

COMPUTATIONAL PLASTICITY: THEORETICAL DEVELOPMENT AND ITS APPLICATIONS

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ABSTRACT

The mathematical formulation of natural and synthesized material for modelling plastic behavior usually consists of differential equations, algebraic equations, and algebraic inequalities. This mathematical combination of ingredients causes the numerical difficulty, hence special treatment for computation is needed. The sub-stepping integration, the return-mapping integration, the angle-based integration, and the exponential map integration have been developed from this background. In recent years, mathematical modelling on plastic behavior of materials pinpoints the material behavior under multiaxial cyclic loading. Under the multiaxial cyclic loading, the yield surface of the material translates, expands, and distorts. Towards the accurate prediction of yield surface evolution, several new plasticity models have been proposed and studied in recent years. Current work suggests, combining the kinematic, the isotropic, and the distortional hardening rules would a crucial point. However, this development greatly increases demands on computing power and require careful examination of numerical convergence. Furthermore, dedicated optimizations of numerical implementation are crucial for computational efficiency of mixed hardening predictions, numerical verification, and calibration.

This MS provides a platform for researchers to exchange his/her work which is especially related to but not limited to the investigation on the computational plasticity in metals, polymers, biological materials, and other materials. The computational investigation includes not only the continuum-based but also the particle-based approach whereas the computational modelling contains single-scale as well as multi-scale simulations. Theoretical research and numerical study are all welcome.