CONFIGURATIONAL MECHANICS OF GENERALIZED CONTINUA. THEORETICAL AND COMPUTATIONAL ASPECTS

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In contrast to standard (classical or local) continuum mechanics, in generalized (non-classical, non-local) continua the behaviour of a material point is not only influenced by the point itself but also by its vicinity. Such a non-locality may for instance enter as a micro-continuum being attached to each physical point of the macro-continuum and being allowed to undergo independent deformations. In the *micromorphic continuum* the deformations of the micro-continuum are assumed to be affine and the size of the micro-continuum introduces a scale-dependence into the theory. A *gradient continuum* of Mindlin-type can be shown to be a particular constraint version of a micromorphic continuum. In the kinematical descriptions we distinguish between the macro- and the micro-deformations: Particularly, the kinematics of the macro-continuum are described by a macro-deformation map and a macro tangent map, whereas the kinematics of the micro-continuum are described by an affine micro-deformation map and its gradient with respect to macro coordinates which represents a third-order curvature-like tensor providing a link between the two scales. Energy and balance considerations lead to the definition of stress quantities being conjugate to the aforementioned kinematics. In the present work both stress and deformation quantities as well as the balance relations are viewed from a configurational-mechanics perspective, i. e. different stress measures are obtained, including Eshelby-type stresses which exclusively act on the material manifold. This allows for the application of the material force method which is anticipated to give an insight into the behaviour at inhomogeneities. Upon constitutive assumptions for the macro- and micro-continuum, finite-element approximations are derived. As an example a cracked specimen is numerically investigated with respect to its behaviour at different characteristic micro-continuum sizes and modifications in the constitutive parameters.

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