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Sommario/riassunto	This book presents three short courses on topics at the intersection of Calculus of Variations, PDEs and Material Science, based on lectures given at the CIME summer school “Variational and PDE Methods in Nonlinear Science”, held in Cetraro (Italy), July 10–14, 2023. Fabrice

Bethuel discusses aympototics for Allen–Cahn systems, providing an overview of classical methods and tools for the scalar case and further results for the two-dimensional vectorial case. An alternate monotonicity formula is described, and the still open parabolic vectorial case is considered. Angkana Rüland considers the modelling and analysis of microstructures in shape-memory alloys, including material on quasiconvexity, differential inclusions, rigidity of the two-well problem under BV-regularity assumptions, and recent results on the quantitative dichotomy between rigidity and flexibility. Duvan Henao focuses on existence theory in nonlinear elasticity, where a central role is played by the Jacobian determinant. The methods developed have implications for the analysis of magnetoelasticity and nematic elastomers. The volume is aimed at graduate students and researchers interested in the applications of PDEs and the calculus of variations to the theory of phase transitions, fluid dynamics, materials science, and elasticity theory.