Investigation of Fluid Lag and Stepwise Fracture Propagation During Hydraulic Fracturing Processes

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ABSTRACT

Hydraulic fracturing involves a process by which fractures are initiated and propagate in a formation due to the injection of fluid at high pressure. Due to the economic benefits to the petroleum industry it is important to predict fracture propagation and understand the physics involved in the evolution of fractures. It has long been recognized that a fluid lag may exist during the fracturing process, dependent on the formation and injection conditions. More recently, it was also observed that under certain conditions the propagation of fractures is not continuous but stepwise. However, there has not been a general consensus on the underlying physics for these two phenomena, which could be of fundamental importance for practical operations. In this work, we present a finite element simulation framework that is capable of accurately tracking the development of fluid lag. The proposed framework is based on the general theory of poroelasticity and the cohesive zone fracturing model. By presenting a series parametric studies, we aim to answer the following questions: 1) the factors influencing or determining these phenomena, 2) the physical reasons behind these phenomena, and 3) the robust simulation strategy for these phenomena.

REFERENCES
