NUMERICAL TREATMENT OF GEOMECHANICS-FLUID FLOW COUPLING IN POROUS MEDIA

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ABSTRACT

The reservoir simulation is an important tool for the prediction of oil and gas production. For better predictions all the important physical phenomena should be considered during the simulation. The geomechanics of the porous rock is one which most influences the oil production, since it deals directly with the changing in porosity and permeability of the medium.

The oil and gas production generates a pressure gradient on reservoir, which changes its stress state and, consequently, the strain state. Those change, if not controlled, can close wellbores and even fully damaged the well. In this work it is considered the Biot's theory of consolidation for deriving the governing equations of the geomechanics process coupled with the fluid flow in the porous rock. Normally, these problems are solved using different numerical tools, being the finite element method used for geomechanics problem while the finite volume method is employed for fluid flow problem.

In this paper both problems are solved using a finite volume technique, the EbFVM – Element-based Finite Volume Method, in the framework of the same unstructured grid. This methodology is a conservative method, important characteristic for numerical solutions of fluid flow equations ans also ensure the correct force balance for the geomechanical problem.

The coupling is solved in an iterative way, called *two-way coupling*, where the models are solved separately and the solutions of each problem exchanges information in all time steps. Two classic problems whose analytical solutions were used to validate the models. the poroelastic column and Mandel's problem.

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