

Namelist "Simulation_Management"

This data setup allows the user to set the time parameters of the code in order to :

- perform the numerical simulation (time step, stopping criteria...)
- record the results associated to time series of probes, instantaneous physical quantity fields, statistical quantities.
- record the backup/restart files

Full data set of the namelist

```
&Simulation_Management      Restart_Parameter= 0 ,
                             Steady_Flow_Stopping_Criterion_Enabled = .false.
,
                             Steady_Flow_Stopping_Criterion = 1.D-20,
                             Temporal_Iterations_Number = 10
,
                             Final_Time = 3.D+01 ,
                             TimeStep_Type = 0 ,
                             Timestep_Min = 1.D-03
                             Timestep_Max = 1.D-03 ,
                             CFL_Min      = 0.5
                             CFL_Max      = 0.5 ,
                             Iterations_For_Timestep_Linear_Progress= 1,
                             Simulation_Backup_Rate                    = 1000
                             Simulation_Checking_Rate = 200 ,
                             Fields_Recording_Rate = 1.D+00 ,
                             Probe_Recording_Rate                    = 10
                             Start_Time_For_Statistics= 1.D+2
                             Time_Range_Statistic_Calculation = 1.D+00 /
```

Definition of the data set

Restart the simulation

Restart_Parameter

- Type : Integer Value
- This data indicates how is initialized the simulation :
 - 0 : The simulation starts from the beginning corresponding to an initialization state.
 - 1 or 2 : The simulation is resumed from a temporary backup file recorded during the

previous simulation. Useful to resume a simulation suddenly interrupted. As the temporary backup file is regularly removed during a simulation, only the two last files created by the code are available. They correspond to the number 1 or 2. The number of last file created is recorded in the file `num_sav_XXXXX.d` (XXXXX correspond to the MPI process number when the simulation is performed in a domain decomposition approach).

- 3 : The simulation is resumed from the last backup file built during the last time step of the previous simulation. Useful to continue a incompleted simulation. The number 3 must be present in the file `num_sav_XXXXX.d` (proof that the previous simulation is correctly completed), otherwise the numbers 0, 1 or 2 (related to the previous cases) will be present.

Stopping criteria

Steady_Flow_Stopping_Criterion_Enabled

- Type : Boolean value
- Activation of the stopping criterion for steady flow (based on the L2-norm of the time variation of physical quantities).

Steady_Flow_Stopping_Criterion

- Type : Real value
- When the L2-norm of the time variation of physical quantities is lower than this value, the simulation is stopped and the solution corresponds to a steady flow.

Number_Temporal_Iterations

- Type : Integer value
- This value is the maximum of time iterations performed by the code before stopping.

Final_Time

- Type : Real value
- This value is the physical time limit reached by the simulation before stopping.



The simulation stops as soon as one of these conditions is achieved.

Numerical time step

TimeStep_Type

- Type : Integer value

- Selection of way to define the numerical time step :
 - 0 : The time step is constant and defined by the user by means of the variable "Timestep_max" (see further).
 - -1 : The time step evolves linearly between the values given by "Timestep_min" and "Timestep_max". The range of variation is defined by the variable "Iterations_For_Timestep_Linear_Progress" (in time iteration number, see further).
 - 1 : The time step is calculated for each time iteration by means of the CFL parameter. The CFL parameter can be constant, it is thus defined by the variable "CFL_Max". It can also evolve linearly between the values given by "CFL_Min" and "CFL_Max". The range of variation is defined by the variable "Iterations_For_Timestep_Linear_Progress" (in time iteration number, see further).

Timestep_min

- Type : Real value
- Minimum value of the time step. This variable can be omitted when the time step is constant.

Timestep_max

- Type : Real value
- Maximum value of the time step. This variable sets the value of the time step when it is constant.

CFL_min

- Type : Real value. This variable can be omitted when the time step is constant.
- Minimum value of the CFL parameter (can be omitted, in this case **CFL_Max** will define the CFL value).

CFL_max

- Type : Real value
- Maximum value of the CFL parameter. This variable sets the value of the CFL parameter when it is constant (in this case, **CFL_Min** is useless).

Iterations_For_Timestep_Linear_Progress

- Type : Integer value
- Number of time iterations over which the CFL parameter or the time step can evolve linearly. When the time step or the CFL parameter are constant, this variable must not be set to a value greater than 1. It could actually be omitted (this default value is 1).



