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# ON A NEW METHOD TO SOLVE CONTACT PROBLEMS WITH AN EVOLVING LEVEL-SET

**M. Graveleau, N. Chevaugeon and N. Moës**

GeM Institute, Ecole Centrale de Nantes, UMR 6183 CNRS,
1, rue de la Noë, F-44321, Nantes, France.
matthieu.graveleau/nicolas.chevaugeon/nicolas.moes@ec-nantes.fr

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In most mechanical systems, contact phenomena play an important role. Nevertheless, they are not always, or sometimes poorly, considered due to the dramatic increase in complexity they create. Even a simple linear elastic problem becomes non linear with the addition of contact. This leads to a variety of mathematical and computational difficulties, see ([1],[2],[3]) .

When bodies come into contact, the contact surface is *a priori* unknown. This corresponds to the addition of inequality equations to the classical formulation. To eliminate the direct treatment of these inequalities, we propose the application of the method described in [4] to contact. The Inequality Level-Set (ILS) method allows a representation of the boundary of the contact zone which is not linked to the mesh through the use of level-set and X-FEM. Furthermore, the X-FEM is a definite asset in representing low regularity of the solution at the boundary of the contact zone, leading to a higher order convergence rate with respect to element size.

The inherent challenge in this problem is to start from an initial contact zone and make it converge to the exact one. This is a shape optimization problem. To deal with the non-linearity which results from this contact zone search, iterative algorithms are used, in which the classic approach involves iterating on the shape of the contact zone. Therefore, an efficient algorithm to cause this contact zone to evolve is a key stone for contact problems. We base our shape optimization on configurational mechanics considerations ([6],[7])(which allows us to take into account adhesion without extra effort). The level-set is evolved using a Newton-Raphson scheme, which ensures rapid convergence.

To illustrate this method, we will consider membranes under pressure limited by a rigid surface. We will treat both axi and non-axi-symetric situations.

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