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Metal Forming Processes Conditioned by Cyclic Loading. A New Challenge for the Theory of Plasticity

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Since early works of cyclic plasticity, it was observed that stress-strain cycles of large amplitude imposed on the cold-worked specimens of metallic materials produce cyclic softening. Korbel and Bochniak proposed the improvement of a method for plastic forming operations conditioned by cyclic loading. The experimental investigations led to the identification of shear banding as the basic mechanism responsible for plastic softening. Our aim is to study this problem from the point of view of cyclic plasticity accounting for multiscale description of shear banding. A new approach to the theory of plasticity describing the discussed above phenomena is proposed and an example illustrating its predictive power is presented. In particular, the parameters controlling cyclic loading under torsion: the amplitude of the cycle and its frequency are related with the microscopic model of shear banding. The optimal ranges of these parameters from the point of view of required plastic softening are estimated.

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