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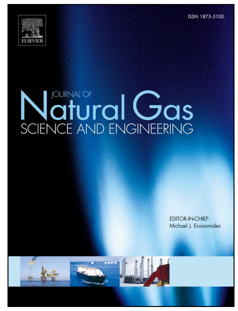

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Modeling of curving hydraulic fracture propagation from a wellbore in a poroelastic medium

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Abstract: Understanding near-wellbore hydraulic fracture behaviors is vital for hydraulic fracturing treatments and other injection-related operations in the petroleum industry. This paper presents a fully coupled fluid flow and geomechanics model for growth of hydraulic fractures in the near-wellbore region. The model is developed within the framework of the extended finite element method (XFEM). Fracture initiation and propagation, fracturing fluid flow, rock deformation, and pore fluid flow are coupled into the XFEM framework. The model is validated against experimental results in the literature. Capabilities of the proposed model for capturing fracture geometry, fluid flow, and local stress and pore pressure distributions are illustrated with numerical examples. A parametric study is carried out using the model to investigate a few operational parameters' effects on near-wellbore fractures. Some recommendations are provided for reducing fracture tortuosity and breakdown pressure based on the results of the parametric study. The XFEM model proposed in this paper provides an efficient tool to predict arbitrary hydraulic fracture growth in the wellbore vicinity. It can be used to aid designs of various hydraulic fracturing related operations in the petroleum industry, such as fracturing stimulations, injectivity tests, waterfloods, and waste injections.

Keywords: Curving hydraulic fractures, near-wellbore region, coupled modeling, fracture tortuosity, breakdown pressure, XFEM

1. Introduction

Understanding behavior of hydraulic fractures in the near-wellbore region is vital for hydraulic fracturing designs, injectivity test interpretations, and other injection-related