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A Hybrid High-Order method for finite elastoplastic deformations within a logarithmic strain framework

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ABSTRACT

We devise and evaluate numerically a Hybrid High-Order (HHO) method for finite elastoplasticity within a logarithmic strain framework [1]. HHO method have been initially introduced in [2] for linear elasticity and in [3] for diffusion problems. For a recent work on HHO methods in computational mechanics, we refer to [4] for hyperelastiticy and [5] for associative plasticity with small deformations. The HHO method uses as discrete unknowns piecewise polynomials of order $k \geq 1$ on the mesh skeleton, together with cell-based polynomials that can be eliminated locally by static condensation. The HHO method leads to a primal formulation, supports polyhedral meshes with non-matching interfaces, is free of volumetric locking, the integration of the behavior law is performed only at cell-based quadrature nodes, and the tangent matrix in Newton's method is symmetric. Moreover, the principle of virtual work is satisfied locally with equilibrated tractions. The HHO method is evaluated using various two- and three-dimensional benchmarks as well as by comparison against known solutions with an industrial software using conforming and mixed finite elements.

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