

TURBULENCE AND STOCHASTIC PROCESSES

Kolmogorov's ideas 50 years on

*Compiled and edited by J.C.R. Hunt, O.M. Phillips
and D. Williams*

It is 50 years since the publication of A.N. Kolmogorov's paper in 1941, probably the most famous paper ever written on turbulence. This volume commemorates this and other papers which established many of the key ideas of probability theory, stochastic processes and turbulence. These have since found application in many areas of research, including the theory of the turbulent motions of fluids, diffusion theory, the theory of automata, and communication theory. In putting together this volume the editors asked their colleagues to review, in the context of recent research, Kolmogorov's different contributions. And because his original papers are so important and not widely available, translations of two of his 1941 papers and one 1942 paper on turbulence have been included.

Most of the fundamental problems in turbulence being investigated today were known to Kolmogorov, and he established lines of research which are still being followed and are attracting new methods of analysis. For example, Mandelbrot and Frisch here describe the recent ideas of multi-fractals and their use in understanding turbulence. Other contributions cover probability theory, small-scale turbulence, branching processes, fractal variables, general turbulent flows and turbulent combustion.

240 pages 1 coloured plate paperback ISBN 0 85403 441 2

First published in *Philosophical Transactions of the Royal Society*,
Series A, Vol 434, 1991

Price including packing and postage
£19.50 (UK addresses) £21.00 (Overseas addresses)

**The Royal Society,
6 Carlton House Terrace,
London SW1Y 5AG**

TECTONIC STRESS IN THE LITHOSPHERE

*Organized and edited by R.B. Whitmarsh, M.H.P. Bott, J. D. Fairhead and
N.J. Kusznir*

Tectonic stress in the Earth's lithosphere not only reflects the forces acting on the lithospheric plates, some of which are responsible for plate motion, but also controls the locations and magnitudes of natural phenomena which have a substantial impact on humankind's activities and well-being. This book covers observational techniques, whereby stress can be directly measured or inferred, as well as a variety of theoretical approaches which help to explain or predict observations. Contributors were asked by the organizers of the Discussion Meeting, held in April 1991, to write articles which review their chosen field; thus it is intended that this volume will be of use to those with a general interest in lithospheric stress as well as to specialists in the subject.

Lithospheric stress is discussed at a variety of scales. At the largest scale are the forces acting on whole plates and at their edges and the global balance of these forces. At least seven different forces have been identified which either drive the individual plates (slab pull, ridge push) or resist their motion (plate drag, etc.). The ridge-push force has a particularly important effect on intraplate tectonic stress, especially beneath oceanic areas. Special problems arise in explaining stress at transform plate boundaries and in some major mountain ranges. On the other hand observations at the Earth's surface, in boreholes or at greater depths (from earthquake focal mechanisms) detect the resultant of these numerous forces and their interpretation and resolution into component parts is also discussed in several papers. In some cases it is possible to make observations from which deductions about past tectonic stress can be made.

194 pages paperback ISBN 0 85403 448 X

First published in *Philosophical Transactions of the Royal Society*,
Series A, Vol. 337

Price including packing and postage
£19.50 (U.K. addresses) £21.00 (Overseas)

**The Royal Society,
6 Carlton House Terrace,
London SW1Y 5AG**

TURBULENT FLOW STRUCTURE NEAR WALLS

Compiled and edited by J.D.A. Walker

Over the past decade, considerable progress has been made in determining the nature of turbulent flow near walls. These advances have occurred through innovative new experimental methodologies, direct numerical simulations, and significant new theoretical developments. Many of these aspects are described in this volume.

Incompressible channel flow and the constant pressure turbulent boundary layer represent canonical bounded turbulent flows and here the emerging dynamical picture is that of a flow dominated by vortex motion and its effects (Grass *et al.*; Falco; Smith *et al.*). Note that a recent synopsis of the direct numerical simulations of turbulence is given elsewhere (S.K. Robinson, *A. Rev. Fluid Mech.* **23**, 601–639 (1991)). An objective assessment of direct numerical simulations is given by Zang, while Perry *et al.* describe a closure model based on flow structure concepts. As yet, the study of flow structure in non-canonical situations is in its infancy. However, there is reason to believe that similar physical phenomena occur (in modified form) in more complex environments. The situations discussed here are: (1) high-speed compressible boundary layers (Smits); (2) separated flows (Simpson); and (3) drag reducing flows (Harder & Tiederman).

175 pages

Paperback

ISBN 0 85403 442 0

First published in *Philosophical Transactions of the Royal Society*,
Series A, Vol. 336, 1991

Price including packing and postage
£19.50 (UK addresses) £21.00 (Overseas addresses)

The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG

Series A Volume 436 Number 1897 8 February 1992

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