

**Professor Cedric Taylor**  
*Department of Civil Engineering,  
 University of Wales,  
 Swansea, 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, U.K.*

# International Journal for Numerical Methods in FLUIDS

**Professor R. H. Gallagher**  
*Clarkson University, Potsdam, New York, NY 13676,  
 U.S.A.*

**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**  
*Division of Applied Mathematics,  
 School of Applied Science and  
 Technology, The Hebrew University of  
 Jerusalem, Givat Ram, Jerusalem,  
 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 Maisonneuve Blvd. West,  
 Montreal, Quebec H3G 1M8, Canada.*

**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.F. 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**  
*Universität Hannover,  
 Lehrstuhl für Stromungsmechanik,  
 Callinstr. 32, D-3000 Hannover,  
 West Germany.*

**K. W. Morton**  
*Numerical Analysis Group,  
 Oxford University Computing  
 Laboratory, 8-11 Keble Road,  
 Oxford OX1 3QD, U.K.*

**J. T. Oden**  
*Engineering Mechanics,  
 The University of Texas at Austin,  
 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. Ramakrishna**  
*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.*

**P. Roe**  
*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.*

**S. F. Shen**  
*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.*

**K. H. Winters**  
*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:** For details contact—

Michael J. Levermore, Advertisement Sales, John Wiley & Sons Ltd., Baffins Lane, Chichester, Sussex, PO19 1UD, England (Telephone 0243 770351; fax 0243 775878; telex 86290).

**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. 1994 subscription prices: U.S. \$1225.00; bona fide personal subscriptions to UK £590.00; elsewhere U.S. \$915.00. 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 1UD, England. Copyright © 1994 by John Wiley & Sons Ltd. Typeset in the U.K. by Techset Composition. Ltd, Salisbury, Wiltshire. Printed and bound in Great Britain by Page Bros, Norwich. Printed on acid-free paper.

**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.