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MACROSCOPIC AND MESOSCOPIC MODELING BASED ON THE CONCEPT OF GENERALIZED STRESSES FOR CUTTING SIMULATIONS

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Based on the concept of generalized stresses proposed by GURTIN [1] and FOREST *et al.* [2] macro- and meso-scopic modeling approaches are considered. A generalized principle of virtual power is postulated involving generalized stresses which are used to derive the constitutive equations for both model approaches. For macroscopic modeling we develop a multi-mechanism model for a strain rate- and temperature dependent plastic material behavior accompanied by a Strength-Difference-effect (SD-effect) and the trip-strain due to phase transformation [3]. Furthermore, we extend this model with the gradient of a phase fraction, which renders an extra degree of freedom in the finite element formulation. For mesoscopic modeling a phase field model is implemented for describing phase transformations. For the scenario of a cutting process we have a martensite-austenite-martensite transformation. In the examples parameters of the multi-mechanism model related to the visco-plasticity with SD-effect and trip-strain are identified for the material DIN 100Cr6. Finally, we show finite element results for a cutting simulation.

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