Buchbesprechungen – Book reviews – Notices bibliographiques

Mathematical Theory in Fluid Mechanics. By G. P. Galdi, J. Màlek and J. Necăs (eds), Pitman Research Notes in Mathematics 354 (Longman, Harlow, 1996). 134 pp., £ 25. - ISBN 0-582-29810-5.

This volume consists of four survey articles, which are based on series of lectures presented at the Fourth Winter School in Mathematical Theory in Fluid Mechanics, held in Raseky, Czech Republic in December 1995.

The first article by Jens Frehse and Michael Rủžička concerns weighted estimates for the stationary Navier–Stokes equations. These weighted estimates are estimates in weighted L^p-spaces where the weight function has a point singularity. The new estimates lead to improved regularity results for the stationary Navier–Stokes equations in five or more space dimensions. While this problem may seem academic, the authors point to some analogies between the steady five-dimensional and the time-dependent three-dimensional problem.

The second article by Konstantin Pileckas reviews known results and open problems associated with the Stokes and Navier–Stokes equations in domains with noncompact boundaries. The shape of outlets to infinity plays a crucial role, and several cases are discussed.

K. R. Rajagopal gives an introduction to theories modeling mixtures of two fluids or a fluid with solid particles. The articles discusses basic principles of continuum mechanics and thermodynamics, the formulation of (phenomenological) constitutive hypotheses for mixtures and boundary and interface conditions.

The final article by Ralf Kaiser and Wolf von Wahl is concerned with the energy stability method for the Taylor problem. The advantage of the energy stability method is that it can be used to show global stability to disturbances of arbitrary size; on the other hand, energy stability estimates are often "too conservative" and guarantee stability in much smaller range than where it actually holds. For axisymmetric disturbances in the small gap Taylor problem, the authors show how to construct an energy functional which can be used to show global stability for all Taylor numbers below the actual onset of instability.

The articles are well written expositions on topics of current interest in mathematical fluid dynamics. The book will be of interest to researchers in partial differential equations and fluid mechanics.

Michael Renardy

Partial Differential Equations in Classical Mathematical Physics. By I. Rubinstein and L. Rubinstein (Cambridge University Press 1994), 676 pp.; £60.-

This book has been designed especially for graduate students in applied mathematics, natural and engineering sciences.

It contains a very well selected combination of background material (where do the equations come from?), basic methods (how to solve the problems), and associated special topics (such as special functions, Hankel transform, asymptotic expansions).

It is written in a clear style and is certainly at the appropriate level for the audience the writers had in mind. I believe it is a very valuable book, and I would highly recommend it to anyone teaching a PDE course.

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