

## Namelist "HypreData\_PoissonSolver"



This namelist contains all parameters for using some solvers available in [the HYPRE library](#). For solving the Poisson's equations, the SOR methods coupled with a multigrid procedure are the most appropriate (i.e. PFMG or SMG). These methods are variants of the "homemade" developments presented for the namelist [HomeData\\_PoissonSolver](#). The former can be better optimized than the latter for the large computations.



- These data are taken into account only when the variable "Poisson\_NumericalMethod" in the Namelist "Numerical\_Methods" is correctly set (see [Numerical\\_Methods \(new version\)](#)).
  - Poisson\_NumericalMethod= Hypre-ConstantMatrixCoef
  - Poisson\_NumericalMethod= Hypre-VariableMatrixCoef
- The HYPRE library tools can be only used when the code is compiled with a MPI configuration.
- Even though numerical methods provided in the HYPRE library are similar to these ones present in the code, the input data are slightly different
- **Not for the release SUNFLUIDH\_EDU**

## Full data set of the namelist

```
&HomeData_PoissonSolver  SolverName="SOR-Redblack-MPI",
                          Number_max_Grid= 5,
                          Number_max_Cycle= 10,
                          Number_Iteration= 0,
                          Number_Iteration_FineToCoarseGrid= 1,
                          Number_Iteration_CoarseToFineGrid= 5,
                          Number_Iteration_CoarsestGrid= 10 ,
                          Relaxation_Coefficient= 1.7 ,
                          Convergence_Criterion= 1.D-15,
                          Off_Set_Poisson_Source_term= .false. /
```



- Following the problem treated, some numerical methods are better adapted than others, this point is precised for each available option.

## Definition of the data set

## SolverName

- Type: Character string
- Selection of the iterative solver coupled with the multigrid method.
  - JACOBI : Successive Over Relaxed solver based on the Jacobi's method
  - SOR : Successive Over Relaxed solver based on the Gauss-Seidel method
  - SOR-Redblack : Successive Over Relaxed solver based on a “Red-Black” algorithm (useful with OpenMP-parallel computations)
  - SOR-Redblack-MPI : Successive Over Relaxed solver based on a “Red-Black” algorithm optimized for the domain decomposition approach (MPI-parallel computations)

## Number\_max\_Grid (multigrid method only)

- Type : Integer value
- Maximum number of grid levels used in the multigrid method.

## Number\_max\_Cycle (multigrid method only)

- Type : Integer value
- Maximum number of V-cycles permitted in the multigrid method.

## Number\_Iteration (only if the SOR method is used)

- Type : integer value
- Number of iterations performed by the SOR method in order to approach the solution on each grid level. This value is the same for any grid level of the Multigrid procedure.

## Number\_Iteration\_FineToCoarseGrid (only if the SOR method is used)

- Type : integer value
- Number of iterations performed by the SOR solver during the restriction step of each V-cycle of the multigrid procedure. For some problems, the minimization of iterations during the restriction step can improve the time-performance of the code.  
BEWARE : this data is enabled only if the variable Number\_Iteration= 0 or is removed from the Namelist.

## Number\_Iteration\_CoarsestGrid (only if the SOR method is used)

- Type : integer value
- Number of iterations performed by the SOR solver on the coarsest grid of each V-cycle of the multigrid procedure.  
BEWARE : this data is enabled only if the variable Number\_Iteration= 0 or is removed from the Namelist.

## Number\_Iteration\_CoarseToFineFGrid (only if the SOR method is used)

- Type : integer value
- Number of iterations performed by the SOR solver during the prolongation step of each V-cycle of the multigrid procedure.  
**BEWARE** : this data is enabled only if the variable Number\_Iteration= 0 or is removed from the Namelist.

## Relaxation\_Coefficient (only if the SOR method is used)

- Type : real value between one and two
- over-relaxation coefficient used in the SOR method.

## Convergence\_Criterion (only if the SOR method is used)

- Type : real value
- The nV-cycle procedure of the multigrid method is stopped if the L2-norm of the Poisson equation's residu is lower than the criterion chosen.

## Off\_Set\_Poisson\_Source\_term

- Type : Boolean value. **Not for the release SUNFLUIDH\_EDU.**
- The source term is shifted from its averaged value such as its integral value over the domain is zero. This could facilitate the convergence in some particular cases. this option must be used with caution. For expert users only.

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