Simulation control data set

We here resort to a specific namelist named “Simulation_Management. It is also used in the next section “Data acquisition”. We specify here some parameters in order to define the numerical time step as well as stop criteria and recording rates related to backup and check files. Two examples are given. The first one corresponds to a simulation starting at t= 0 with a variable time step.

```
 &Simulation_Management Restart_Parameter= 0                              ,!-
-- Option value for starting the simulation from t=0.
       Steady_Flow_Stopping_Criterion_Enabled = .false. ,!--- Stop criterion
for steady flows. When it is enabled, residues between two successive flow
fields are computed
       Steady_Flow_Stopping_Criterion = 1.D-20          ,!--- convergence
tolerance threshold for a steady flow solution (it works only when the
previous parameter is enabled)
       Temporal_Iterations_Number = 10                  ,!--- maximum value
of time iterations before stopping the computation
       Final_Time = 3.D+01                              ,!--- Maximum value
of time before stopping the computation
       TimeStep_Type = 1 ,                              ,!--- Option value
for specifying a variable time-step computed from a CFL criterion
       CFL_Min = 0.05                                   ,!--- Minimum value
of the CFL criterion imposed by the user when the simulation starts
       CFL_Max = 0.4                                    ,!--- Maximum value
of the CFL criterion imposed by the user after n time iterations (here n=
100, see the next parameter)
       Iterations_For_Timestep_Linear_Progress= 100     ,!--- Number of time
iterations over which the CFL criterion increase linearly between CFL_Min
and CFL_Max
       Simulation_Backup_Rate                 = 1000    ,!--- Recording rate
(in time-iteration units) for generating backup files (save_fld_xxxxx_y.d ,
save_var_xxxxx_y.d)
       Simulation_Checking_Rate               = 200     /!--- Recording rate
(in time-iteration units) for writing some relevant check data in a file
checkcalc_xxxxx.d
```

The second example corresponds to a restart of the previous simulation with a uniform time step.

```
&Simulation_Management Restart_Parameter= 3              ,!--- Option value
for resuming the simulation from the end of a previous computation.
       Steady_Flow_Stopping_Criterion_Enabled = .false. ,!--- Stop criterion
for steady flows. When it is enabled, residues between two successive flow
fields are computed
       Steady_Flow_Stopping_Criterion = 1.D-20          ,!--- convergence
tolerance threshold for a steady flow solution (it works only when the
previous parameter is enabled)
       Temporal_Iterations_Number = 1000                ,!--- maximum value
of time iterations before stopping the computation
       Final_Time = 6.D+01                              ,!--- Maximum value
of time before stopping the computation
```

```
       TimeStep_Type = 0 ,                                  ,!--- Option value
for specifying a constant time-step
       Timestep_Max = 1.e-3,                                ,!--- Value of the
time step
       Iterations_For_Timestep_Linear_Progress= 100     ,!--- Number of time
iterations over which the CFL criterion increase linearly between CFL_Min
and CFL_Max
       Simulation_Backup_Rate                 = 1000    ,!--- Recording rate
(in time-iteration units) for generating backup files (save_fld_xxxxx_y.d ,
save_var_xxxxx_y.d)
       Simulation_Checking_Rate               = 200     /!--- Recording rate
(in time-iteration units) for writing some relevant check data in a file
checkcalc_xxxxx.d
                         Fields_Recording_Rate = 1.D+00 ,
                         Probe_Recording_Rate                    = 10     ,
                         Start_Time_For_Statistics= 1.D+2                ,
                         Time_Range_Statistic_Calculation = 1.D+00  /
```

For more information on this data set, click here.

Keep in mind the time step must be chosen with caution because it can generate numerical instabilities when it is too much large. The numerical stability depends on the property of the numerical methods used for solving the conservation equations It often relies on the CFL criterion which have not to exceeded a reference value. This value depends on the numerical scheme properties as well as the computational problem.

- For semi-implicit schemes proposed here, a maximum CFL-value about 0.5 is generally prescribed for usual computations, but it could be smaller for problems with strong gradients.
- For explicit schemes, the CFL criterion also depends on the viscous/diffusive time scales as well as the space dimension of the problem. As a consequence, the CFL value prescribed is generally between 0.5^{n-1} and 0.5^n, where n is the dimension of the problem.

When the time-step value is constant, the user can verify if the CFL criterion is respected by checking regularly the file checkcalc_xxxxx.d