The efficiency, accuracy and stability of reservoir flow simulations strongly depend on the proper grid selection. Roughly speaking, efficiency is governed by the number of grid-blocks and their number of faces, and by the numerical scheme used for discretizing the flow equations (for example, using k-orthogonal grids yields to simpler systems of equations). Accuracy is determined by three main factors: the way structural features and wells are taken into account in the mesh generation process, the influence of grid orientation effects (both in reservoir and well areas), that is to say the ability to capture the main flow directions, and the local changes of mesh resolution in the most demanding parts of the study domain. Finally, stability is highly related to the shape of the grid-blocks, and conditioned by the convergence of the numerical scheme being used.

Defining a suitable geometry for the simulation grid is thus critical. This talk will describe an original three-dimensional mesh generation technique where the resulting grid is seen as a collection of modules, which are independent sets of three-dimensional cells with their own structure, geometry, and coordinate system. The discussed approach will show how combining modules in the flow simulation grid allows to impose local changes in the resolution of the mesh, avoid orientation effects, and vary the number of grid-blocks faces, to achieve better simulation results. The ability to update the grid dynamically, and ways for building unstructured polyhedral transition meshes between modules will be also presented. The talk will be illustrated by examples of realistic simulation grids built using this method.

The proposed approach will be compared with other existing grid generation and local refinement techniques in the frame of reservoir flow simulation, and particularly the latest "windowing" techniques recently developed by Heinemann et al ([Heinemann 94], [Mlacnik 03], [Heinemann 03]).

**Related papers:**


[Heinemann 03] Zoltan E. Heinemann, G.F. Heinemann (June 2003). Gridding Techniques For Reservoir Simulation. 7th International Forum on Reservoir Simulation (held in Baden-Baden, Germany).