A Cosserat model of elastic solids reinforced by a family of curved and twisted fibres

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Abstract

We outline a Cosserat model for fibre-reinforced solids in which the fibers are modelled as continuously distributed spatial Kirchhoff rods with intrinsic flexural, torsional and extensional elasticity. The basic kinematical variables are a deformation field and a rotation field that describes the local fibre orientation. Constraints on these fields are introduced to account for the materiality of the fibres with respect to the underlying continuum deformation, with the associated Lagrange multipliers interpreted as transverse shear tractions acting on the fibre cross sections. The theory is illustrated via simple examples involving finite deformation.

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