Data_Block= .true. /
```



- Whatever the grid topology, the orientation and the span of the inflow are defined by means of :
  - the normal vector of the inlet plane associated to a specific direction (I, J or K).
  - the coordinates associated to the position of the inlet sides along the two perpendicular directions to the normal vector (denoted the first and second span directions).
- When the normal vector is oriented along the I-direction, the first span direction is J and the second is K.
- When the the normal vector is oriented along the J-direction, the first span direction is I and the second is K.
- When the the normal vector is oriented along the K-direction, the first span direction is I and the second is J.
- When the inflow conditions are constant the time data can be omitted.
- By default the domain is enclosed. The boundary conditions defined by default at the ends of the domain are walls. When an inlet is placed at the end of the domain, it replaces the wall conditions over the inflow area.
- Don't forget to set the boolean data "End\_of\_Data\_Block" at the end of the



namelist. A “.true.” value means the end of the data block when several namelists are used to create several inlets.

Find some examples [here](#) about inflow configurations.

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## Definition of the data set

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### Type\_of\_BC

- Type : String of 6 characters
- Name to define the inflow boundary conditions type. Only one kind of inlet boundary condition is defined at present (Dirichlet type) and the associated name is “INLET”.

### Direction\_Normal\_Plan

- Type : integer value
- This data defines the orientation of the normal vector the inlet in respect with the grid {I,J,K}. The values 1, 2 or 3 point the I, J or K-direction, respectively.
- Default value : none

### Plan\_Location\_Coordinate

- Type: real value
- Coordinate of the position of the inlet plan along the normal direction previously defined.
- Default value : none

### Start\_Coordinate\_of\_First\_Span

- Type : real value
- This coordinate defines the lower side of the inlet plan span along “the first direction” (see the note above).
- Default value : none

### End\_Coordinate\_of\_First\_Span

- Type : real value
- This coordinate defines the upper side of the inlet plan span along “the first direction” (see the note above).

## Start\_Coordinate\_of\_Second\_Span

- Type : real value
- This coordinate defines the lower side of the inlet plan span along “the second direction” (see the note above).
- Default value : none

## End\_Coordinate\_of\_Second\_Span

- Type : real value
- This coordinate defines the upper side of the inlet plan span along “the second direction” (see the note above).
- Default value : none

## Flow\_Direction

- Type : integer value
- This value is set to 1 or -1. It indicates the presumed direction of the inflow in accordance to the position of the outlet. If the inflow is oriented along the increasing or decreasing index (for a given direction) the value is set to 1 or -1, respectively.
- Default value : none

## Normal\_Velocity\_Reference\_Value

- Type : real value
- Reference value of the normal component of the velocity. The other ones are automatically set to zero.
- Default value : none

## Define\_Velocity\_profile

- Type : Integer value
- Type of the velocity profile over the inlet :
  - 0 : Uniform profile
  - 1 : Parabolic profile along the first span direction (the mean velocity at the inlet is defined with the “Normal\_Velocity\_Reference\_Value”)
  - 2 : Parabolic profile along the second span direction (the mean velocity at the inlet is defined with the “Normal\_Velocity\_Reference\_Value”)
  - Default value = 0

## Variable\_Flowrate

- Type : Integer value
- This data allows the user to define a time variation of the flowrate :
  - 0 : the flowrate is constant
  - 1 : the flowrate is variable in time. The time functions can be defined by the users in the

specific module of the code named “module\_user\_defined\_temporal\_function.f90”. The parameters of the time-function can be read from the following variables :

- Time\_Fct\_Name : character string linked to the user's time function defined in the module “module\_user\_define\_temporal\_function.f90”. At present, two temporal functions are available, The sinusoidal function (named “Sinus”) and the linear-ramp function, (called “ Linear\_Ramp”).
- Time\_Fct\_Threshold : time from which the time function starts.
- Time\_Fct\_Time\_Scale : time scale of the function (i.e the period for the sinusoidal function, and the time range for the linear ramp function)
- Time\_Fct\_Magnitude : magnitude of the time function.
- Default value= 0

## Temperature\_Reference\_Value

- Type : real value
- Reference value of the temperature.
- Default value : none

## Density\_Reference\_Value

- Type : real value
- Reference value of the fluid density.

## Species\_Reference\_Value

- Type : array of real values (the size is determined by the species number considered)
- This data setup defines the reference value of mass fractions for each species
- Default value : none

## Species\_Boundary\_Condition\_Type

- Type : integer value ( **Not for the release SUNFLUIDH\_EDU** ).
- This option defines the inlet boundary
- condition type for the density of species
  - 0 : Dirichlet condition (the mass fraction value is imposed at the center of the ghost-cell).
  - 1 : The mass flux value is imposed on the inlet plan. This flux is defined as  $F_i = \rho \cdot Y_i \cdot \vec{V}$  : the product of the variables “Define\_Velocity\_profile”, “Normal\_Velocity\_Reference\_Value” and “Species\_Reference\_Value” . The diffusion flux is null.
- Default value : none

## Define\_Mass\_Fraction\_profile

- Type : integer value ( **Not for the release SUNFLUIDH\_EDU** ).
- This data determines the distribution law on the first species mass fraction over the inlet (the

complementary law is reported on the 2nd species by default):

- 0 : Uniform profile
- 1 : Heaviside profile centered on the inlet
- Default value : none

## Temporal\_Variation\_For\_Each\_Species

- Type : array of integer value (the size is determined by the species number considered. **Not for the release SUNFLUIDH\_EDU** ).
- This data setup defines time function used to define the temporal variation of species. The time functions can be programmed by the user in the fortran file named "module\_user\_define\_temporal\_functions.f90". Sinusoidal and linear ramp functions can be used by means of time parameters already described in the part "Variable\_Flowrate" .
- Default value : none

## End\_of\_Data\_Block

- Type : boolean value
- Specify the end of the namelist or a group of this type of namelist (if true).

From:

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

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Last update: 2017/12/19 10:43

