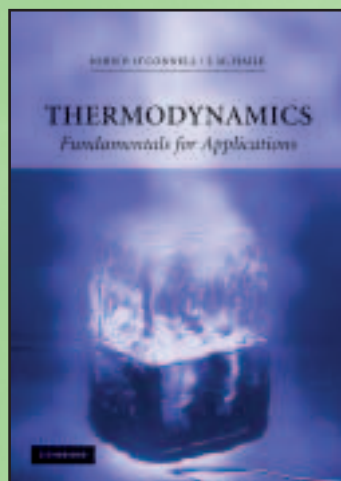


Chemical Engineering



Thermodynamics

Fundamentals for Applications

John P. O'Connell

University of Virginia, USA

and J. M. Haile

Macatea Productions, South Carolina, USA

A thermodynamics textbook for graduate students in chemical engineering which develops the fundamentals of thermodynamics and applies them to thermodynamic properties, phase equilibria and chemical reaction equilibria, especially for fluid mixtures. Unlike other texts, this book develops fundamental thermodynamics in a complete and rigorous fashion using patterns of knowledge and procedure before extensive applications to engineering situations. Although unconventional, this approach usually leads to a more satisfying and thorough learning experience for students and instructors.

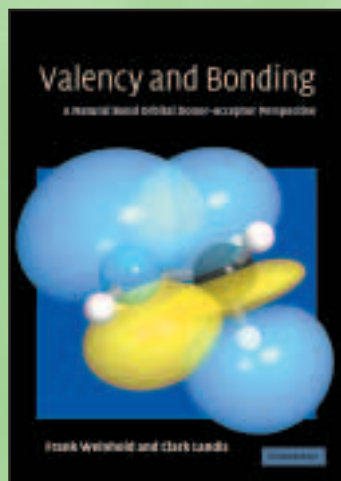
Features

- Includes many worked examples and homework problems along with explicit problem-solving strategies
- Helps students unify the material by emphasizing recurring patterns in thermodynamics, and relating thermodynamics to molecular theory, laboratory experiment, and engineering practice
- A unique approach that fully develops fundamentals before applications with consistent emphasis on conceptual patterns for more effective and efficient learning

Contents

Part I. The Basics: 1. Primitives; 2. The first and second laws; 3. Fundamental relations; Part II. Single-Phase Systems: 4. Properties relative to ideal gases; 5. Properties relative to ideal solutions; 6. Relations among relations; Part III. Multiphase and Reacting Systems: 7. Transfers, transformations, and equilibria; 8. Criteria for observability; 9. Phase diagrams for real systems; Part IV. Engineering Calculations: 10. Options for equilibrium calculations; 11. Elementary computational procedures; 12. Selected applications; Afterward; Appendices.

June 2005 672pp 172 illustrations 287 exercises
0 521 58206 7 Hardback £55.00



Valency and Bonding

A Natural Bond Orbital Donor-Acceptor Perspective

Frank Weinhold

and Clark Landis

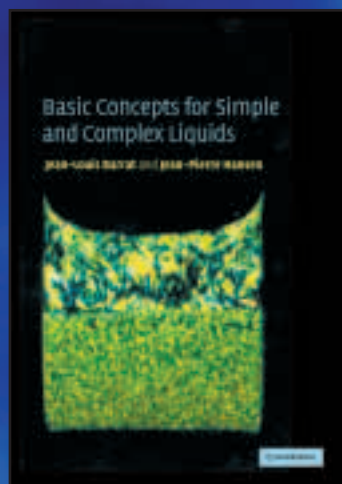
Both from University of Wisconsin, Madison, USA

Presenting a comprehensive overview of modern chemical valency and bonding theory, written by internationally recognised experts in the field. The authors build on the foundation of Lewis- and Pauling-like localized structural and hybridization concepts to present a book that is directly based on current ab-initio computational technology. The presentation is highly visual and intuitive throughout. Hundreds of orbital illustrations help to convey the essence of modern NBO concepts for those with little background in the mathematical machinery of quantum mechanics.

