

## **Applied Analysis of the Navier–Stokes Equations**

C. R. DOERING and J. D. GIBBON

An introductory physical and mathematical presentation of the Navier–Stokes equations, suitable as a text book for introductory courses in mathematical fluid dynamics. Includes new and recent results, bringing the reader to the forefront of research in the field.

£40.00 net HB 0 521 44557 4 231 pp. 1995

£14.95 net PB 0 521 44568 X

Cambridge Texts in Applied Mathematics 12

*Now in paperback*

## **Vortex Dynamics**

P. G. SAFFMAN

Vortex dynamics is a natural paradigm for the field of chaotic motion and modern dynamical system theory.

'... a major contribution to the literature of physical and mathematical vortex dynamics.'

*Science*

'attractive for students of fluid mechanics ... a valuable source of inspiration for teachers'

*Bulletin of the London Mathematical Society*

£17.95 net PB 0 521 47739 5 325 pp. 1995

Cambridge Monographs on Mechanics

## **Equivalence, Invariants and Symmetry**

PETER J. OLVER

This book presents an innovative synthesis of methods used to study problems of equivalence and symmetry which arise in a variety of mathematical fields and physical applications. It will be a valuable resource for students and researchers in geometry, analysis, algebra, mathematical physics and related fields.

£24.95 net HB 0 521 47811 1 541 pp. 1995

## **Acta Numerica 1995**

Edited by ARIEH ISERLES

*Acta Numerica* provides an annual compendium of the major advances in numerical mathematics. Highlights of this year's issue include articles on sequential quadratic programming, mesh adaptation, free boundary problems and particle methods in continuum computations.

£35.00 net HB 0 521 48255 0 497 pp. 1995

Acta Numerica 4

## **New Cambridge Statistical Tables**

Second Edition

D. V. LINDLEY and W. F. SCOTT

The latest edition of this authoritative set of tables has been improved by the addition of new tables.

The book contains all the tables likely to be required for elementary statistical methods in the social, business and natural sciences. It will be an essential aid for teachers, researchers and students in those subjects where statistical analysis has not been superseded by computers.

£3.50 net PB 0 521 48485 5 96 pp. 1995

Cambridge books are available from good bookshops, alternatively call UK + 44 (0)1223 325970 to order direct using your credit card, or fax UK + 44 (0)1223 315052. For further information please email Giulia Williams on [science@cup.cam.ac.uk](mailto:science@cup.cam.ac.uk) See also <http://www.cup.cam.ac.uk>



**CAMBRIDGE**  
UNIVERSITY PRESS

The Edinburgh Building, Cambridge CB2 2RU

# Journal of Fluid Mechanics

**Editor-in-Chief:** G. K. BATCHELOR, FRS  
*Emeritus Professor of Applied Mathematics,*  
*University of Cambridge*

*Journal of Fluid Mechanics* publishes authoritative articles covering theoretical, numerical and experimental investigations of all aspects of the mechanics of fluids. Each of the twice monthly volumes contains papers on both the fundamental aspects of fluid mechanics, and their applications to other field, such as

- aeronautics • astrophysics • meteorology
- oceanography • volcanology • colloid science • hydraulics • chemical engineering
- mechanical and civil engineering • acoustics

In addition to original research, the journal includes reviews of books and films relevant to the field.

*Journal of Fluid Mechanics* is of vital importance to all those who are working and researching in the field of fluid mechanics, an area that touches many of the engineering and geophysical disciplines.

## Recent Articles

Free convection in an electrochemical system with nonlinear reaction kinetics, F. H. BARK & F. ALAVYOON

A study of non-parallel and nonlinear effects on the localized receptivity of boundary layers, J. D. CROUCH & P. R. SPALART

Sedimentation and sediment flow in settling tanks with inclined walls, B. KAPOOR & A. ACRIVOS

Strongly nonlinear interfacial dynamics in core-annular flows, V. KERCHMAN

On the equilibrium and stability of a row of point vortices, H. AREF

Critical microjets in collapsing cavities, M. S. LONGUET-HIGGINS & H. OGUZ

Finite-amplitude three-dimensional instability of core-annular flow, H. H. HU & N. PATANKAR

An experimental study of a three-dimensional pressure-driven turbulent boundary layer, S. M. ÖLÇMEN & R. L. SIMPSON

## Subscription details:

Volumes 306–329 twice monthly.  
£744 for institutions; £382 for individuals; airmail £182 per year extra. ISSN 0022-1120

Please send me a free sample copy of *Journal of Fluid Mechanics*

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Send this coupon to: Journals Marketing Department, Cambridge University Press, FREEPOST\*, The Edinburgh Building, Cambridge CB2 1BR, UK (\*No postage stamp necessary if posted in the UK)

In USA, Canada & Mexico, write to Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA



**CAMBRIDGE**  
UNIVERSITY PRESS

**CAMBRIDGE**

## **The Mathematics of Financial Derivatives**

A Student Introduction

P. WILMOTT, S. HOWISON and J. DEWYNNE

The authors describe the modelling of financial derivative products from an applied mathematician's viewpoint, from modelling through analysis to elementary computation. A unified approach to modelling derivative products as partial differential equations is presented, using numerical solutions where appropriate. Over 140 exercises are included, making this suitable for an advanced undergraduate text.

