An Energy Approach Applied to Define Elasto-Plastic Constitutive Models Describing Thermomechanical Metallic Materials Behavior During Forming Processes

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Abstract. A new formalism for the definition of metallic materials constitutive laws expressing the stress as a function of the plastic deformation energy it is proposed. This new approach, called energy approach, can integrate physical mechanisms governing the microstructure changes during a plastic deformation. It is also important to emphasize that the proposed energy formulation is more relevant since it can describe physical phenomena taking place in a material forming process characterizing at the different scales the material properties evolution. This formulation remains valid for a large field of deformation, the whole spectrum of loading conditions and remains able to predict rigorously the material response for all types of stresses states: static, transient or dynamic.

Keywords: energy approach, differential equation's constitutive models, plastic deformation energy, work hardening and dynamic softening

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