DISCONTINUOUS FINITE ELEMENT FORMULATIONS
FOR MISCIBLE VISCOUS FINGERING PROBLEMS

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We present discontinuous stabilized finite element approaches to investigate the dynamical evolution of two-dimensional miscible flows taking in porous media into account the appearance of viscous fingers and their influence on the breakthrough time of the injected fluid. The problem is modelled by a coupled system of nonlinear partial differential equations. Through a backward finite difference scheme in time, a sequentially implicit time-stepping algorithm that uncouples the system at each time-step is defined [1, 3]. A stabilized dual hybrid mixed method (SDHM) is employed for computing velocity field and pressure approximations, involving the conservation of mass and Darcy’s law. Finally, the SUPG (Streamline Upwind Petrov-Galerkin) method is used to approximate the concentration equation. As demonstrated by the authors [2] the SDHM is locally conservative and is free from any compromise between the finite element approximation spaces. Moreover, in contrast with continuous finite element methods [3], the SDHM formulation is flexible for implementing $hp$–adaptivity approaches, making it a efficient strategy in studying flow patterns in oil reservoirs.

Robustness and accuracy will be illustrated by simulations of viscous fingering in quarter five-spot arrangements to homogeneous and heterogeneous porous media. This proposal is a extension of the methodology developed in [2] to miscible displacements with high adverse mobility ratios.

REFERENCES
