Defense Announcement

Accelerating Computations for Oil and Gas Problems: Reduced Physical Modeling of Hydraulic Fracturing and High-Performance Computing for Fluid Flow in a Porous Medium

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Date:	07/28/2020	**Committee Members**:	Dr. Egor Dontsov
Time:	10am-12pm		Dr. Pradeep Sharma
Location:	Zoom meeting		Dr. Christine Ehlig-Economides
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Abstract

The mechanical modeling of hydraulic fractures is a mathematically complex problem involving the coupling between the equations that describe fracturing of and fluid flow through the porous rock, and fluid flow inside the fractures. Simulation of these physical processes can offer critical insights into practical design problems associated with hydraulic fracturing technology. However, exploration of the influence of the relatively large number of control variables defining the design space is limited by the available computational resources. Generally speaking, the computational time can become a bottleneck for practical usage of available hydraulic fracture simulators. Acknowledging this limitation, this thesis presents a series of combined analytical-computational models that enable efficient simulation of the propagation of multiple non-planar hydraulic fractures, within the context of hardware-conscious advanced numerical techniques.

Hydraulic fracture simulations are often coupled with the fluid flow within the surrounding porous rock. This thesis realizes the need for computationally efficient porous media flow simulations that achieve similar level of efficiency as the fast hydraulic fracturing models. Remarkable computational efficiency is achieved through the development of the novel formulations of numerical techniques and the of state-of-the-art computational methods: reduced-order modeling of the hydraulic fracturing, and the application physical block solvers to the porous media flow.