Contents

Part I. Introduction and Theoretical Background; Part II. Electrostatic and Ionic Bonding; Part III. Molecular Bonding in the S/P-Block Elements; Part IV. Molecular Bonding in the D-Block Elements; Part V. Supramolecular Bonding.

June 2005 694pp 326 illustrations 51 worked examples
0 521 83128 8 Hardback £60.00



Basic Concepts for Simple and Complex Liquids

Jean-Louis Barrat

Université Lyon, France

and Jean-Pierre Hansen

University of Cambridge, UK

Presenting a unified approach, which focusses on the concepts and theoretical methods that are necessary for an understanding of the physics and chemistry of the fluid state. The authors do not attempt to cover the whole field in an encyclopedic manner. Instead, important ideas are presented in a concise and rigorous style, and illustrated with examples from both simple molecular liquids and more complex soft condensed matter systems such as polymers, colloids, and liquid crystals.

Features

- Jean-Pierre Hansen is the well known author of the classic book on liquids - Theory of Simple Liquids, 2nd edition
- Deals with the physics and chemistry of a wide range of complex liquids
- Will be of interest to physicists, chemists, chemical engineers and material scientists

Contents

1. An introduction to liquid matter; Part I. Thermodynamics, Structure and Fluctuations; 2. A reminder of thermodynamics; 3. Equilibrium fluctuations; Part II. Phase Transitions; 4. Mean field approaches; 5. Critical fluctuations and scaling; Part III. Interfaces and Inhomogeneous Fluids: 6. Macroscopic description of interfaces; 7. The density functional approach; 8. Curvature and fluctuations; Part IV. Dynamics: 9. Phenomenological description of transport processes; 10. Brownian motion, diffusion and the Langevin equation; 11. Response and correlation functions; 12. Slow relaxations.

2003	308pp	58 illustrations	27 exercises
0 521 78953 2		Paperback	£33.00
0 521 78344 5		Hardback	£80.00

FORTHCOMING

Numerical Methods of Engineering with MATLAB

Jaan Kiusalaas

Pennsylvania State University, USA

A text for engineering students and a reference for practicing engineers, especially those who wish to explore the power and efficiency of MATLAB®. Examples and applications were chosen for their relevance to real world problems, and where numerical solutions are most efficient. The numerical methods are discussed thoroughly and illustrated with problems involving both hand computation and programming. MATLAB® mfiles accompany each method and are available on the book web site. Explore numerical methods with MATLAB®, a great program for teaching scientific computation.

Features

- Only available MATLAB® based engineering numerical methods text
- Includes numerous problems and examples
- Each method is accompanied by computer code written in MATLAB® which is also available on the book web site

Contents

1. Introduction to MATLAB®; 2. Systems of linear algebraic equations; 3. Interpolation and curve fitting; 4. Roots of equations; 5. Numerical differentiation; 6. Numerical integration; 7. Initial value problems; 8. Two-point boundary value problems; 9. Symmetric Matrix Eigenvalue problems; 10. Introduction to optimization; Appendices.

September 2005	608pp	145 illustrations
346 exercises		
0 521 85288 9	Hardback	£45.00

Also available in Python version 0 521 85287 0

FORTHCOMING

The Potential Distribution Theorem and Models of Molecular Solutions

Thomas Beck

University of Cincinnati, Ohio, USA

Michael Paulaitis

John Hopkins University, Baltimore, USA

Lawrence Pratt

Los Alamos National Laboratory, USA

The understanding of statistical thermodynamic molecular theory is fundamental to the appreciation of molecular solutions. Though effective monographs on molecular simulation methods are available, down-to-earth presentations of molecular theory are not. This book aims to re-address the balance, using Potential Distribution Theorem (PDT) as the basis. The authors discuss the field in a concise and simple manner, illustrating the text with useful models of solution thermodynamics and numerous exercises.

