A continuation problem for computing solutions of discretised evolution problems

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Let us consider incremental problems that correspond to a discretised nonlinear quasi-static or dynamic mathematical model, possibly involving viscous terms. When solving such problems numerically, one can encounter situations where usual solvers (e.g., the Newton method with the initial approximation chosen to be a solution from the previous time step) fail to compute any solution.

To deal with these situations, we introduce a suitable continuation problem with an additional scalar parameter. Afterwards, we are concerned with path-following of problems of such a type. Whereas path-following is well explored under the assumption of continuous differentiability of the function involved, we suppose it to be only *piecewise* differentiable. In this framework, a condition guaranteeing existence of local solution branches is given and an analogy of the first-order system from the smooth case is derived and analysed. Possibility of continuation of solution paths along one-sided tangent directions coming from this system is studied. Finally, a continuation algorithm based on the strategy presented in [2], [1] is proposed for following solution branches numerically.

This is a joint work with Prof. Yves Renard.

References

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[2] *V. Janovský, T. Ligurský*: Computing non unique solutions of the Coulomb friction problem. Math. Comput. Simul. *82* (2012), 2047–2061.