Application of Deep Learning for Planar 3D Hydraulic Fracturing Simulation

Victoria Dochkina, Ilia Perepechkin, Natalia Zavialova, and Sergei Negodiaev
LLC Oil and Gas Center of MIPT, Moscow, Russian Federation

Nowadays, none of widely used hydraulic fracturing simulators can simultaneously provide high calculation speed and sufficient physical reliability, which is crucial in engineering problems. Hence, an optimization of hydraulic fracturing simulation in terms of speed and accuracy is needed. It is possible to create a tool that will simultaneously solve the above-mentioned problems using Machine Learning methods. In that case, the simulation will have an accuracy close to the Planar3D model and almost instantaneous speed of calculation. The development of such a tool will simplify a selection of optimal injection parameters.

This paper presents a Neural Network that approximates a planar three-dimensional hydraulic fracturing model. A feature of the proposed approximator is that it predicts the evolution of two-dimensional fracture aperture field. This is a key difference of this model from other approximators that predict well-defined parameters of the fracture geometry, such as half-length, height, etc. The availability of complete fracture geometry information allows highly accurate estimation of production and possible complications during hydraulic fracturing.

The paper presents an ability of creating a Neural Network that will cover a wide range of production problems: from express simulation and optimization to accurate and physically reliable modeling.