Features

- A concise and accessible account of molecular statistical thermodynamic theory in solutions
- Numerous examples, models and exercises are included to guide the reader through molecular theory
- Discusses practical theory in conjunction with simulation results based fundamentally on Potential Distribution Theory, providing a modern account with a broad multi-disciplinary appeal

Contents

1. Introduction; 2. Statistical thermodynamic necessities; 3. Potential distribution theorem; 4. Models; 5. Generalities; 6. Statistical tenets; 7. Quasi-chemical theory; 8. Developed examples; Index; References.

Oct 2005	300pp	76 illustrations
116 exercises		
0 521 82215 7	Hardback	£65.00



NEW EDITION

Physical Properties of Polymers

Third edition

James Mark

University of Cincinnati, USA

Kia Ngai

US Naval Research Laboratory,

Washington DC, USA

William Graessley

Princeton University, New Jersey, USA

Leo Mandelkern

Florida State University, USA

Edward Samulski

University of North Carolina, Chapel Hill, USA

and Jack Koenig

Case Western Reserve University, Ohio, USA

This book is a thoroughly revised and up-dated third edition of a well established textbook. Containing numerous problem sets and worked examples it will be of primary interest to graduate students and researchers studying all aspects of polymeric materials.

Review of the second edition:

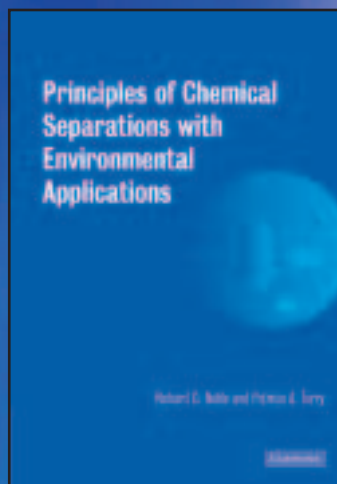
'The authors are all acknowledged experts in their fields within polymer science and their accounts are authoritative, thorough and clearly written. My overall impression is that this book will be of great value to research workers old and new in polymer science and to post-graduate students studying polymer science as part of their further degree.'

Journal of Materials Chemistry

Contents

1. The rubber elastic state; 2. The glassy state and the glass transition; 3. Viscoelasticity and flow in polymer melts and concentrated solutions; 4. The crystalline state; 5. The mesomorphic state; 6. Spectroscopic characterization of polymers; 7. Scattering techniques.

2004	536pp	270 illustrations	50 exercises
0 521 53018 0		Paperback	£38.00
0 521 82317 X		Hardback	£90.00



Principles of Chemical Separations with Environmental Applications

Richard D. Noble

University of Colorado, Boulder, USA

and Patricia A. Terry

University of Wisconsin, Green Bay, USA

Chemical separations are of central importance in many areas of environmental science, whether it is the clean-up of polluted water or soil, the treatment of discharge streams from chemical processes, or modification of a specific process to decrease its environmental impact. This book is an introduction to chemical separations, focusing on their use in environmental applications. The book contains many worked examples and homework problems. It is an ideal textbook for undergraduate and graduate students taking separations courses with a focus on environmental applications or environmental engineering.

Features

- Discusses selection criteria for various separation technologies
- Covers necessary physical and chemical background material to get readers up to speed
- Includes a chapter on membrane separations

Contents

1. Introduction; 2. Separations as unit operations; 3. Separations analysis fundamentals; 4. Distillation; 5. Extraction; 6. Absorption and stripping; 7. Adsorption; 8. Ion exchange; 9. Membranes; Appendices.

2004	336pp	178 illustrations	115 exercises
0 521 01014 4		Paperback	£40.00
0 521 81152 X		Hardback	£80.00



Distillation Theory and its Application to Optimal Design of Separation Units

F.B. Petlyuk

ECT Service, Moscow, Russia

Intended for designers and operators of separation units in the chemical, pharmaceutical, food, and other industries and for software designers. This work answers such fundamental questions as:

- What are the feasible separation products for a given mixture?
- What minimum power is required to separate a given mixture?
- What minimum number of trays is necessary to separate a given mixture at a fixed power input?

