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HYBRID MESH GENERATION FOR RESERVOIR FLOW SIMULATION : EXTENSION TO CPG GRIDS

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ABSTRACT

The technological improvements in seismic imagery and forage imply simulations in more and more complex geological structures. To achieve such an objective, simulators need in particular to gain accuracy at the well vicinity. This problem should be adressed at the mesh generation step for a better modelling of the flow around the well in the reservoir simulation. For this purpose, a new approach based on a hybrid mesh was proposed in 2D [1] to capture the radial characteristics of the flow around the wells. In this hybrid mesh, the reservoir is composed of a structured quadrilateral mesh and the drainage areas of wells are represented by structured radial meshes. In order to generate a global conforming mesh, unstructured transition meshes constituted by convex polygonal elements satisfying finite volume properties are used. This hybrid model was generalized to 3D for cartesian grids and an algorithm was proposed to generate a hybrid mesh in a slightly deformed Corner Point Geometry (CPG) grid [2]. In real cases where geological deformations are very important, the extension to CPG grid already implemented is not efficient enough and some geometrical constraints are not satisfied, compromising the generation of the conforming polyhedral mesh.

This paper presents a method to extend the generation algorithm in the CPG cases with high levels of deformation, ensuring a fully functional mesh generation for real cases. The main idea is first to construct a mapping between the real space containing the CPG grid along with the radial mesh of the well and a virtual space where the CPG reservoir grid becomes a cartesian grid. Then, in the virtual space, the reservoir grid is deformed at the vinicity of the well in order to restore the circular property of the radial grid. To this end, an optimization technic using mesh refinement procedures is applied. The mapping combined with the above deformation allows us to generate the transition mesh in the virtual space using the algorithm proposed in [2]. Coming back to the real space, the transition mesh may contains curved edges. Finally, this transition mesh must be optimized to recover its finite volume properties.

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