An Ultrafast Simulation of Hydraulic Fracture Growth and Interaction for Field Development Planning

Dmitry Chuprakov, Ph.D.
(Schlumberger Moscow Research)
and
Aleksandra Peshcherenko
(Moscow Institute of Physics and Technology)

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Dr. Dimitry Chuprakov, Scientific Computing Engineer at Schlumberger Moscow Research, and Ms. Aleksandra Peshcherenko, Student Intern at Schlumberger Moscow Research and a PhD student at Moscow Institute of Physics and Technology, will speak on **Thursday, February 3, 2022**. The topic is "An Ultrafast Simulation of Hydraulic Fracture Growth and Interaction for Field Development Planning."

Abstract

We develop a fast-running model of hydraulic fracture growth and interaction in a reservoir with many multistage vertical or horizontal wells. We show that sufficient accuracy of fracture simulation is combined with computational time allowing for thousands of successive runs within a minute. The model has three important enhancements: (1) lateral asymmetry of fracture wing growth, (2) stress shadow induced by presence of hydraulic fractures close to each other in rock, and (3) gravity of injected fluid in a fracture. The model is meshless and semi-analytical, which makes it run significantly faster than most numerical models. Having implemented fracture interaction via stress shadow, we investigate when this effect contributes to fracture asymmetry substantially and when it is negligible. Complex well and fracture placement geometry, including cases of close offset wells, fracture clusters of different sizes, and inclined wells where the fracture plane is not perpendicular to the well, are the cases of the particular interest for stress shadow simulations. Gravity of injected slurry helps to extend a fracture tip downwards when fracture height becomes large. Rheology of pumped fluids helps to control lateral asymmetry of fracture propagation as well as total surface area. Our model is an example of an appropriate tool to see why and how the mechanics of fracture growth manipulates economic factors of a developing reservoir in complex geological conditions.

Biography

Dimitry Chuprakov is a Scientific Computing Engineer at Schlumberger Moscow Research with expertise in geomechanics of rock stimulation. His current duties are development of computationally effective models of reservoir stimulation, including hydraulic fracturing and matrix acidizing for homogeneous and heterogeneous formations, post-stimulation production evaluation, inverse problems, and integration with borehole measurements.

Aleksandra Peshcherenko is a Student Intern at Schlumberger Moscow Research and a PhD student at Moscow Institute of Physics and Technology. She is involved in research and development of hydraulic fracturing and other reservoir stimulation models.