# A Remark on Superconvergence for Approximate Solutions of an Elliptic Problem by the Mixed Finite Element Method

Richard E. Ewing
Institute for Scientific Computation
Texas A&M University
College Station, TX 77843
ewing@isc.tamu.edu

Mingjun Liu
Imagine Software, Inc.
New York, NY 10017
mingjunl@imagine-sw.com

Junping Wang
Department of Mathematical & Computer Sciences
Colorado School of Mines
Golden, CO 80401
jwang@mines.edu

**Abstract:** A superconvergence result is established for finite element approximate solutions of an elliptic problem by using the mixed method of Raviart-Thomas over rectangular elements. The optimal order error estimate in $L^2$-norm for the flux approximation is known to be of order $\mathcal{O}(h^{k+1})$ where $k \geq 0$ is the order of polynomials employed in the Raviart-Thomas element. The superconvergence result reveals an order of $\mathcal{O}(h^{k+3})$ accuracy between the finite element approximation and an appropriately-defined local projection of the flux variable. A post-processing technique using the least-squares method locally on macro-elements is proposed and analyzed in order to provide a new approximate solution of order $\mathcal{O}(h^{k+3})$.