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MULTILEVEL PROJECTION METHODS FOR NONLINEAR LEAST-SQUARES FINITE ELEMENT COMPUTATIONS*

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Abstract. The purpose of this paper is to describe and study several algorithms for implementing multilevel projection methods for nonlinear least-squares finite element computations. These algorithms are variants of the full approximation storage (FAS) scheme which is widely used in nonlinear multilevel computations. The methods are derived in the framework of the least-squares mixed formulation of nonlinear second-order elliptic problems. The nonlinear variational problems on each level are handled by smoothers of Gauss-Seidel type based on a space decomposition of the finite element spaces. Finally, the different algorithms are tested and compared for a nonlinear elliptic problem arising from an implicit time discretization of a variably saturated subsurface flow model.

Key words. nonlinear elliptic problems, least-squares finite element method, nonlinear multilevel methods, multilevel projection methods, FAS scheme.

AMS subject classifications. 65M55, 65M60.

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