Abstract:

In this talk, I will describe my results on superconvergence estimates of mixed methods using Raviart–Thomas finite elements. First I prove the canonical interpolant and finite element solution approximating the vector variable are superclose in $L^2$ norm. The main tool is a triangular integral identity in Bank and Xu SIAM J. Numer. Anal 41 (2003) 2294-2312, and a discrete Helmholtz decomposition. Comparing to previous supercloseness results (eg. Brandts Numer. Math. 68 (1994) 311–324), my proof is constructive and works on irregular triangular meshes. Even on a special uniform grid, my result shows that the previous supercloseness result is suboptimal. Next I will describe several postprocessing operators based on simple edge averaging, $L^2$ projection or superconvergence patch recovery. Then I will show the postprocessed finite element solution superconverges to the true solution. If time permits, I will also briefly describe applications to Maxwell’s equations and generalizations to fourth order elliptic equations.