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Modeling of Viscoplastic Constitutive Equation for Polymers by Taking Into Account Strain Recovery

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Polymers reveal significant viscoplastic deformation at the room temperature. Peculiar strain recovery is shown during unloading in particular, and it is quite different behavior from what is shown in metals. In order to describe such characteristic deformation of polymers, a viscoplastic constitutive equation which is formulated by combining the kinematic hardening creep theory of Malinin and Khadjinsky with the nonlinear kinematic hardening rule of Armstrong and Frederick is employed, and the evolution equation of a back stress is modified. In the present study, a loading surface is defined in a viscoplastic strain space, and a criterion of loading-unloading is defined by using the loading surface. Moreover, a parameter is defined by using the loading surface, and the evolution equation of a back stress is modified by using the parameter. Then, experimental results are simulated by using the constitutive equation, and the validity of the modification is confirmed.

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