Sensitivity of the pressure decline curve during the minifrac to the properties of poroelastic medium

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Hydraulic fracturing (HF) is a technology aimed to stimulate low-permeable oil and gas reservoirs. The fracture is created due to the injection of highly pressurized fluid in a certain part of the wellbore. The resulting fracture with the characteristic length up to first hundreds meters, acts as a highly permeable channel for the inflow of oil or gas from the reservoir into the well. Computer simulators of hydraulic fracturing rely on known physical properties of the reservoir, in particular, the leak-off coefficient and the confining in situ stress.

The sensitivity analysis of the pressure decline curve (PDC) after the pump-in/shut-in test during the initiation of small fracture (minifrac) is one of the ways to estimate the physical properties of the medium. The standart methods of minifrac's interpretation are based on simple assumptions that lead to less accuracy of interpretation. In addition, the existing applied algorithms make difference between periods during pump-in, before and after fracture closure.

The attempt of interpretation of the PDC has been made in the present work. We use a more sophisticated poroelastic model [1] for pressure curve interpretation that can describe processes taken place in system "reservoir–fracture" properly. The model is based on Biot's equations of poroelasticity [2] and takes into account the influence of pore pressure and fluid filtration on stress-strain state. In particular, it allows us to unite the periods before, during and after fracture closure. The assumption of radial geometry is used for simplification.

The sensitivity analysis of the pressure decline curve to the filtration and physical properties and poroelastic effects has been performed using described poroelasticity model. The obtained results serve as a basis for a further development of the more accurate methods for a mini-frac data interpretation.

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References

[1] Golovin S. V., Baykin A. N. *Influence of pore pressure on the development of a hydraulic fracture in poroelastic medium.* Int. J. Rock Mech. Min. Sci. 2018. V. 108. P. 198–208.

[2] Coussy O. *Poromechanics.* Chichester: John Wiley & Sons Ltd, 2004.