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Viscous fingering in five-spot immiscible displacement

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During immiscible flows in a porous medium, instability, called viscous fingering, can occur at the interface of the two fluids [1,2]. This instability, which has been the subject of much research, occurs in a wide variety of industrial and natural processes, particularly in the enhanced oil recovery where this phenomenon is undesirable because it reduces the sweep efficiency [3]. Faced with a double complexity, that of the nature of the porous medium and that of the nature of the flow, most of the researchers concentrated on simple geometries and on the qualitative aspect of the phenomenon [2]. The work, presented in this paper, is a numerical study that treats the Viscous fingering phenomenon in a five-spot geometry which is considered a good model of the oil fields. The effect of the presence of fractures on the sweep efficiency is considered. The flow equations are solved using the finite volume method (FVM). Brooks-Corey model for relative permeability has been implemented in a finite volume code. The solution method is Implicit in Pressure and Explicit in saturation (IMPES).

Keywords
Porous medium, Fracture, Multiphase flow, Finite Volume Method, IMPES.

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