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

```
&HypreData_PoissonSolver  SolverName= "PFMG" ,
                          PreconditionerName= "NONE" ,
                          RelaxationMethodName= "SOR-RedBlack-Nonsym",
                          Convergence_Criterion = 1.D-08  ,
                          Number_Iteration= 10 ,
                          Number_Iteration_FineToCoarseGrid= 1,
                          Number_Iteration_CoarseToFineGrid= 5 ,
                          Matrix_Symmetrization= .false. ,
                          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 numerical methods for solving the Poisson's equation(PFMG or SMG are recommanded).
    - SMG : Parallel semicoarsening multigrid solver for the linear systems arising from finite difference, finite volume, or finite element discretizations of the diffusion equation. SMG is a particularly robust method. The algorithm semicoarsens in the z-direction and uses plane smoothing. The xy plane-solves are effected by one V-cycle of the 2D SMG algorithm, which semicoarsens in the y-direction and uses line smoothing.
    - PFMG : PFMG is a parallel semicoarsening multigrid solver similar to SMG. The main difference between the two methods is in the smoother: PFMG uses simple pointwise smoothing. As a result, PFMG is not as robust as SMG, but is much more efficient per V-cycle.

SolverName

- Type: Character string
- Selection of a preconditioner. Not useful for SMG or PFMG methods.

- NONE : No preconditioner is considered.
- SMG : The SMG method is used as preconditioner.
- PFMG : The PFMG method is used as preconditioner.

RelaxationMethodName (for PFMG method only)

- Type : Character string
- Set the solver for the relaxation procedure
    - Jacobi : Jacobi's method
    - Weighted-Jacobi : Weighted Jacobi's method
    - SOR-Redblack-sym : SOR method for symmetrical matrix
    - SOR-Redblack-Nonsym : SOR method for non symmetrical matrix

Number_Iteration (only if the SOR method is used)

- Type : integer value
- Maximum number of iterations performed by the SMG or PFMG method

Number_Iteration_FineToCoarseGrid (only if the PFMG method is used)

- Type : integer value
- Number of relaxation sweeps before coarse-grid correction

Number_Iteration_CoarseToFineFGrid (only if the PFMG method is used)

- Type : integer value
- Number of relaxation sweeps after coarse-grid correction

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 computation is stopped if the residu is lower than the criterion chosen.

Matrix_Symmetrization

- Type Boolean value (default value= .false.). **Not for the release SUNFLUIDH_EDU**.
- The matrix is symmetric (set to .false. if any doubt exits)

Off_Set_Poisson_Source_term

- Type : Boolean value (default value= .false.). **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 particuliar cases. this option must be used with caution. For expert users only.