£14.95 net PB 0 521 49789 2 328 pp. 1995

## **Ocean Acoustic Tomography**

W. MUNK, P. WORCESTER and C. WUNSCH

This volume presents the underlying oceanography and mathematics necessary to understand and develop a practical system of transmitters and receivers to interpret the behaviour of the oceans. A valuable resource for applied mathematicians and engineers interested in applications of fluid mechanics tools.

£45.00 net HB 0 521 47095 1 447 pp. 1995

*Now in paperback*

## **Group Theory and Physics**

S. STERNBERG

This textbook, based on courses taught at Harvard University, is a cohesive and well motivated introduction to group theory and its application to physics. Many modern topics are dealt with, making this an essential resource for senior undergraduate students and their teachers in physics and applied mathematics.

£19.95 net PB 0 521 55885 9 448 pp. 1995

## **Asymptotic Efficiency of Nonparametric Tests**

YAKOV NIKITIN

This monograph is the first unified treatment of an indispensable technique for comparing statistical tests, especially in nonparametric statistics. It presents powerful new methods to evaluate explicitly different kinds of efficiencies. Many Russian results are published here for the first time in English.

£32.50 net HB 0 521 47029 3 288 pp. 1995

## **Generalised Euler–Jacobi Inversion Formula and Asymptotics Beyond All Orders**

V. KOWALENKO, N. E. FRANKEL, L. GLASSER and T. TAUCHER

This work presents exciting new developments in understanding the subdominant exponential terms of asymptotic expansions which have previously been neglected. All researchers interested in the fascinating area of exponential asymptotics will find this a most valuable book.

£19.95 net PB 0 521 49798 1 141 pp. 1995

London Mathematical Society Lecture Note Series 214

Cambridge books are available from good bookshops, alternatively call UK + 44 (0)1223 325970 to order direct using your credit card, or fax UK + 44 (0)1223 315052. For further information please email Giulia Williams on [science@cup.cam.ac.uk](mailto:science@cup.cam.ac.uk) See also <http://www.cup.cam.ac.uk>



**CAMBRIDGE**  
UNIVERSITY PRESS

The Edinburgh Building, Cambridge CB2 2RU

# Mathematical Structures in Computer Science

## Editor-in-Chief

G. Longo, *Laboratoire d'Informatique (CNRS) et DMI, Ecole Normale Supérieure, 45 rue d'Ulm, 75005, Paris (email: longo@dmi.ens.fr)*

## Associate Editors

P. L. Curien, *LIENS, 45 rue d'Ulm, 75230 Paris (email: curien@dmi.ens.fr)*

A. M. Pitts, *Computer Laboratory, University of Cambridge, Pembroke St, Cambridge CB2 3QG*

**Mathematical Structures in Computer Science (MSCS)** is a new journal of excellence in theoretical computer science which focuses on the application of ideas from the structural side of mathematics and mathematical logic to computer science. The journal bridges the gap between theoretical contributions and software design, publishing original papers or broad surveys with original perspectives in all areas of computing, provided that ideas or results from algebra, geometry or category theory form a basis for the work.

MSCS is distinct from existing titles in that it specialises in the art of applying mathematics of genuine interest and general applicability to computer science; its objective is to promote the useful application of high level mathematics to language design and software implementation. The journal increases the circulation of new results in this fast growing area.

## Essential reading for:

- Mathematicians with interests in computer science
- Theoretical computer scientists
- Computer scientists working in language development or formal methods

## Subscription information

*Mathematical Structures in Computer Science*, Volume 6, 1996: February, April, June, August, October and December 1996: £144. Delivery by airmail £22.00 per year extra. ISSN 0960-1295

## Recent articles

The glueing construction and lax limits

HAROLD SIMMONS

Dynamic labeled 2-structures

A. EHRENFUCHT AND G. ROZENBERG

Interaction Systems I: The theory of optimal reductions

ANDREA ASPERTI AND COSIMO LANEVE

Languages under concatenation and shuffling

STEVEN T. TSCHANTZ

## Take a closer look – FREE!

Please send me a free sample copy of **Mathematical Structures in Computer Science**

Please send me further information

Name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Send to:

Journals Marketing Department, Cambridge University Press, FREEPOST\*, The Edinburgh Building, Cambridge, CB2 1BR, UK.

Tel: +44 (0)1223 325806 Fax: +44 (0)1223 315052

Email: journals\_marketing@cup.cam.ac.uk

(\*no postage stamp necessary if posted in UK)

In USA, Canada & Mexico, write to: Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA.



