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Book Reviews

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BOOK REVIEWS

C. Cercignani: SLOW RAREFIED FLOWS, THEORY AND APPLICATION TO MICRO-ELECTRO-MECHANICAL SYSTEMS. Birkhäuser Verlag AG, Basel, 2006. ISBN 3-7643-7534-5, 180 pages, hardcover, price EUR 58,-.

The main topic of the book is *rarefied gas dynamics* which can be defined as the study of gas flows in which the distance between two subsequent collisions of a molecule (the so-called mean free path) is not negligible in comparison with the length typical for the surrounding structure.

As a tool for the study of the dynamics of rarefied gas the so-called *Boltzmann equation* is used. As a consequence, the theme of this book is mostly reduced to the study of the Boltzmann equation. Two approaches are presented: 1. Theoretical (Chapters 1–4); 2. Applicable (first section of Chapter 4 and Chapters 5–7).

More specifically, the contents of particular chapters is as follows.

After introducing the Boltzmann equation in Chapter 1, a survey of rigorous theorems on validity and existence is given in Chapter 2. The global existence of a weak solution for the Cauchy problem for the Boltzmann equation, first obtained by DiPerna and Lions in *Ann. Math.* 130 (1989), pp. 321–366, is established.

Chapter 3 is devoted to the basic existence theory for flows close to equilibria in an infinite expanse of gas or in a periodic box.

In Chapter 4 some realistic boundary conditions are imposed which correspond to the physical requirement that the molecules are assumed to be re-emitted by the surface (the boundary of a bounded domain) with negligible delay.

Chapter 5 deals with the techniques used to solve problems in a simple but extremely important case of slab geometry.

In Chapter 6, first the extension of the techniques to handle the linearized Boltzmann equation to the case of geometries different from a slab or a half-space is studied. The results on the general solution in the one-dimensional case, suitably modified, then give a general idea of the solution in three dimensions. Internal and external steady flows are discussed.

Chapter 7 is devoted to the recent contributions to rarefied lubrication theory with particular attention paid to memory effects. The first task of lubrication theory is to predict the pressure distribution and from it the load-carrying capacity.

Two-page index is included. The book will be useful to specialists in the mathematical theory of fluids. It can serve also those who are beginners in this area provided they have some erudition in mathematics on graduate level.

Ivan Straškraba

G. Darvas: SYMMETRY. Cultural-historical and Ontological Aspects of Science-Arts Relations; the Natural and Man-made World in an Interdisciplinary Approach. Birkhäuser Verlag AG, Basel, 2007. ISBN-13: 978-3-7643-7554-6, 508 pages, 420 illus., 66 in colour, softcover, price EUR 59.90.

This publication is not a research monograph aimed at mathematicians, but rather an accessible semi-popular book aimed at general audience. Indeed, one can find very few mathematical equations throughout the book and instead it abounds with explicit examples and beautiful illustrations. Preliminary knowledge concerning symmetry is not required and in fact one page is even devoted to the etymology of the word “symmetry”.

In the first, introductory, part the concept of symmetry is explained and historical survey of the use of this phenomenon over the ages is given.

Two sections of this part are also devoted to symmetry in geometrical and decorative art and to the golden section. The second part of the book is dedicated to interdisciplinary applications and discusses such topics as e.g. Fibonacci numbers, beauty, fivefold symmetry, tilings of the plane including Penrose and non-periodic tilings. The third section is devoted to symmetries of natural world and symmetries (and symmetry breakings) of physical laws. As an illustrative example, gauge invariance of the electromagnetic field is also discussed in detail. The fourth section discusses various topics on the long path between physical laws, chemistry, biology and human brain, and the final section is devoted to the appearance of symmetry in products of human consciousness.

Many aspects of symmetry are nicely illustrated by hundreds of figures, often using Escher works. A special section of the book is dedicated to illustrations in colours.

This book can serve as an excellent survey of the topic not only for mathematicians, physicists and engineers but also to experts and students in humanities.

Vojtěch Pravda