DATA ASSIMILATION METHOD APPLIED TO PARTICLE-BASED SIMULATIONS USING FIELD ALIGNMENT

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Data assimilation, on the other hand, is a process used in many scientific fields (such as meteorology, oceanography, and hydrology) to integrate observed data with output from a numerical model, aiming to provide more accurate and consistent information about the state of a system. Its methods aim to refine model predictions iteratively using observed data [1]. Intensive efforts have been made to apply these methods to high-dimensional and non-linear problems, with the Ensemble Kalman Filter being particularly noteworthy.

While these methods have been naturally applied to problems defined on solutions within Eulerian grids, their application in simulations based on Lagrangian discretizations has been limited. These methods discretize continuous fields and operators using an ensemble of particles (computational elements) that move according to a velocity field.

The main challenge lies in managing a set of simulations with different particle discretizations. Consequently, assimilation, involving a combination of states, becomes challenging at this level. Moreover, configurations may not share the same supports, necessitating the introduction of a method to reposition the particle distribution appropriately.

In this presentation, we will introduce various data assimilation concepts capable of addressing this issue. These approaches specifically consider the particle structure of the state and implement methods to adapt it to the assimilated state's configuration. This involves proposing remeshing schemes or determining a displacement to align the states with the observations. The filters will be applied to a 2D problem in incompressible fluid dynamics using The Vortex Method (VM) [2].

**REFERENCES**

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