Adaptive quadratic finite element method for unilateral contact problem.

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Numerical analysis of the non-linear problems arising from unilateral contact problems using finite element methods exhibits technical adversity both in approximating the continuous problem and numerical modeling of contact conditions on a part of the boundary. The Signorini contact model typically is a prototype model for the class of unilateral contact problem. The main aim of my talk is to present and analyze a posteriori error estimates in the energy norm of a quadratic finite element method for the frictionless unilateral contact problem which is modeled as elliptic variational inequality of the first kind. The major challenge involved using quadratic finite elements is to model the non penetration Signorini condition on the discrete solution along the contact region at both theoretical and numerical end. Compared to the linear finite elements, we compute more accurate discrete solution to unilateral contact variational inequalities using higher order finite elements. The reliability and the efficiency of a posteriori error estimator is discussed. The main idea in our analysis is the appropriate construction of the discrete counterpart of the continuous contact force density which helps in proving the main results of this article. The suitable decomposition of the discrete space V^h and a discrete space Q^h, where the discrete counterpart of the contact force density is defined, play crucial role in deriving a posteriori error estimates. The error estimator involves various residuals consisting the data of the problem, discrete solution and a Lagrange multiplier related to the obstacle constraint. The numerical results for adaptive FEM are presented in order to exhibit the reliability and the efficiency of the proposed error estimator.

References:

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