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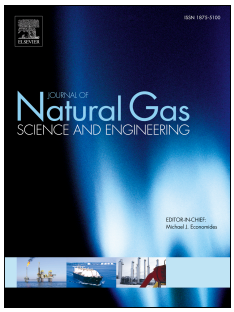

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A new semi-analytical method for calculating well productivity near discrete fractures

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Abstract

Highly permeable discrete fractures are often observed in sandstone and carbonate formations. However, the impacts of these fractures on the productivity index of a vertical well are poorly understood. In this paper, we present a new uniform-flux fracture solution derived by integrating an eccentric point source in a pseudo-steady state within a circular reservoir. Moreover, we establish a new model of fluid flow in a uniform-flux fracture. We then integrate the fracture solution and flow model into a semi-analytical model capable of calculating the productivity index of a vertical well near discrete fractures in a circular reservoir. Finally, we discuss the effect of discrete fractures on the productivity index in detail.

Our results show that, for a single-fracture-well system, the well-fracture distance and fracture conductivity exert significant influences on the productivity index of the well. The maximum productivity index of a vertical well can be achieved if the well is drilled on a discrete fracture, and the productivity index decreases with increasing well-fracture distance and falling fracture conductivity. The effect of fracture conductivity on the productivity index of a vertical well can be ignored if the distance between the well and the fracture is greater than a certain value. At large conductivity values, the dimensionless fracture-well distance d_{1D} has a much greater impact on the productivity index than