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Weiming Cao* (weiming.cao@utsa.edu), Dept. of Mathematics, The University of Texas at San Antonio, San Antonio, TX 78249. *A Superconvergence Analysis of the Quadratic Finite Element Method Based on Unstructured Anisotropic Meshes*. Preliminary report.

For problems exhibiting strong anisotropic features, the finite element method based on adaptive anisotropic meshes can be much more effective than the one based on isotropic meshes. In this talk, we present our recent results on the error estimates and mesh refinement controls for the anisotropic finite element method. We discuss in particular the quadratic finite element method for two dimensional elliptic equations based on a class of unstructured anisotropic meshes that are quasi-uniform under given Riemannian metrics. Based on the notion of approximate (anisotropic) parallelograms for element pairs and the notion of anisotropic measures for the higher order derivatives of PDE solutions, we show that the finite element solutions are super-close to the the quadratic interpolation of the exact solutions in the energy norm. Numerical results demonstrating the superconvergence behaviors of the adaptive finite element solutions are also presented. (Received September 03, 2014)