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MODELING OF INELASTIC BENDING OF CABLES USING CONSTITUTIVE LAWS FOR COSSERAT RODS

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This contribution focuses on constitutive modeling for Cosserat rod models in order to simulate bending of cables. Cyclic experiments on cables have shown that cables behave inelastically on the macroscopic level if they are deformed [1]. Bending behavior can be investigated using three point bending (*3PB*) or pure bending (*PB*) experiments. In [2], the authors have formulated constitutive laws based on the sectional quantities of the Cosserat rod, which were able to capture the inelastic effects during the first load cycle. An elastoplastic constitutive model is sufficient to describe the deformation behavior in the first load cycle of *3PB*. However, it is not possible to simulate the first cycle of *PB* experiments with it as higher curvatures can be applied in this experiment. Therefore, the first load cycle in *PB* was modeled by coupling the elastoplastic constitutive law with a damage formulation. The damage formulation is able to capture the effect of a decrease in stiffness (*softening*) during unloading. The experimental results show another effect which cannot be simulated with this coupled model: The first load cycle differs in any experiment from the following load cycles. Afterwards, the behavior is approximately stationary. In the context of particle filled elastomers, this effect is known as the *Mullins* effect [3]. We reformulate our damage model following the principles given in [4] in order to include the Mullins effect in the constitutive equations for the Cosserat rod model.

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