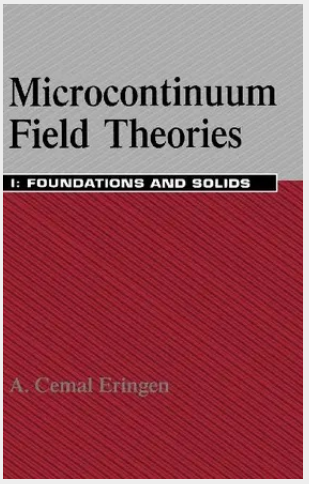
Eringen

Microcontinuum Field Theories

I. Foundations and Solids



Microcontinuum field theories constitute an extension of classical field theories -- of elastic bodies, deformations, electromagnetism, and the like -- to microscopic spaces and short time scales. Material bodies are here viewed as collections of large numbers of deformable particles, much as each volume element of a fluid in statistical mechanics is viewed as consisting of a large number of small particles for which statistical laws are valid. Classical continuum theories are valid when the characteristic length associated with external forces or stimuli is much larger than any internal scale of the body under consideration. When the characteristic lengths are comparable, however, the response of the individual constituents becomes important, for example, in considering the fluid or elastic properties of blood, porous media, polymers, liquid crystals, slurries, and composite materials. This volume is concerned with the kinematics of microcontinua. It begins with a discussion of strain, stress tensors, balance laws, and constitutive equations, and then discusses applications of the fundamental ideas to the theory of elasticity.

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