

A Continuous Fracture Front Tracking Algorithm with Multi-Layer Tip Elements (MuLTipEl)

Dr. Egor Dontsov, ResFrac Corporation

Thursday, April 29, 2021, 9 a.m. Central Time



Dr. Egor Dontsov, Chief Scientist, ResFrac Corporation, will speak on Thursday, April 29, 2021, at 9:00 a.m. Central Time.

The topic is “A Continuous Fracture Front Tracking Algorithm with Multi-Layer Tip Elements (MuLTipEl).”

Abstract

Modeling of hydraulic fracture growth is challenging due to the need of tracking the moving crack front. Typically, this problem is solved by creating or opening one element at a time. Unfortunately, such an approach leads to noticeable mesh dependence, which in turn requires using a finer mesh and, as a result, leads to an increased computational time. In addition, fine formation layering poses an extra requirement on the element size since a single set of properties is typically assigned to an element, i.e., each element is characterized by a single value of each property (such as confining stress or toughness). To address the above problems and to enable using a relatively coarse mesh for hydraulic fracture modeling without significantly sacrificing accuracy, a new methodology for tracking the moving fracture front is developed. To enable continuous description of the fracture growth, the algorithm utilizes partially filled tip elements, which are the elements containing the fracture boundary. These elements are prevented from being fully open by an additional stress, which depends on the degree of filling and generally decreases as the element is being filled. The ability to continuously track the fracture front also allows to account for various rock properties within the same element, i.e., each element can now contain several layers, which removes the necessity to reduce the element size to match rock layers. A theoretical basis for the algorithm will be covered in the talk, which will also be complemented by a series of numerical examples demonstrating the ability of the algorithm to accurately capture the effect of thin layers even on a coarse mesh. This algorithm has been implemented into a coupled hydraulic fracturing and reservoir simulator ResFrac.

Biography

Dr. Egor Dontsov currently works at ResFrac Corporation, where he develops a fracture front tracking algorithm to address the problem of mesh dependence. Previously, Egor worked at W. D. Von Gonten Laboratories and as an Assistant Professor at the University of Houston. He has over 50 scientific peer-reviewed publications, most of which are in the area of hydraulic fracture and proppant transport modeling.