Outline

MEDCOUPLING Projection methods and parallelism

Conclusion

Agenda

Interpolation, extrapolation or projection?

Spatial discretization and nature of a field

What MEDCoupling can do for you

Parallelism in MEDCoupling

Illustration

Code coupling

Introduction: A typical use case: code coupling

- Different numerical codes simulate different physics
  - And hence (might) use different numerical schemes
    - E.g. temperature computed on nodes in code A and on elements in code B
  - And/or different spatial discretization (i.e. different meshing of the same geometrical domain)
    - A cylinder meshed with hexahedrons in code A, and with tetrahedrons in code B
  - Or even worse, use different dimensions
    - A heat flux on a 2D surface for code A and a 3D source term (e.g. fuel rode) for code B
- How do you “transfer” information from one to the other?
  - I need to provide code B with the temperature computed by code A
  - Solution A: ad-hoc solution. For each pair (code A, code B), write a mapper . . . good luck
  - Solution B: use generic projection methods thanks to MEDCoupling

Spatial Discretization & Nature Of A Field

Spatial discretization of a Field

Where are the discrete values defined?

- A field can be supported by:
  - The nodes (or vertices) of the mesh: ON_NODES also called P1
  - The cells (or elements) of the mesh: ON_CELLS also called P0
  - By more complex reference locations:
    - Gauss Points (ON_GAUSS_PT, ON_GAUSS_NE),
    - Kriging points (ON_NODES_KR)
- Obviously the projection methods will differ according to the localization
- Generally P0-P0 projection is the best supported option
  - Source field is defined on cells
  - Desired result: a target field expressed on cells
  - Very common case
- Not all combinations are possible
  - See the reference table at the end of the presentation
  - If you don't find what you need, ask for it!

Field Nature (1/2)

Functionalities

Projection Methods

General principle

To project one field onto a new target mesh, one has to:

1.Prepare (required only once): The weight matrix is internally computed Ratios of the volumes between source cells and target cells From the source mesh and the target mesh only Wij: how much from source cell (i) will contribute to target cell (j) API: prepare(source, target, method)

2.The source field must have a valid nature set!

3.Transfer (can be done several times): A field on the source mesh can be transferred to the target mesh API: transfer(srcField, tgtField, defaultValue) Default value covers non-overlapping cases Supported configurations What you can do

Mesh combination (U: unstructured, C: cartesian, E: extruded) U - U U - C C - U C - C E - E Dimensions 1D 2D curve, full 2D 3D surface, full 3D Spatial discretization P0 - P0 P1 - P0 P0 - P1 P1

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Try it!

- Any question ?
- Let’s go for the exercises!