J. Fluid Mech. (1995), *vol.* 286, *pp.* 405–407

REVIEWS

Statics and Kinematics of Granular Materials. By R. M. NEDDERMAN. Cambridge University Press, 1992. 352 pp. £50.

It is unfortunate that the mechanics of granular materials such as coal, food grains, and cement is still poorly understood. Dr Nedderman's book provides an excellent introduction to the prediction of stress and velocity fields in such materials using continuum models. The focus is on statics within and flow through storage vessels, known as bins, hoppers, and bunkers. Because various methods of analysis are explained in detail and a large number of figures are used, the book is well suited for undergraduate and postgraduate students, and also for independent study.

The chapters on statics deal with two-dimensional stress analyses based mainly on the Mohr–Coulomb yield function. Approximate solutions are discussed and compared with 'exact' (numerical) solutions based on the method of characteristics. Readers who are not familiar with this method will find the detailed treatment very helpful.

The chapters on flow deal with steady two-dimensional velocity fields in bins and hoppers. Both kinematic models and frictional models based on plasticity theory are discussed. The discussion of plasticity contains a few misleading statements such as 'λ is a scalar constant', and 'during steady flow, we can ... consider the material to be incompressible'. The factor λ occurs in the plastic potential flow rule, and it may in general vary with position. Similarly, the other remark is applicable to shear tests, but not to problems such as flow in the exit region of hoppers.

There is a good treatment of the radial velocity field, construction of velocity fields using the method of characteristics, and velocity discontinuities in regions where the stress field is continuous. This is followed by a discussion of correlations and theories for estimating the flow rates of coarse materials, together with a lucid account of air-impeded and air-augmented flows of fine particles.

The book ends with a set of problems for which numerical answers are provided. The problems are directly related to the material covered, and will be particularly useful to students.

The major shortcoming of this book is the lack of adequate comparisons between theory and experiment. For example, one is unable to assess the extent to which the predicted stress fields are applicable to real systems. Though it is stated that the 'predictions are excellent for many materials', a quantitative comparison would have been more convincing. Similar remarks apply to most of the other topics.

Overall, I would warmly recommend this book to anyone who wishes to learn about granular mechanics.

K. KESAVA RAO

SHORTER NOTICES

An Introduction to the Kinetic Theory of Gases and Magnetoplasmas. By L. C. Woods. Oxford University Press, 1993. 300 pp. £27.50.

In a little under 300 pages the author has given a lightning tour through the basics of the kinetic theory of gases and partially ionized plasmas. Although inevitably mathematical, owing to the nature of the subject, the author has made a strenuous attempt to bias this book towards a more physical treatment and he has used mean-free-path arguments to good effect to achieve this.

His lively account of the subject begins with an outline of the basic concepts of molecular kinetic theory. Within this section the author introduces an unconventional and somewhat controversial concept of the pressure. Most of the familiar ground of kinetic theory is covered in the subsequent chapters and in common with other modern books on the subject considerable emphasis is placed on transport phenomena within gases since, as the author recognizes, this is of particular relevance to much of the present activity in the field and to those involved with computations.

To pave the way for the final chapters which deal with magnetoplasmas, a second-order transport theory is developed. In this respect the book differs from traditional accounts of the subject, in which the 'Burnett' terms are derived from the Boltzmann equation using a frame of reference for the molecular random motion that not only moves with fluid but also takes into account accelerations including spin. The book concludes with an interesting chapter on transport phenomena within plasmas in the presence of strong magnetic fields, demonstrating the need to consider second-order effects.

Magmatic Systems. Edited by M. P. Ryan. Academic Press, 1994. 398 pp. $119.

During the last 15 years or so some members of the fluid mechanical research community have made considerable contributions to many of the multi-disciplinary fluid problems suggested by geology. The 15 essays in this book review the progress that has been made in understanding one of these areas – the heat and mass transport of magma through the mantle and the crust of the Earth, which make up one of the central problems of volcanology and igneous petrology. Most of the chapters are written by distinguished authors who demonstrate how theoretical analysis, laboratory experimentation and field observations need to be carefully interwoven in order to make progress in this fascinating but difficult field. The editor, who also edited a previous set of essays entitled *Magma Transport and Storage* (reviewed in *J. Fluid Mech.* vol. 238, 1992, p. 723), is well known for the care and dedication he devotes to his work, as is reflected in his admirably written Prologue, which summarizes the main new concepts introduced in each chapter. This group of essays will make exciting reading for both experts and newcomers to the field.

The following volumes of conference proceedings have also been received:

Solar and Planetary Dynamos. Edited by M. R. E. PROCTOR, P. C. MATTHEWS and A. M. RUCKLIDGE. Cambridge University Press, 1994. 366 pp. £35.

Modelling and Simulation. Edited by C. R. BURROWS and K. A. EDGE. John Wiley & Sons, 1994. 299 pp. £85.

Mechanics and Physiology of Animal Swimming. Edited by L. MADDOCK, Q. BONE and J. M. V. RAYNER. Cambridge University Press, 1994. 250 pp. £35.

Eddy Structure Identification in Free Turbulent Shear Flows. Edited by J. P. BONNET and M. N. GLAUSER. Kluwer, 1993. 501 pp. Dfl. 295.

Nonlinear Partial Differential Equations and Their Applications. Edited by H. BREZIS and J. L. LIONS. Longman, 1994. 235 pp. £28.

Progress in Theoretical and Computational Fluid Mechanics. Edited by G. P. GALDI, J. MÁLEK and J. NECAS. Longman, 1993. 172 pp. £22.

Computational Methods for Fluid-Structure Interactions. Edited by J. M. CROLET and R. OHAYON. Longman, 1994. 281 pp. £32.

Complex Analysis and Its Applications. Edited by C. C. YANG, G. C. WEN, K. Y. LI and Y. M. CHIANG. Longman, 1994. 359 pp. £39.

Surveys in Fluid Mechanics, III. Edited by R. NARASIMHA. Indian Academy of Sciences, 1993. 367 pp. $30.

Computational Fluid Dynamics '94, Invited Lectures and Special Technological Sessions. Edited by S. WAGNER, J. PÉRIAUX and E. H. HIRSCHEL. John Wiley & Sons, 1994. 267 pp. £195 (with second volume).

Computational Fluid Dynamics '94, Proceedings. Edited by S. WAGNER, E. H. HIRSCHEL, J. PÉRIAUX and R. PIVA. John Wiley & Sons, 1994. 1029 pp. £195 (with first volume).

Numerical Simulation in Science and Engineering. Edited by M. GRIEBEL and C. ZENGER. Vieweg, 1994. 188 pp. DM78.