For a dynamic computation of the time step from a CFL condition, you can only set the variable **CFL_Max** if you want a constant CFL value and **CFL_Min** can be omitted. In any way, the maximum value the time step can reach is limited by the value of **Timestep_max** (useful when the initial condition is defined from a zero velocity field for which the time step cannot be computed from the CFL condition).

Recording rates for different kind of files

- For backup/restart files :

Simulation_Backup_Rate

- Type : Integer value
- This variable defines the recording rate, in time iteration units , of the backup files (for instance, when "Simulation_Backup_Rate=1000" a data backup is carried out for all time iteration numbers that are a multiple of 1000).
Backup data are dispatched in two files that are named save_var_yyyyy_n.d and save_fld_yyyyy_n.d ('yyyyy' is the subdomain number for simulations based on the MPI domain-decomposition approach, n= 1 or 2 for temporary backup files and n=3 for the backup files created during the last time step of the simulation).

- For snapshot files :

Field_Recording_Rate

- Type : Real value
- This variable defines the recording rate, in time units , of instantaneous fields (for instance, when "Field_Recording_Rate=1.5" an instantaneous field file is created as soon as the time value is a multiple of 1.5).
Instantaneous field files are named res_xxxxxxx_yyyyy.d ('yyyyy' is the subdomain number for simulations based on the MPI domain-decomposition approach, 'xxxxxxx' is the file number).
The instantaneous fields of the physical quantities are defined with the namelist "Instantaneous_Fields_Listing".

InstantaneousFields_RecordingStartTime

- Type : Real value
- This variable sets the time threshold from which the record of instantaneous fields begins. It must be used along with the next variable "InstantaneousFields_TimeRecordingRate". This value is defined in time units.

InstantaneousFields_TimeRecordingRate

- Type : Real value
- This variable defines the recording rate, in time units , of instantaneous fields. For instance, when "InstantaneousFields_TimeRecordingRate=1.5" a file is created at every 1.5 time units from the start time provided by the variable "InstantaneousFields_RecordingStartTime".

InstantaneousFields_StartTimeIterationRecording

- Type : Integer value
- This variable sets the time-iteration threshold from which the record of instantaneous fields begins. It must be used along with the next variable

"InstantaneousFields_TimeliterationRecordingRate". This value is defined in time-iteration units (number of time steps).

InstantaneousFields_TimeliterationRecordingRate

- Type : Integer value
- This variable defines the recording rate, in time-iteration units , of instantaneous fields. For instance, when "InstantaneousFields_TimeliterationRecordingRate=100" a file is created at every 100 time steps from the threshold provided by the variable "InstantaneousFields_StartTimeliterationRecording".

InstantaneousFields_RecordingReset

- Type : Boolean value
- When this variable is set to "true", the ID number of file 'xxxxxxx' is set to zero for the next simulation.

Keep in mind :



- Instantaneous field files are named res_xxxxxxx_yyyyy.d. T
- The number 'yyyyy' stands for the subdomain number on which fields are recorded for simulations based on the MPI domain-decomposition approach. When the domain decomposition approach is not used (just one domain), 'yyyyy=00000' is the default value.
- 'xxxxxxx' is the ID number of the file. 'xxxxxxx' is incremented by one for each new file created.
- The instantaneous fields of the physical quantities written in each file are defined with the namelist "Instantaneous_Fields_Listing".

- For statistics files :

Start_Time_For_Statistics

- Type : Real value
- Time from which the statistical fields are calculated.

Time_Range_Statistic_Calculation

- Type : Real value
- Time range over which statistical fields are calculated. When this time range has been covered, statistical fields are recorded in a file named rst_xxxxxxx_yyyyy.d ('yyyyy' is the subdomain number for simulations based on the MPI domain-decomposition approach, 'xxxxxxx' is the file number). If the simulation is not completed a new cycle of statistical calculation is initialized. The statistical quantities are defined with the namelist "Statistical_Fields_Listing".

- For probe time-series files :

Probe_Recording_Rate

- Type : Integer value
- This variable defines the recording rate, in time iteration units , of time series associated to the probes distributed over the domain (see the namelist “Probe_Location”). The physical quantities linked to the probe time-series are defined with the namelist “Probe_Quantities_Enabled”. For instance, when “Probe_Recording_Rate=10”, a new value is added to probe time-series for all time iteration numbers that are a multiple of 10).

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