



The Mechanics and Thermodynamics of Continua

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The Mechanics and Thermodynamics of Continua, intended for graduate students and advanced undergraduates in engineering, physics, and mathematics, is a valuable reference source which presents a fairly detailed and complete treatment of the foundations of continuum mechanics and thermodynamics, with applications to formulating modern constitutive theories of materials. A large class of theories in continuum mechanics takes as its starting point the balance laws for mass, for linear and angular momenta, and for energy, together with an entropy imbalance that represents the second law of thermodynamics. The basic balances, the entropy imbalance, and the principle of material frame-indifference are viewed as fundamental building blocks upon which to build theories of material behavior, and particular classes of materials are defined by additional equations in the form of constitutive relations. The discussion of constitutive equations in the book is based on the principle of frame-indifference, and the use of thermodynamics to restrict constitutive equations. Specific constitutive theories discussed include: (i) heat conduction; (ii) compressible and incompressible, linearly viscous fluids; (iii) elastic solids under isothermal and non-isothermal conditions; (iv) coupled elastic deformation and species transport; (v) theories for isotropic and crystalline plastic solids, as well as some recent theories of gradient plasticity. In our treatment of these topics the book considers both large and small deformations.