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A Viscoplastic Model for Thermoplastic Polymers Under Uniaxial Monotonic and Cyclic Straining

Ghorbel Elhem

Université de Cergy Pontoise, Neuville Sur Oise, France

The thermodynamic approach of the continuous medium and the local state method were widely used for the study of the mechanical behavior of metal alloys under complex triaxial loading conditions. The purpose of this paper is to show that these classical models can be modified then used for modeling mechanical behavior of polymers. Viscoplastic constitutive equations are proposed into the restrictive framework of standard generalized materials and the field of the small deformations. A yield criterion is established. It is based on the first stress invariant and the second and the third invariant of deviatoric stress. First invariant allows the description of hydrostatic pressure effects on the polymers yielding while the third invariant is used to delineate the experimentally observed stress state dependency effects. A non-linear kinematic hardening rule is proposed to describe cyclic softening that several polymers exhibit under strain controlled cyclic tests.

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