Editors

Professor Cedric Taylor

Department of Civil Engineering, University of Wales Swansea, Swansea, SA2 8PP, U.K.

Dr. Philip M. Gresho

Lawrence Livermore National Laboratory, P.O. Box 808, L-262, Livermore, California 94551-9900, U.S.A.

Advisory Editors

Professor O. C. Zienkiewicz

Department of Civil Engineering, University of Wales Swansea, Swansea, SA2 8PP, U.K.

Editorial Board

K. J. Bai

Department of Naval Architecture and Ocean Engineering, Seoul National University, Seoul 151-742, Korea.

A. J. Baker

University of Tennessee, Department of Engineering Science and Mechanics, 317 Perkins Hall, Knoxville, Tennessee 37916, U.S.A.

M. Bercovier

Institute of Computer Science, The Hebrew University of Jersusalem, Ross Bidg, Givat Ram, Jerusalem 91904, Israel.

P. Bettess

Department of Naval Architecture and Shipbuilding, University of Newcastle upon Tyne, Queen Victoria Road, Newcastle upon Tyne, NE1 7RU, U.K.

G. de Vahl Davis

School of Mechanical and Industrial Engineering, The University of New South Wales, P.O. Box 1, Kensington, N.S.W., Australia 2033.

J. Donea

Applied Mechanics Division, Joint Research Centre, Ispra Establishment, 21020 Ispra (Varese), Italy

D. J. Evans

Department of Computer Studies, University of Technology, Loughborough, Leicestershire, U.K.

J. H. Ferziger

Mechanical Engineering Department, Stanford University, Stanford, CA 94305, U.S.A.

B. A. Finlayson

Dept. of Chemical Engineering, BF-10, University of Washington, Seattle, Washington 98195, U.S.A.

D. K. Gartling

Fluid Mechanics and Heat Transfer Division 5511, Sandia Laboratories, Albuquerque, New Mexico 87115, U.S.A.

R. Glowinski

Department of Mathematics, University of Houston, Houston, TX 77004, U.S.A.

D. F. Griffiths

Department of Mathematics, University of Dundee, Dundee DD1 4HN, Scotland.

W. G. Habashi

Department of Mechanical Engineering, Concordia University, 1455 de Maissonneuve Rlvd. West Montreal, Quebec H3G 1M8, Canada

International Journal for Numerical Methods in **FLUIDS**

Professor R. H. Gallagher

University of Arizona, Tucson, AZ 85721, U.S.A.

T. J. R. Hughes

Division of Applied Mechanics, Stanford University, Stanford, California 94305, U.S.A.

A. G. Hutton

Nuclear Electric Plc, Berkeley Nuclear Laboratories, Berkeley, Gloucestershire, U.K.

M. ikegawa

Mechanical Engineering Research Laboratory, Hitachi Ltd., 502 Kandatsu-machi, Tsuchiura-shi, Ibaraki-ken 300, Japan.

A. Jameson

Aerospace Engineering D-302D, Engineering Quadrangle, Princeton University, Princeton, NJ 08544, U.S.A

M. Kawahara

Chuo University, Department of Civil Engineering, Kasuga 1-chome 13, Bunkyo-ku, Tokyo, Japan.

R. L. Lee

Lawrence Livermore Laboratory, Atmospheric and Geophysical Science Division, Physics Department, University of California, Livermore, California 94550, U.S.A.

B. P. Leonard

Department of Mechanical Engineering, The University of Akron, Akron, OH 44325, U.S.A.

J. N. Lillington

A.E.E. Winfrith, Dorchester, Dorset DT2 8DH, U.K

Y. W. Ma

Institute of Mechanics Chinese Academy of Sciences, 15 Zhong Guan Cun Road, Beijing 100080, China.

U. Meissner

T H Darmstadt, Institüt für Numerische Methoden und Informatik im Bauwesen, Petersenstrasse 13,

D-64287 Darmstadt. Germany.

K. W. Morton

Numerical Analysis Group, Oxford University Computing Laboratory, 8~11 Keble Road, Oxford OX1 3QD, U.K.

J. T. Oden

Texas Institute for Computational and Applied Mathematics (TICAM), The University of Texas at Austin, Taylor Hall 2400, Austin, Texas 78712, U.S.A.

M. D. Olson

The University of British Columbia, Department of Civil Engineering, 2075 Wesbrook Place, Vancouver British Columbia, Canada V6T 1W5.

