AN ALTERNATIVE METHOD OF MODELLING IRREVERSIBLE DEFORMATIONS OF HYPERELASTIC MATERIALS

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Abstract: At present, multiplicative plasticity models are used to model irreversible deformations of hyperelastic materials. The underlying theory assumes that the body's intermediate configuration consists of an assembly of isolated and locally stress-free neighbourhoods after plastic deformations, where no plastic deformation gradient exists that meets the conditions of compatibility [1, 2]. Consequently, the deformation gradient is not integrable, and the body moves from the initial configuration to its intermediate configuration without a plastic displacement field. Such treatment of the body is neither mathematically nor physically justified, and the related material models can hardly be considered continuum-based. This paper will show that the plastic flow rule causes the incompatibility of the plastic deformation gradient in reality. We will try to change the flow rule so that it meets the conditions of compatibility and objectivity and modify the models accordingly, critically analysing the obtained results.

Keywords: nonlinear continuum theory for finite deformations of elastoplastic media, objective and thermodynamically consistent formulation, multiplicative plasticity, hyperelastic materials, compatible flow rule.

References

1. BONET, J. – WOOD, R. D. *Nonlinear Continuum Mechanics for Finite Element Analysis.* Cambridge: Cambridge University Press, 2008. 340 p. ISBN 978-0521838702.
2. De SOUZA NETO, E. A. et al. *Computational Methods for Plasticity, Theory and Applications.* Singapore: John Wiley & Sons Ltd, 2008. 814 p. ISBN 978-0-470-69452-7.

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