Evolution of Bauschinger effect in cyclic plasticity(*)

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THE BEHAVIOUR of plastically strained solids under monotonic and cyclic loading is very complex and several concepts were proposed to describe it. In some of them, it is assumed that apart from the traditional yield surface in the stress space, there exist one or more surfaces in a space of the tensor describing the motion of the centre of the yield surface. This tensor is sometimes identified with a phenomenological measure of microstresses. The evolution law for microstresses and the law of evolution for the isotropic part of hardening are usually postulated first, and then they are jointly verified by means of the data obtained from the measurements of global strain-stress curves.

Since such data are insufficient for unique separation of kinematic and isotropic hardening, the investigation of new concepts requires measurements of some additional physical quantity. The objective of this work is an experimental determination of such a quantity. Assuming the Huber–Mises yield surface it enables an experimental determination of yield surface motion and the evolution of the yield surface radius for cyclic plastic loading under complex stress state and out of phase loading. The experiments were performed for two different materials (21CrMoV57 and 18G2A steel) on thin tubes under tension-torsion.

Using the new technique of succesive unloadings, the yield surface center motion and yield surface radius were observed even inside a single cycle. Quite new experimental results concerning cyclic behaviour, memory effect and influence of stress history on cyclic behaviour were obtained.

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