

Decompositions and Identification Relations as Guides in the Formulation of Multiscale Field Theories

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Abstract

This presentation addresses the issues of (i) the selection of fields that reflect specific aspects of multiscale geometrical changes and (ii) the manner in which such fields might appear in the field equations that govern the motions of a continuous body.

The multiscale geometry employed in this talk is based on structured deformations and structured motions. A variety of results will be presented of the following type: a familiar macroscopic geometrical or statical quantity is decomposed additively or multiplicatively into terms or factors that reflect individually either smooth submacroscopic geometrical changes or non-smooth submacroscopic geometrical changes (disarrangements). The decision as to which term(s) in a given decomposition are associated with disarrangements and which are not is provided by identification relations, formulas that are derived, for example, by means of the Gauss-Green formula or change of variables formula and that express a term or factor as a limit of averages of smooth or of non-smooth parts of approximating piecewise smooth deformations. A variety of decompositions and associated identification relations will be discussed, and field equations for an elastic body undergoing disarrangements will be presented as an illustration of the use of the decompositions and identification relations.