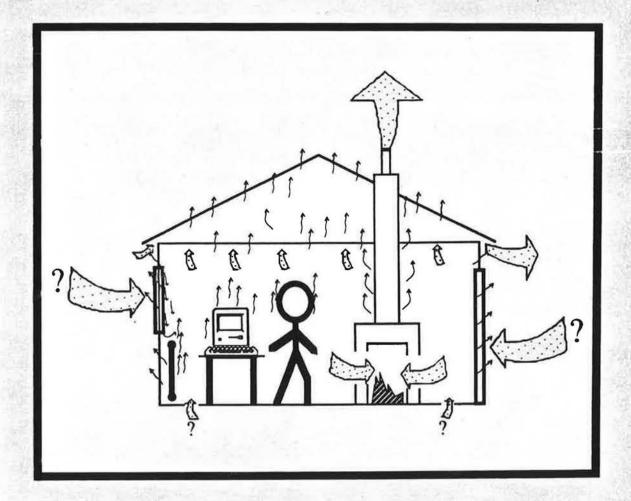
# **IMechE**

# Computational fluid dynamics - tool or toy?





Papers presented at a Seminar organized by the Environmental Engineering Group of the Institution of Mechanical Engineers and held at the Institution of Mechanical Engineers on 26 November 1991.



## **Environmental Engineering Group Committee**

- C. E. Smith, MA, MSc, CEng, MIMechE, MIHospE (Chairman)
- P. E. Baldrey, BSc, FEng, FIMechE, MiLE (Vice Chairman)
- H. Dawson
- T. C. Dwyer, BSc, CEng, MIMechE, MCIBSE
- A. N. Jackson, BTech(Hons), CEng, MIMechE, FCIBSE
- J. Lewin, CEng, FICE, FIMechE, FIWEM, MConsE
- F. A. Mills, BSc(Hons), CEng, FCIBSE, MIMechE, MASHRAE
- A. F. R. Newton, BSc(Chem), BSc(Mech Eng)

- A. O. Page, BA, CEng, MInstR
- J. R. Platts, BSc(Eng), CEng, FIMechE, FIEE, FCIBSE (Vice Chairman)
- A. Porteous, BSc, MEng, DEng, CEng, FIMechE, MIChemE, FIWM
- K. Ratcliffe, BSc, MIMechE
- J. Roberts, BSc, PhD, CEng, CPhys, MIOE, MCIBSC, MIOA, MIGasE, MIPhys
- J. Taylor, CEng, MIMechE
- R. P. Went, BSc, CEng, MIMechE
- A. E. D. Wilson, MSc, CEng, MIMechE

### Seminar Adviser

T. C. Dwyer, BSc, CEng, MIMechE, MCIBSE Institute of Environmental Engineering Polytechnic of the South Bank

# COMPUTATIONAL FLUID DYNAMICS

for the Environmental and Building Services Engineer

# - TOOL OR TOY?

Papers presented at a Seminar organized by the Environmental Engineering Group of the Institution of Mechanical Engineers and held at the Institution of Mechanical Engineers on 26 November 1991.



Published by
Mechanical Engineering Publications Limited for
The Institution of Mechanical Engineers
LONDON

#### C The Institution of Mechanical Engineers 1991

This publication is copyright under the Berne Convention and the International Copyright Convention. All rights reserved. Apart from any fair dealing for the purpose of private study, research, criticism or review, as permitted under the Copyright, Designs and Patents Act, 1988, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission of the copyright owners. Reprographic reproduction is permitted only in accordance with the terms of licences issued by the Copyright Licensing Agency, 90 Tottenham Court Road, London W1P 9HE. Unlicensed multiple copying of the contents of the publication without permission is illegal. Inquiries should be addressed to: The Managing Editor, Mechanical Engineering Publications Limited.

Authorization to photocopy items for personal or internal use, or the internal or personal use of specific clients, is granted by the Institution of Mechanical Engineers for libraries and other users registered with the Copyright Clearance Center (CCC), provided that the base fee of \$2.00 per paper plus \$0.05 per page is paid direct to CCC, 21 Congress Street, Salem, Ma 01970, USA. This authorization does not extend to other kinds of copying such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. No copying fees are payable for papers published prior to 1978.

0957-6509/91 \$2.00 + .50.

ISBN 0 85298 790 0

A CIP catalogue record for this book is available from the British Library.

