J. Fluid Mech. (1994), *vol.* 268, *pp.* 373–375

REVIEWS

Chaos, Dynamics and Fractals. An Algorithmic Approach to Deterministic Chaos. By J. L. McCauley. Cambridge University Press, 1993. 323 pp. £50 (hardback) or £16.95 (paperback).

During the last two decades the subject of the book has attracted the attention of specialists in many branches of physics, including fluid dynamics. Now it has become fashionable to use the sophisticated facilities of physical laboratories to study the delicate properties of flow systems with weak traces of stochasticity, and to compare the results with qualitative models adapted to the use of this technique. At the beginning much was expected of the application of this approach in studies of turbulence. The reviewer remembers hearing an early warning from A. N. Kolmogorov that this approach, effective for low-dimensional dynamical systems, is applicable only to a rather narrow class of flows in a narrow range of parameters. Developed fluid turbulence is too complicated to be described by low-dimensional dynamical systems, even those possessing chaotic solutions. However, this does not mean that such systems are not interesting. It is evident for instance that the possibilities of this approach are not sufficiently used in aeroelasticity. Therefore a book containing a short clear precise and sufficiently complete presentation of the subject and the available mathematical technique is needed, especially for newcomers. To a certain extent this book has such objectives, at least its first part.

The titles of the chapters are: 1. Flows in phase space; 2. Introduction to deterministic chaos; 3. Conservative dynamic systems; 4. Fractals and fragmentation in phase space; 5. The way to chaos by instability of quasiperiodic orbits; 6. The way to chaos by period doubling; 7. Introduction to multifractals; 8. Statistical mechanics of symbol sequences; 9. Universal chaotic dynamics; 10. Intermittence in fluid turbulence; 11. From flows to automata: chaotic systems as completely deterministic machines. Generally the presentation is clear and comprehensive, and the author has found unexpected fresh viewpoints for the presentation of the basic ideas. However, reading the book I had the impression that the author was too preoccupied with his tendency to present everything from the original unique viewpoint of iterated maps to reach this educational goal.

Apparently the author has done his best to explain turbulence in fluids. He even repeats (although with a different caption) a photograph of an ink droplet which has fallen into a water-filled container. He presents it both times as an illustration of the eddy cascade in the small-scale turbulence although in fact it has little to do with that. The driving force here is gravity, not the inertia force. In spite of the author's best intentions this chapter cannot be recommended for beginners in fluid mechanics, even those with high qualifications in other branches of physics. I had the same impressions about some other parts too, in particular when the important concept of multifractals is presented. Nevertheless for those who already know the subject it might be interesting to look at a new way of presentation, and perhaps use it for teaching purposes.

G. I. Barenblatt

SHORTER NOTICES

New Perspectives in Turbulence. Edited by L. SIROVICH. Springer, 1991. 367 pp. DM 98.

The 14 articles in this book are based on lectures presented at a meeting held in June 1989 at Salve Regina College, Newport, Rhode Island. The articles have been prepared with more care than the typical conference report, and in keeping with the broad title of the meeting they are expository in character. The meeting attracted a number of distinguished contributors to our present understanding of turbulence, and the articles are authoritative. Some are perhaps a little way-out, but the book makes good browsing, even if the 'perspectives' discussed are not all new.

Russian Journal of Engineering Thermophysics. Editor-in-Chief V. E. NAKORYAKOV. Published by the Institute of Thermophysics, 1991–. $95 per annual volume.

Many scientists from the West have visited the Institute of Thermophysics in Novosibirsk and have been impressed by the wide range of active research into problems of fluid mechanics of the kind that allows application in chemical and mechanical engineering. The Director of the Institute and his colleagues have now launched a new journal for the publication of papers in English in this broad field, primarily from authors in Russia. Four quarterly parts making one volume have been published in each of 1991, 1992 and 1993, with 4 or 5 papers in each part. The general standard appears to correspond with that of papers in the past from the various institutes in Novosibirsk associated with the Siberian Branch of the Russian Academy of Sciences. The FAX number of the editorial office is (3832) 357880.

