

Session: Mathematical and numerical modeling of enhanced oil recovery

Oral presentation.

Title: Compositional flow in porous media using GPUs

Authors:

Julián Tercero Becerra Sagredo
Independent Research, SENER-CONACYT

Carlos Málaga
Science Faculty, UNAM

Francisco Mandujano
Science Faculty, UNAM

We present the advances in the development of a compositional flow simulator for porous media using GPUs.

The conservation of mass for multiphase and multicomponent fluids in porous media is a non-linear system of partial differential equations. The inclusion of Peng-Robinson equations of state for each phase gives a non-linear algebraic system of equations to close the problem.

We invert the non-linear system of equations numerically using the Newton's method in each cell of the discretized domain.

The code runs entirely on GPUs allowing the explicit computation of the pressure equation with finite differences. The optimization of the computation requires an implicit numerical method for the pressure equation and for that purpose we explore the use of available libraries to solve the resulting Helmholtz equation.

We present results for the validation of the code with an analytic solution and for the computational times. We also present the computational implementation in both CUDA C and OpenCL.