Modeling Gas Flow in Hydraulically Fractured Shale

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Natural gas currently supplies 22% of the energy that the United States consumes annually. As other supplies run low, there is a need to dig deeper in order to access a different resource called shale gas, located miles under the surface of the earth. Each well costs millions of dollars, and uses millions of gallons of water. Predicting the behavior of shale gas has proved challenging, and are especially inaccurate at predicting long term behavior. An accurate prediction is necessary in deciding the fate of shale, a decision that will strongly affect the production of national energy. In this project, a simple rock damage model is developed to better predict the long-term production rate of hydraulically fractured shale wells. The model is combined with a nonlinear-pressure-diffusion equation derived based on mass conservation, Darcy's law, and Peng-Robinson equation of state. To solve the equation, numerical schemes are constructed, and a Java code is built. After ensuring convergence of the numerical schemes, the results are compared to field data available in the literature. Good agreements between production field data and the numerical calculation are observed.

Awards Won:

Society of Exploration Geophysicists: First Award of $1,000