Analysis of the laboratory hydraulic fracturing curves.

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In this study, the data obtained during a series of laboratory experiments on hydraulic fracturing were analyzed. The main goal was to determine the time of the fracture closure, the pressure of the fracture closure, and the permeability of the sample, where the fracture was formed and propagated.

A special laboratory setup was used to conduct the experiments. The design of this setup allows to provide a three-axis load on the model sample, which makes the conditions of the laboratory experiment on hydraulic fracturing closer to the real conditions in the field. To produce the fracture, viscous fluid was injected under constant rate through the preliminary created cased borehole with perforations.

As results of the experiments, the curves of the fluid injection pressure variations with time were obtained. Their analysis was carried out using the G-function technique developed by Nordgren [1] and Nolte [2]. It is based on the plotting and analyzing of the behavior of the following dependencies: the injection pressure, first derivative of the pressure and the semi-logarithmic derivative of the pressure with respect to G-function. The curves processing allows to estimate the time of the fractures closure, with the help of which the fracture closure pressure was determined. The obtained pressure values were compared with the minimum stresses known from the experimental conditions.

Additionally, the permeability of the model reservoir sample was calculated using a technique developed by Horner [3] and improved by Nolte et al. [4]. The approach is based on an assumption that the fracture in the formation has been already closed, and a radial regime of fluid flow has been established. The obtained results were compared with the actual permeability, which was determined in the preliminary laboratory experiment.

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References