The publishers are not responsible for any statement made in this publication. Data, discussion and conclusions developed by authors are for information only and are not intended for use without independent substantiating investigation on the part of potential users. Opinions expressed are those of the authors (or contributors to discussion) and are not necessarily those of the Institution of Mechanical Engineers or its publishers.

Printed by Waveney Print Services Ltd, Beccles, Suffolk

## **CONTENTS**

Getting started with CFD  N. S. J. Fawcett	1
Thermo-fluid analysis in the built environment: expectations and limitations F. Alamdari	5
Calculation of buoyant air movement in buildings — proposals for a numerical benchmark test J. J. McGuirk, and G. E. Whittle	13
Applications of computational fluid dynamics in building services engineering A. A. Setrakian, D. J. McLean, and D. A. Morgan	33
The use of CFD techniques for the assessment and improvement of a workshop ventilation system S. T. Awolesi, H. B. Awbi, M. J. Seymour, and R. A. Hiley	39
Air flow analysis for large spaces in an airport terminal building: computational fluid dynamics and reduced-scale physical model tests R. M. H. Yau, and G. E. Whittle	47
The effect of air inlet location on the ventilation of an auditorium B. Vazquez, M. Samano, and M. Yianneskis	56
Computational fluid dynamics in ventilation H. B. Awbi, and G. Gan	67
Microclimate performance of an open atrium office building: a case study in themo-fluid modelling F. Alamdari, S. C. Edwards, and G. P. Hammond	81
If you don't like the graphics, go home and watch the radio N. Rhodes	93
The role of CFD modelling in design for safety and environmental management S. V. Emslie	99

# Safety Developments in the Offshore Oil and Gas Industry

Offshore platforms are potentially an extremely hazardous environment. Therefore the improvement of the safety factors in offshore production platforms is of vital importance and involves areas such as the design, engineering and construction of these installations. An international conference on this subject was organised by the IMechE in April 1991, and covered such topics as the human dimension in offshore safety, materials for safe platforms and legislating for safer engineering design.

Complete contents: Safety is good engineering; Hollistic safety engineering from an authority point of view; Increasing safety awareness through high profile legislation - a Norwegian continental shelf offshore project experience; Overpressure protection on an oil-producing platform: an evolving situation: The functional and safety aspects of the location of submarine pipeline risers; Offshore platform safety shut-down system effectiveness; Certification of explosion protected electrical equipment; The regulatory implications of the use of glass reinforced plastics as a structural material in platform topsides; A review of the fatigue integrity maintenance of offshore structures; Quality management offshore; A review of human factors guidance applicable to the design of offshore platforms; Designing a safer and more efficient drill floor: the human factors contribution; The effect of improved platform design on emergency evacuation requirements; The role of predictive analysis in offshore safety; A structured approach to hazard assessment; The double-edged sword of objective regulations.

0 85298 763 3/297 x 210mm/softcover/approx 160 pages/April 1991 £49.00 inclusive of postage and packing within the UK. Overseas customers please add 10% for delivery. Orders and enquiries to: Sales Department, Mechanical Engineering Publications Limited, Northgate Avenue, Bury St Edmunds, Suffolk, IP32 6BW, England. Telephone: 0284 763277 Fax: 0284 704006 Telex: 817376

## **Engineering for Profit from Waste**

The great emphasis at the moment on safeguarding the environment from pollution, means that engineers and waste managers must find acceptable solutions to the problem of the safe disposal of industrial, municipal and agricultural wastes. The possibility of recycling waste by using landfill gas for power generation or refuse-derived fuel for heating, is also a consideration. This volume records the proceedings of the third European conference on this important subject which was held in Dusseldorf in April 1991.

Contents include: An up-to-date waste incineration concept for optimal waste destruction; Twenty-five years of electricity and district heat co-generation from thermal waste processing; A novel sludge dewatering process using woven tubular fabric; Power generation from landfill gas; Recyling for profit; Flue gas cleaning - a must for ensuring public acceptance of refuse incineration plants; Environmental control and energy recovery of landfill gas: a conflict of interests? Energy efficient control of volatile organic compounds.

0 85298 762 5/297 x 210mm/softcover/approx 200 pages/April 1991 £73.00 inclusive of postage and packing within the UK. Overseas customers please add 10% for delivery.

Orders and enquiries to: Sales Department, Mechanical Engineering Publications Limited, Northgate Avenue, Bury St Edmunds, Suffolk, IP32 6BW, England.

Tel: 0284 763277 Fax: 0284 704006 Telex: 817376

