How to Simplify Return-Mapping Algorithms in Computational Plasticity: PART 2 – Implementation Details and Experiments

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ABSTRACT

This contribution connects to the contribution [1] submitted by S. Sysala, where a simplification of return-mapping algorithms for elastoplastic problems was suggested. The simplification is based on using the subdifferential form of the plastic flow rule. Due to this idea, we do not distinguish between the return to the smooth portion and to the apex of the yield surface and solve only a unique system of non-linear equations. So the aim is to describe in detail improved implementation of the non-associated elastoplastic model containing the Drucker-Prager yield criterion and a nonlinear isotropic hardening law.

In particular, we use the standard finite element method and formulate the problem in an algebraical form. This leads to solving a system of nonlinear equations in each time step. Since the systems are solved by the semi-smooth Newton method in combination with the GMRES linear solver it is necessary to describe a construction of the consistent tangential stiffness matrice, similarly as in [2].

The problem is implemented within MatSol library [3] developed in Matlab. This library contains the TFETI [4] domain decomposition method which enables us to prepare also parallel implementation. Two benchmarks are considered. For the first one, the decomposition is not used to illustrate quadratic convergence of the method. In the second benchmark (around millions DOFs), the parallel implementation is used. For this computation, the supercomputer ANSELM in IT4Innovations National Supercomputing Center is used. Up to five hundred of processors can be used in ANSELM.

REFERENCES

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