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A consistent computational framework for finite micropolar hyper-elastoplasticity: formulation, linearization and application to the simulation of size effects

By Steffen Bauer

Shaker Verlag Jul 2012, 2012. Buch. Condition: Neu. Neuware - The interaction between the internal length scale and the spatial dimensions of a structure has implications on the observable mechanical behavior. Experimental studies that address this physical phenomenon, which is commonly referred to as size effect, reveal a stiffening tendency of the load-displacement behavior with decreasing specimen size. On the other hand, miniaturization plays a vital role in several sectors of research and industry. Against this background, the modeling and simulation-driven predictive analysis of the mechanical size effect is of growing importance. Since the standard continuum model is not able to capture this phenomenon, alternative so-called microcontinuum theories, in particular the micropolar or Cosserat model, have moved into a broader research focus. This thesis contributes to the field of computational solid mechanics and presents novel results in the simulation of the size effect by means of micropolar elastoplasticity. It describes the development of a sufficiently general, numerically efficient and robust computational framework and its application. A concise review of the basic concepts of non-linear micropolar continuum mechanics is given at the beginning of the thesis. The kinematical setting as initially developed by Steinmann is outlined, and thermodynamic consistent constitutive relations...



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