SOME PARALLEL METHODS FOR 2D GRID REFINEMENT

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Hydrodynamics simulation by the finite volumes methods in Lagrangian coordinates requires continuous control over the quality of the computational grid. The required grid quality can be maintained with grid refinement methods. Since for acceleration we use parallel computing on distributed memory which involves grid decomposition, the grid refinement method must also be parallelized to avoid the slowing down of simulation. When constructing the initial grid, it's important to consider the specifics of the original task to find a balance between the desired accuracy and the simulation speed. Here of importance is not only the total number of cells in the grid but also its structure.

Three types of grids are discussed: a regular grid of quadrilateral cells; a cascade grid (a sequence of regular grids with the varying level of detail which are sewn together by a thin layer); and an irregular grid of triangular and quadrilateral cells. The refinement of regular and cascade grids is based on the popular mapping methods including the algebraic method [1, p. 22], the elliptic method [2, p. 237], and the variational method QIS [3]. Irregular grid refinement is performed using local topological corrections and a parallel algorithm that utilizes the sequential refinement implemented in [4].

The paper describes parallel refinement algorithms for the above grids and presents results of their testing. The finite volumes method used to solve hydrodynamics equations is based on its parallel implementation from [5].

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