The acute difficulties that scientists in the former Soviet Union have in obtaining foreign currency are well known. Virtually all subscriptions to journals published in the West from Russian institutes stopped in 1991. In the light of these difficulties the launching of the *Russian Journal of Engineering Thermophysics* seems to be a brilliant idea. It is to be hoped that this new journal sells well in the West and thereby generates foreign currency which Russians can use to subscribe to journals published in the West.

Turbulent Flows in Gas Suspensions. Edited by A. A. DOLINSKY. Hemisphere Publishing, 1990. 248 pp. £89.

This book is concerned with turbulent flow of a gas which contains small solid particles or liquid drops in suspension. Turbulent flow is a notoriously difficult subject for research; and two-phase flow, which has its own source of randomness and closure problems is likewise difficult. A team of four authors, with help from seven others, have written different parts of the book and have tried in particular to present work done in the former Soviet Union to readers in the West. However, it cannot be said to be readable and informative. Work at this level of difficulty needs to be spelt out with extreme care and concern for clarity, and with less reliance on models. The authors have also not been well served by their publisher; the translation from the Russian is poor (many Western names have not survived the translation into and out of Russian, e.g. Facsen, Quette, Bussinesc), and the setting of the numerous mathematical equations is ugly. Not a bargain at £89.

Annual Review of Fluid Mechanics, Vol. 26. Edited by J. L. LUMLEY and M. VAN DYKE. Annual Reviews Inc., 1994. 704 pp. $52.

The list of articles and authors in the current volume of this periodical is as follows:

A. N. Kolmogorov as a fluid mechanician and founder of a school in turbulence, by A. M. Yaglom.

Lagrangian PDF methods for turbulent flows, by S. B. Pope.

Dynamics of drop deformation and breakup in viscous fluids, by Howard A. Stone.

Wave evolution on a falling film, by Hsueh-Chia Chang.

High Rayleigh number convection, by Eric D. Siggia.

Vortex reconnection, by S. Kida and M. Takaoka.

Three-dimensional long water-waves phenomena, by T. R. Akylas.

Compressibility effects on turbulence, by Sanjiva K. Lele.

Double diffusion in oceanography, by Raymond W. Schmitt.

The physics of supersonic turbulent boundary layers, by Eric Spina, Alexander J. Smits and Stephen K. Robinson.

Premixed combustion and gasdynamics, by P. Clavin.

Climate dynamics and global change, by R. S. Lindzen.

Görtler vortices, by William S. Saric.

Physical mechanisms of laminar-boundary-layer transition, by Yury S. Kachanov.

Parallel simulation of viscous incompressible flows, by Paul F. Fischer and Anthony T. Patera.

Pulmonary flow and transport phenomena, by J. B. Grotberg.

Vortex interactions with walls, by T. L. Doligalski, C. R. Smith and J. D. A. Walker.

Dynamics of coupled ocean-atmosphere models: the tropical problem, by J. David Neelin, Mojib Latif and Fei-Fei Jin.

From Order to Chaos. Essays: Critical, Chaotic and Otherwise. By L. P. KADANOFF. World Scientific, 1993. 555 pp. £34.

This volume contains reprints of previously published papers by L. P. Kadanoff. The author is an eminent physicist who has contributed to important areas of statistical physics.

The papers are grouped for this publication into four sections: A. Fundamental issues in hydrodynamics, condensed matter and field theory; B. Scaling and phase transitions; C. Simulations, urban studies and social systems; D. Turbulence and chaos. For the reader of the *Journal of Fluid Mechanics* section D is obviously the most interesting, especially the paper with Bensimon, Liang, Shraiman & Tang, now famous, concerning Saffman–Taylor displacement flow in a Hele-Shaw cell. However, section B, where the reader can trace the development of the fundamental idea of the renormalization group is also very instructive. In fact the concept of the renormalization group is closely related to such concepts of mathematical physics and fluid mechanics as intermediate asymptotics, self-similarity of the second kind and incomplete similarity.

Publication of this volume will be very useful, especially for young readers. The papers disseminated over many journals acquire a new quality by being collected together. Readers not only can see a result in its final form, but also can trace its evolution.