A symmetric algorithm for solving mechanical contact problems using FreeFEM

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The mechanical Contact between two bodies is one of the most difficult problems in solid mechanics, indeed the material non-linearity must be taken into account and the contact area is unknown. In the case of frictional contact another non-linearity must be considered and makes the problem even more difficult. There exist several algorithms to solve the contact problems [3], most of them involve the concept of master/slave, which prevents the penetration of the slave body into the master one, and therefore causes the non-symmetry of the algorithm.

In this work the contact problem is formulated into a constrained minimization one. In the first part, we will present some algorithms, developed using FreeFEM [1], treating Signorini's problem [2] (contact between a body and a rigid foundation). In the second part two algorithms treating the contact between two bodies are presented, the first algorithm uses the penalty method, and the second one uses the interior-point method. One of the advantages of these two algorithms is the symmetric behavior, in addition the Interior point optimizer (IPOPT) [4] is used in order to solve the constrained minimization problem.

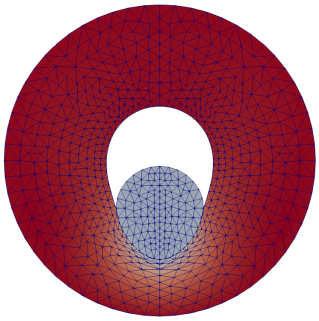

Figure 1: Contact between two discs

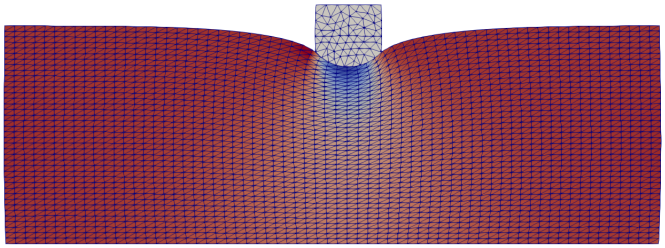

Figure 2: Shallow ironing problem

Références

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[3] Peter Wriggers, *Computational Contact Mechanics, Second Edition*, Springer-Verlag, 2006.

[4] Andreas Wächter and Lorenz T. Biegler , *On the implementation of an interior-point filter line-search algorithm for large-scale nonlinear programming*, Mathematical programming, Springer, vol. 106, no 1, p. 25-57, 2006.

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