

Elements of Multifield Theories for Complex Materials



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Complex materials are widely used to construct and manufacture complicated devices, especially in the field of nanotechnology. Their unusual mechanical properties---due to their articulated substructures influencing their macroscopic behavior---require suitable modeling for both scientific and design purposes. Although a number of specific models are available, there also exists a metamodel that may encompass various special cases. This monograph focuses on such a metamodel, presenting multifield theories not only as a tool to interpret the mathematical and physical nature of elements of existing models, but also to describe possible new models. An introductory chapter outlines a one-dimensional example of a two-phase material to highlight the essential features of the approach used throughout the book. In addition to the general setting, specific cases are treated in detail for quasicrystals, ferroelectrics, and complex fluids. Further topics covered include: * Presentation of elementary aspects of Lagrangian and Hamiltonian formalism of elastic complex materials * Analysis of bodies with special geometry * Consideration of evolving interfaces and junctions during phase transitions and changes of content and material metric; deduction of relevant evolution equations * Description of structural mutations

in bodies within the general setting* Treatment of transport modeling of substructures* Discussion of "procedural" microstructures arising at a meso-level as solutions of variational problems"Elements of Multifield Theories for Complex Materials" will serve a diverse audience of graduate students, researchers, and practitioners in applied mathematics, mathematical physics, and engineering. The book may be used as a textbook for graduate-level courses in theoretical and applied mechanics, mathematical physics, and materials science, or as a self-study reference.

作者介绍:

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