

## Adaptive Modelling of Microscopic Heterogeneous Medium Undergoing Large Deformation

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The problem of computing large deformation in microscopic heterogeneous media is characterized by non-uniform change of microstructure; starting with perfect periodic distribution of inhomogeneities in the reference state, the material becomes functionally graded due to nonuniform macroscopic deformation. We consider two-scale method of homogenization. The proposed algorithm for the numerical modelling allows for significant reduction in number of the cell problems to be solved on the microscopic scale. The homogenized stiffness coefficients and the averaged stresses associated with the updated Lagrangian formulation are approximated over the macroscopic domain according to the local deformation. A concept of the so-called macroelements is introduced, each of which spans the deformation gradients in particular macroscopic subdomain. Various approximation schemes can be defined over the macroelements using simplexes, sensitivity analysis of homogenized coefficients is employed. An adaptive refinement of the approximation is suggested, which is controlled by the “modelling error” indicator computed using two different approximation schemes. Numerical examples for materials with incompressible, or rigid inclusions are introduced to demonstrate performance of the method.

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