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FICTITIOUS DOMAIN AND NITSCHE'S METHOD APPLIED TO CONTACT PROBLEMS IN ELASTICITY

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The aim of this work is 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 a extended finite element method [2]. The method is validated using Herz contact in two dimensional as the test problem (*c.f.* Figure 1).

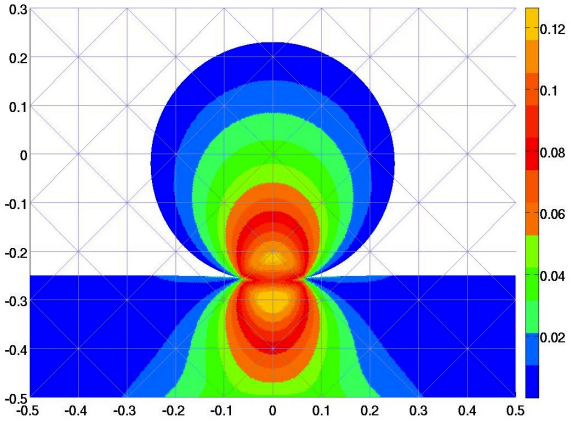

Figure 1: Example of numerical result of Von Mises stress for Hertz contact.

Some theoretical results are presented: the consistency of the discrete method, existence and uniqueness results. Furthermore, we establish an optimal a priori error estimate. As far as we know, the optimal a priori error estimate for a contact problem with a fictitious domain approach is a new result. Finally, a Hertz contact experiments illustrate the well behavior of the method.

REFERENCES

[1] F. Chouly, P. Hild and Y. Renard. Symmetric and non-symmetric variants of Nitsche's method for contact problems in elasticity: theory and numerical experiments. Submitted.

[2] J. Haslinger and Y. Renard. A new fictitious domain approach inspired by the extended finite element method. *SIAM J. Numer. Anal.*, Vol. **47**, 1474–1499, 2009.

[3] M. Juntunen and R. Stenberg. Nitsche's method for general boundary conditions. *Mathematics of Computation*, Vol. **78**, no. 267, 1353-1374, July 2009.