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Editorial

Special Issue "Petroleum Engineering: Reservoir Fracturing Technology and Numerical Simulation"

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Hydraulic fracturing is a technique that can provide space for oil and gas flow by pumping fracturing fluid into a reservoir to fracture rock and filling proppant to create fractures or fracture nets. This technology is of great significance in improving oil and gas recovery. Hydraulic fracturing is widely used in the field of oil and gas development; end-sand-fallout fracturing can be used to prevent sand production in high-permeability reservoirs, hydraulic fracturing can connect dead oil, and volume fracturing is used to improve the stimulated reservoir volume (SRV) of tight and unconventional reservoirs to realize commercial exploitation. The progress of hydraulic fracturing technology, including fracturing procedures, fracturing materials, and fracturing equipment, is propelling global oil and gas exploitation into a new era. The Special Issue on "Petroleum Engineering: Reservoir Fracturing Technology and Numerical Simulation" showcases advances in the development and application of hydraulic fracture modeling and analysis of production. The Special Issue is available online at: https://www.mdpi.com/journal/processes/special_issues/petroleum_reservoir_fracturing (accessed on 29 November 2021).

1. Experiments for Hydraulic Fracture Growth

Lab or field experimental studies are essential to reveal the mechanisms of hydraulic fracture growth. A true triaxial hydraulic fracturing simulation system is generally used for fracturing experiments. In the experiments, a cubic specimen made from real rock or artificial rock with a size of 30~50 cm is applied for fracturing experiments. The paper by Zou et al. [1] provides their lab investigation into fracture growth behavior during temporary plugging and diverting fracturing in coal seams. They found that effective temporary plugging can be achieved by using a temporary plugging agent with the proper size and concentration. Li et al. [2] also studied the fracture growth mechanism of diverting fracturing. They found that increasing the proportion of the temporary plugging agent of larger particle size can improve the effectiveness of intra-fracture and intra-stage temporary plugging fracturing, and tends to open new fractures. Qu et al. [3] provided their findings on shale fracture surface morphology using a case study of Barnet shale. Wu et al. [4] gave another interesting study. They investigated perforation erosion using a field experiment. It is helpful to develop a more accurate model for perforation erosion.

2. Numerical Simulation for Hydraulic Fracture Growth

Mathematical models and numerical simulations are the primary methods for studying field-scale fracture propagation. Hydraulic fracture models are diverse and usually computation-extensive. Numerous methods have been provided to solve fluid-driven fracture propagation. Wang et al. [5] outlined a numerical multi-fracture simulation during extremely limited entry perforation using a planar 3D hydraulic fracture model. An efficient time-stepping algorithm was used in the study to accelerate computation. Zeng et al. [6] investigated fracture height growth considering elastic–plastic deformation using a finite element solver. Zheng et al. [7] and Gong et al. [8] provided their work on fracture growth simulation for different fracturing designs. Lin et al. [9] focused on stress alteration during multi-cluster and refracturing. These simulations help in the understanding of fracture growth and design field fracturing schemes.

3. Production Prediction for Fractured Wells

Production prediction is the most critical part of determining a fracture design. Understanding the flow mechanism of oil and gas in porous media helps develop a reservoir simulation solver. Li et al. [10] studied shale oil's temporal and spatial multiscale coupling flow. They found that the oil mainly flows through the outer boundary of the stimulated region through surface diffusion. Pan et al. [11] proposed a capacity prediction method that considers time-dependent conductivity and validates its accuracy using commercial simulators. In the presence of complex fractures and natural fractures, the increase in the variable conductivity production curve was smaller than that in the constant conductivity production curve. Zhao et al. [12] combined well-test interpretation with dynamic production analysis to diagnose a carbonate reservoir's main control factors and production characteristics. Huang et al. [13] presented a transient pressure behavior model for multistage fractured horizontal wells in inter-salt shale oil reservoirs, considering the dissolution of salt and the stress sensitivity mentioned above. Yang et al. [14] proposed an integrated reservoir model and differential stimulation model. Wang et al. [15] carried out comprehensive reservoir quality evaluation and clustering model training, testing, and prediction for the Lucaogou Formation in Jimsar Sag, Junggar Basin. This method provides an excellent technical basis for determining the placement of multi-cluster fracturing perforation.

Conflicts of Interest: The authors declare no conflict of interest.

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