Cihan, Mertcan; **Hudobivnik, Blaž**; **Aldakheel, Fadi**; **Wriggers, Peter**

3D mixed virtual element formulation for dynamic elasto-plastic analysis. (English)

Zbl 1477.74117
Comput. Mech. 68, No. 3, 581-598 (2021).

Summary: The virtual element method (VEM) for dynamic analyses of nonlinear elasto-plastic problems undergoing large deformations is outlined within this work. VEM has been applied to various problems in engineering, considering elasto-plasticity, multiphysics, damage, elastodynamics, contact- and fracture mechanics. This work focuses on the extension of VEM formulations towards *dynamic elasto-plastic* applications. Hereby low-order ansatz functions are employed in three dimensions with elements having arbitrary convex or concave polygonal shapes. The formulations presented in this study are based on minimization of potential function for both the static as well as the dynamic behavior. Additionally, to overcome the volumetric locking phenomena due to elastic and plastic incompressibility conditions, a mixed formulation based on a Hu-Washizu functional is adopted. For the implicit time integration scheme, Newmark method is used. To show the model performance, various numerical examples in 3D are presented.

MSC:

74S99 Numerical and other methods in solid mechanics
74C15 Large-strain, rate-independent theories of plasticity (including nonlinear plasticity)

Keywords:

large deformation elasto-plasticity; mixed formulation; low-order ansatz function; Hu-Washizu functional; implicit time integration; Newmark method

Software:

AceFEM

Full Text: DOI

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