Book Review

Albrecht Bertram, Elasticity and Plasticity of Large Deformations. An Introduction. Springer-Verlag Berlin Heidelberg 2005, XIV, 326 pp., Hardcover, EUR 69.95, SFR 123.50, GBP 54.00, US $ 89.95, ISBN 3-540-24033-0

The book addresses a rational framework to analyze non-linear behavior of solids undergoing finite elastic and inelastic deformations. Based on many years teaching experience in continuum mechanics and material theory the author combines a rather complete introductory course with several advanced topics. Fundamentals of non-linear continuum mechanics including equations of kinematics, balance laws, principles of the material theory and internal constraints are presented in organized and concise manner. A part of the book deals with finite elasticity, where general concepts of elastic isomorphisms, elastic symmetries, and thermodynamical restrictions are discussed in detail. Furthermore, the reader will find a collection of constitutive models recently proposed for the description of elastic material behavior. The theory of elasticity is the well developed branch of continuum mechanics and is a masterpiece for theories of plasticity and viscoplasticity, where the rational background is still a subject of many discussions. A part of the book deals with the description of the material behavior within the range of finite plasticity. As stated in the introduction to this part one of the fundamental problems is the introduction of internal state variables and, in particular a definition (or even existence) of a measure for inelastic strain. The author’s contribution is the elaboration of the theory based on the assumption of material isomorphismus between the elastic ranges. This approach leads to the introduction of a non-symmetric second rank tensor as the fundamental plastic variable, called plastic transformation. The book consists of an introduction and 10 chapters: 1. Mathematical Preparation; 2. Kinematics; 3. Balance Laws; 4. The Principles of Material Theory; 5. Internal Constraints; 6. Elasticity; 7. Hyperelasticity; 8. Solutions; 9. Inelasticity; 10. Plasticity.

The book is well-written. The direct tensor notation is employed throughout the text having the advantage of clear, compact, and coordinate-free representation of governing equations and boundary value problems. A list of notations and an index provide a help to find specific topics. The book can be recommended for graduate students at the master and PhD levels as well as to research scientists and teachers.

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