Adaptive inexact semi–smooth Newton methods for a contact between two membranes ADMOS 2017

Jad Dabaghi*, Vincent Martin† and Martin Vohralík*

* Inria Paris, 2 rue Simone Iff, 75589 Paris, France
e-mail: jad.dabaghi@inria.fr, martin.vohralik@inria.fr

† Université technologie de Compigne (UTC), 60200, France
e-mail: vincent.martin@utc.fr

ABSTRACT

We propose an adaptive inexact version of a class of semi-smooth Newton methods. As a model problem, we consider the system of variational inequalities describing the contact between two membranes and its finite element discretization. Any iterative linearization algorithm like the Newton-min, Newton-Fisher Burmeister is taken into account, as well as any iterative linear algebraic solver. We prove an a posteriori error estimate between the exact solution and the approximate solution valid on any step of the linearization and algebraic resolution. This estimate is based on discretization and algebraic flux reconstructions, where the latter one is obtained on a hierarchy of nested meshes. The estimate distinguishes the discretization, linearization, and algebraic components of the error and allows us to formulate adaptive stopping criteria for both solvers. Numerical experiments for the semi-smooth Newton-min algorithm in combination with the GMRES solver confirm the efficiency of the method.

REFERENCES

[1] Facchinei, Francisco and Pang, Jong-Shi *Finite-dimensional variational inequalities and complementarity problems*, *Springer Series in Operations Research* Vol.**I,II** (2003).

[2] Ben Belgacem, Faker and Bernardi, Christine and Blouza, Adel and Vohralík, Martin. On the unilateral contact between membranes. Part 2: *a posteriori* analysis and numerical experiments. *IMA Journal of Numerical Analysis*, Vol. **43**, pp. 33–52, (2012).

[3] Ern, Alexandre and Vohralík, Martin. Adaptive inexact Newton methods with a posteriori stopping criteria for nonlinear diffusion PDEs. *SIAM Journal on Scientific Computing*, Vol. **35**, pp. A1761–A1791, (2013).