

Material Instabilities in Continuum Mechanics, and Related Mathematical Problems, edited by J. M. Ball. Oxford Science Publications, 1988. 542 pages.

REVIEWED BY D. D. JOSEPH¹

This volume contains the proceedings of the symposium year on "Material Instabilities in Continuum Mechanics," which was held during 1985-86 in the Department of Mathematics of Heriot-Watt University, Edinburgh. The majority of the articles concern various aspects of the mathematical theory of phase transitions in solids and fluids, and reflect the revitalization of this area by recent advances in the theory of systems of nonlinear partial differential equations and in the calculus of variations. These advances have led to new insights into the morphology of phase transitions and their dynamic behavior. The remaining articles concern related problems and techniques in solid and fluid mechanics, mathematical physics, and optimization.

There are 31 papers collected into this volume. The titles and authors are as follows: An approximation lemma for $W^{1,p}$ functions, by E. Acerbi and N. Fusco; Homogenization and periodic structure with holes, by E. Acerbi; Thin insulating layers: The optimization point of view, by G. Buttazzo; Lower semicontinuity and relaxation for some problems in optimal design, by E. Cabib; Mathematical models of phase boundaries, by G. Caginalp; Continua with constrained or latent microstructure, by G. Capriz; Elastic behavior of very thin cellular structures, by D. Cioranescu and J. Saint

Jan Paulin; A counterexample in the vectorial calculus of variations, by B. Dacorogna and P. Marcellini; Elastic invariants in crystal theory, by C. Davini; Concentrations in solutions to conservative systems, by R. J. DiPerna; Some constrained elastic crystals, by J. L. Ericksen; Some results for a linear, partly hyperbolic model of viscoelastic flow past a plate, by L. E. Fraenkel; Derivation and validity of the Boltzmann equation, by R. Illner; Microstructure and weak convergence, by R. D. James; Standing waves of nonlinear Schrödinger equations: Existence and stability, by C. K. R. T. Jones; Remarks about equilibrium configurations of crystals, by D. Kinderlehrer; Some remarks on uniqueness properties, by J. L. Lions; On a certain variational problem of phase equilibrium, by K. A. Lurie and A. V. Cherkaev; Some remarks on non-convex problems, by E. Mascolo; Experimental and theoretical aspects of cellular and dendritic solidification, by D. G. McCartney and J. D. Hunt; On the viscous Cahn-Hilliard equations, by A. Novick-Cohen; Some asymptotic problems of linear elasticity, by O. A. Oleinik; Phase mixtures in nonlinear viscoelasticity in one dimension, by R. L. Pego; Statistical mechanics and the kinetics of phase separation, by O. Penrose; On 1- and 3-dimensional models in "non-convex" elasticity, by M. Pitteri; An application of the method of compensated compactness to a problem in phase transitions, by V. Roytburd and M. Slemrod; A review of some non-convex problems, by R. Schianchi; Nonlinear geometric optics and conservation laws, by M. E. Schonbek; On the admissibility of shocks and propagating phase boundaries in a van der Waals fluid, by M. Silhavy; Unilateral problems in continuum mechanics, by F. Tomarelli; Surface tension effects in phase transitions, by A. Visintin.

This is a very outstanding and varied collection of topics of current interest to analysts interested in the mathematical aspects of continuum mechanics.

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