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A posteriori error estimate for fictitious domain and Nitsche's method applied to contact problems in elasticity

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ABSTRACT

The aim of this work is to present a residual-based *a posteriori* error estimator on the approximation of unilateral contact problems between two elastics bodies in a fictitious domain framework. The Dirichlet and contact boundary conditions are taken into account with a Nitsche type method.

In the present work, we consider the unilateral contact in the small deformation between two elastic bodies with nonzero initial gap, a potential contact zone and Dirichlet and Neumann boundary conditions. This work is based on a generalization to the case of two elastic bodies and a fictitious domain approach analyzed in [1]. To obtain an optimal *a priori* error estimate, a stabilized fictitious domain method is necessary. This stabilization is inspired by an extended finite element method [2]. *A posteriori* error estimator based on residual approach for contact problem is proposed [3] and adapted for Nitsche's method and fictitious domain approach.

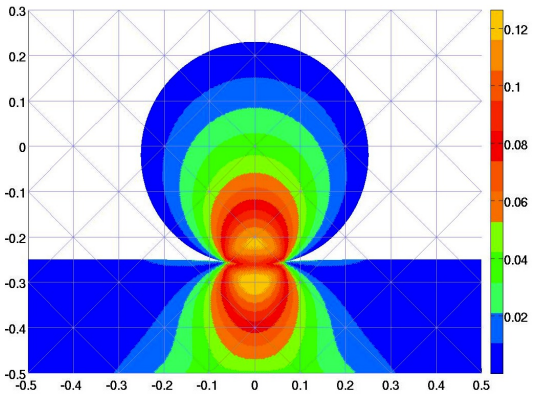

Figure 1: Example of numerical result of Von Mises stress for Hertz contact.

Some theoretical results are presented: the consistency of the discrete method, existence and uniqueness results. As far as we know, the optimal *a priori* error estimate and *a posteriori* error estimator for a contact problem with a fictitious domain approach and Nitsche's method is a new result. Finally, the method is validated using Hertz contact in two dimensional as the test problem (*c.f.* Figure 1).

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