**CAMBRIDGE**  
UNIVERSITY PRESS

#### INSTRUCTIONS TO AUTHORS

*Submission of manuscripts* Papers may be submitted to any member of the editorial board. Three copies should be sent; originals of figures should *not* be included until the paper has been accepted. Upon acceptance of a paper, the author will be asked to transfer copyright to the publisher. Papers may be submitted electronically by sending a LaTeX file to [EJAM@VAX.OX.AC.UK](mailto:EJAM@VAX.OX.AC.UK); this file should include the figures (line figures only). Electronic communications can also be used for minor corrections and for messages to the editors.

*Layout of manuscripts* Papers should be typewritten in **double spacing throughout**, on one side of the paper. Please avoid footnotes if possible. Papers must begin with an abstract of not more than 300 words, and they should end with a brief concluding section. The SI system of units must be used throughout. There is no formal restriction on length, but the constraint of fitting an integral number of papers into 96 pages means that short papers (20 typed pages or fewer) are likely to appear sooner than the long ones.

*Illustrations* Figures should be drawn in indian ink on good quality white paper or produced by computer to comparable quality. Wherever possible they will be reproduced *with* the author's lettering. A list of captions for figures should be attached separately.

Where appropriate, articles may be illustrated by photographs: high-quality glossy black and white prints are necessary.

*References* References should be listed in alphabetical order at the end of the main text. Please include the article title in the reference, which should be in the order: author's surname, initials; year in parentheses; article title; journal name, abbreviated in accordance with the *World List of Scientific Periodicals* (4th Edn); volume number (underlined); inclusive page numbers.

*Citations in the text* Any unambiguous system is acceptable. Three recommended ways of citing a 1992 paper by A. European are: European (1992); European [Eu]; European [7]. In the second case, the reference at the end of the text should be preceded by [Eu], and in the third by [7]. Please note that in the third system, alterations may lead to wholesale renumbering.

#### EDITORIAL POLICY

The **European Journal of Applied Mathematics** aims to publish papers in all areas of applied mathematics, with especial emphasis on the following.

(i) **The exposition of new mathematical ideas relevant to the modelling and analysis of modern technological processes.**

(ii) **The development of interesting mathematical methods with broad areas of applicability.**

There is no restriction in the areas of applicability or the style of mathematics as long as the content is presented so as to be as accessible as possible to the entire community of mathematicians and mathematical scientists. This applies in particular to the introductory section of the paper. Standard mathematical techniques will only be published if they are associated with novel applications or lead to substantial advances in established problem areas.

Information on the *European Journal of Applied Mathematics* and all other Cambridge journals is available on <http://www.cup.cam.ac.uk/> and in North America on <http://www.cup.org/>.

#### COPYING

This journal is registered with the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA. Organisations in the USA who are also registered with the C.C.C. may therefore copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to C.C.C. of the per-copy fee of \$11.00. This consent does not extend to multiple copying for promotional or commercial purposes. Code 0956-7925/96 \$11.00 + .10.

Organisations authorised by the Copyright Licensing Agency may also copy material subject to the usual conditions.

*ISI Tear Sheet Service*, 3501 Market Street, Philadelphia, Pennsylvania 19104, USA, is authorised to supply single copies of separate articles for private use only.

*For all other use*, permission should be sought from the Cambridge or the American Branch of Cambridge University Press.

© Cambridge University Press 1996

CAMBRIDGE UNIVERSITY PRESS

The Pitt Building, Trumpington Street, Cambridge CB2 1RP

40 West 20th Street, New York, NY 10011-4211, USA

10 Stamford Road, Oakleigh, Melbourne 3166, Australia

*European Journal of*  
**Applied Mathematics**

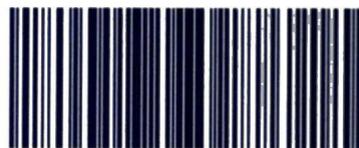
VOLUME 7 · PART 1 · FEBRUARY 1996

**CONTENTS**

Fluid flow in a medium distorted by a quasiconformal map can produce fractal boundaries	page 1
O. MARTIO and B. ØKSENDAL	
Asymptotic behaviour of functional-differential equations with proportional time delays	11
Y. LIU	
Convergence of a numerical method in mathematical spontaneous potential well-logging	31
Y. ZHOU and Z. CAI	
Non-equilibrium imbibition of a porous block	43
A. GILMAN	
Convergence of attractors for the simplified magnetic Bénard equations	53
H. IMAI, N. ISHIMURA and M. NAKAMURA	
Existence of solutions for elastohydrodynamic piezoviscous lubrication problems with a new model of cavitation	63
G. BAYADA, M. EL ALAOU TALIBI and C. VÁZQUEZ	
On the solution of a class of polydisperse spray problems	75
F. ANIDJAR, J. B. GREENBERG and Y. TAMBOUR	

*Printed in Great Britain by the University Press, Cambridge*

**CAMBRIDGE**  
**UNIVERSITY PRESS**



0956-7925(199602)7:1;1-R