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 Qi-Zhi Xiao and Bhushan Lal Karihaloo; 1. Introduction; 2. Mathematical Formulation of First- and Higher-Order Two-Scale Asymptotic Homogenisation; 2.1. Two-scale expansion; 2.2. $O(\epsilon^2)$ equilibrium: Solution structure of $u_i(0)$; 2.3. $O(\epsilon)$ equilibrium: First-order homogenisation and solution structure of $u_i(1)$; 2.4. $O(\epsilon^0)$ equilibrium: Second-order homogenisation; 2.4.1. Solution structure of $u_i(2)$; 2.4.2. Solution of $u_i(0)$; 2.4.3. Solution of $m_{ij}^k(y)$; 2.4.4. Constraints from higher-order solutions; 2.5. $O(1)$ equilibrium: Third-order homogenisation; 2.5.1. Solution of $u_i(3)$; 2.5.2. Constraints from higher-order terms; 3. Variational Formulation of Problem (29); 4. Finite Element Methods; 4.1. Displacement compatible elements from the potential principle; 4.2. Element-free Galerkin method from the potential principle; 4.2.1. MLS interpolant; 4.2.2. Imposition of the essential boundary conditions; 4.2.3. Discontinuity in the displacement field; 4.2.4. Interfaces with discontinuous first-order derivatives; 4.3. Displacement incompatible element from the potential principle; 4.3.1. 2D 4-node incompatible element; 4.3.2. 3D 8-node incompatible element; 4.4. Hybrid stress elements from the Hellinger-Reissner principle; 4.4.1. Plane 4-node Pian and Sumihara (PS) 5 element; 4.4.2. 3D 8-node 18 hybrid stress element; 4.5. Enhanced-strain element based on the Hu-Washizu principle; 4.5.1. Plane 4-node enhanced-strain element; 4.5.2. 3D 8-node enhanced-strain element; 4.6. Comments on the various methods; 5. Enforcing the Periodicity Boundary Condition and Constraints from Higher-Order Equilibrium in the Analysis of the RUC.

Sommario/riassunto

This unique volume presents the state of the art in the field of multiscale modeling in solid mechanics, with particular emphasis on computational approaches. For the first time, contributions from both leading experts in the field and younger promising researchers are combined to give a comprehensive description of the recently proposed techniques and the engineering problems tackled using these techniques. The book begins with a detailed introduction to the theories on which different multiscale approaches are based, with regards to linear Homogenisation as well as various nonlinear approa.
