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**56256;56320; Quasi-Newton preconditioners for the  
iterative solution of nonlinear equation in porous media**

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In this work preconditioners for solving the linear systems of the Newton method in each nonlinear iteration are studied. The preconditioners are defined by means of a Broyden-type rank-one update at each nonlinear iteration, as described in [1]. We report numerical results of the application of this approach for the solution of the nonlinear system of algebraic equations arising from the finite element discretization of two-phase flow model in porous media. Sequential and parallel results show that the efficiency of the proposed method. The parallel version of the algorithm uses the FSAI approximate inverse as initial preconditioner [2]. The obtained performances show that the high cost of the FSAI evaluation is amortized by the efficiency of the subsequent Broyden updates.

[1] L. Bergamaschi, R. Bru, A. Martinez and M. Putti, “Quasi-Newton Preconditioners for the Inexact Newton Method”, to appear in *Electr. Trans. on Num. Analysis*. 2006.

[2] L. Yu. Kolotilina and A. Yu. Yeremin, Factorized sparse approximate inverse preconditionings I. Theory, *SIAM J. MATRIX Anal. Appl.*, 14:45-58, 1993.