G. F. Pinder

The University of Vermont, College of Engineering and Mathematics, 101 Votey Building, Burlington, Vermont 05405-0156, U.S.A.

O. Pironneau

Institut National de Recherche en Informatique et en Automatique, Domaine de Voluceau, Rocquencourt BP 105-78153 Le Chesnay Cedex, France.

C. V. Ramakrisna

Department of Applied Mechanics, Indian Institute of Technology, Hauz Khas, New Delhi 110016. india.

J. N. Reddy

Department of Mechanical Engineering, Texas A&M University, College Station, Texas 77843-3123, U.S.A.

P. J. Roache

Ecodynamics, Research Associates Inc., P.O. Box 8172, Albuquerque, New Mexico 87108, U.S.A

Department of Aerospace Engineering, University of Michigan, Ann Arbor, Michigan 48109, U.S.A.

R. L. Sani

Department of Chemical Engineering, University of Colorado, Campus Box 424, Boulder, Colorado 80309, U.S.A.

L. E. Scriven

University of Minnesota, Department of Chemical Engineering and Materials Science, 421 Washington Avenue, SE, Minneapolis, MN 55455-0132, U.S.A.

Cornell University, Sibley School of Mechanical and Aerospace Engineering, Upson and Grumman Halls, Ithaca, New York 14853, U.S.A.

D. B. Spalding

Imperial College of Science and Technology, Department of Mechanical Engineering, Exhibition Road, London SW7 2BX, U.K.

R. L. Taylor

University of California, Department of Civil Engineering, Berkeley, California 94720, U.S.A.

T. E. Tezduyar

Aerospace Engineering and Mechanics Department, 107 Aderman Hall, 110 Union Street, SE, University of Minnesota, Minneapolis, Minnesota 55455, U.S.A.

J. R. Whiteman

Director, Institute of Computational Mathematics, Brunel University, Uxbridge, Middlesex UB8 3PH, U.K.

Theoretical Physics Division, Harwell Laboratory, Didcot, Oxon OX11 0RA, U.K.

M. Wolfshtein

Technion University, Aero Engineering Department, Haifa, Israel.

Cover inset: snapshot of vorticity field for Re = 250—courtesy of Dr. Mark Christon of Lawrence Livermore National Laboratory.

Advertising: To advertise in this journal or to rent the subscription list contact: Caroline Melling, Non-subscription Sales Manager, John Wiley & Sons, Ltd., Baffins Lane, Chichester, West Sussex, PO19 1UD, UK. Telephone: 44 (0)1243 770351, Fax 44 (0)1243 770429, Email: info-assets@wiley.co.uk
Reprints: Bulk reprints of articles published in this journal are available to order. Please contact the above address.

Advertising: Advertising Sales Department, John Wiley & Sons Inc, 605 Third Avenue, New York, NY 10158-0012, USA. Telephone: (212) 850 8832, Fax: (212) 850 8888. Reprints: The Reprint Department, John Wiley & Sons Inc, 605 Third Avenue, New York, NY 10158-0012, USA. Telephone: (212) 850 8776.

To subscribe: International Journal for Numerical Methods in Fluids (ISSN 0271-2091/USPS 586-530) is published semi-monthly by John Wiley & Sons Limited, Baffins Lane, Chichester, Sussex, England. 1996 subscription prices: U.S. \$1595.00; bona fide personal subscriptions to UK £675.00; elsewhere U.S. \$1200.00 Second class postage paid at Jamaica, NY 11431. Air Freight and mailing in the U.S.A. by Publications Expediting Services Inc., 200 Meacham Avenue, Elmont, NY 11003. Orders should be addressed to: Subscriptions Department, John Wiley & Sons Limited, Baffins Lane, Chichester, Sussex, PO19 110D, England. Copyright © 1996 by John Wiley & Sons Ltd. Typeset in the U.K. by Techset Composition, Ltd, Salisbury, Wilishire, Printed and bound in Great Britain by Page Bros, Norwich, Printed on acid-free paper. For further subscription information: please contact Journals Administration Department, John Wiley & Sons, Ltd., 1 Oldlands Way, Bognor Regis, West Sussex, PO29 9SA, UK. Telephone: +44 (0)1243 843288; fax: +44 (0)1243 843232.

U.S.A. POSTMASTER: Send address changes to International Journal for Numerical Methods in Fluids, c/o Publications Expediting Services Inc., 200 Meacham Avenue, Elmont, NY 11003.