Concepts are reinforced by chapter exercises using free DistillDesigner software, which provides quick and reliable solutions to problems of flowsheet synthesis and to optimal design calculations. This software allows refinement and confirmation of the algorithms of optimal design.

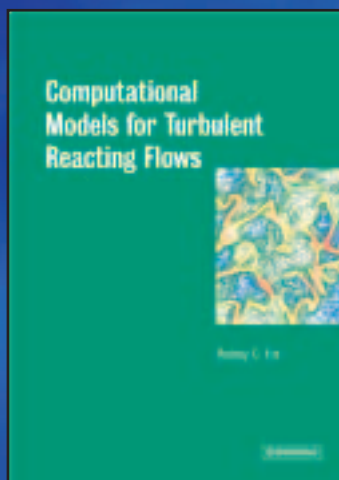
Features

- Presents a clear multidimensional geometric representation of distillation theory, that is valid for all types of distillation
- Petlyuk is well known for seminal work in distillation theory
- Contains exercises to be solved with demo DistillDesigner software, an evaluation version is available free on accompanying web site

Contents

1. Phase equilibrium and its geometrical presentation; 2. Basic concepts of distillation; 3. Trajectories of distillation in infinite columns under infinite reflux; 4. Trajectories of thermodynamically reversible distillation; 5. Distillation trajectories and conditions of mixtures separability in simple infinite columns at finite reflux; 6. Distillation trajectories in infinite complex columns and complexes; 7. Trajectories of the finite columns and their design calculation; 8. Synthesis of separation flowsheets.

2004	360pp	188 illustrations	
0 521 82092 8		Hardback	£60.00



Computational Models for Turbulent Reacting Flows

Rodney O. Fox

Iowa State University, USA

This book carefully analyzes the strengths and weaknesses of the various techniques described, with the focus on formulation of practical models not just the numerical issues arising from their solution. A theoretical framework based on the one-point, one-time joint probability density function (PDF) is developed. It is shown that all commonly employed models for turbulent reacting flows can be formulated in terms of the joint PDF of the chemical species and enthalpy.

'Fox has become a master of the material described in the book, and has made significant contributions to the subject. The writing is clear and authoritative, and contains ample historical and modern references. The book is attractively presented ...'

Journal of Fluid Mechanics

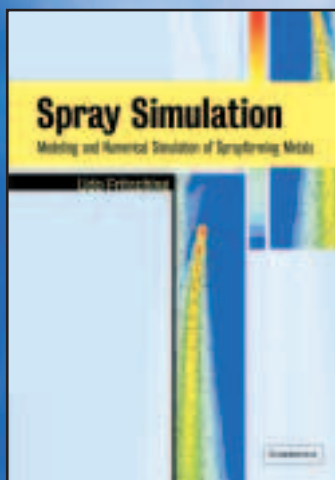
Features

- Provides a unified modern treatment of computational fluid dynamics models for turbulent reacting flow
- Emphasizes models that can handle detailed finite-rate chemistry as opposed to specialized applications
- Includes an introduction to the theory of turbulent and turbulent scalar transport

Contents

1. Turbulent reacting flows; 2. Statistical description of turbulent flow; 3. Statistical description of turbulent mixing; 4. Models for turbulent transport; 5. Closures for the chemical source term; 6. PDF methods for turbulent reacting flows; 7. Full PDF simulations; Appendices.

2003	438pp	104 illustrations		
0 521 65907 8		Paperback	£40.00	
0 521 65049 6		Hardback	£80.00	



Spray Simulation

Modeling and Numerical Simulation of Sprayforming metals

Udo Fritsching

Universität Bremen, Germany

Spray forming combines the metallurgical processes of metal casting and powder metallurgy to fabricate metal products with enhanced properties. This book provides an introduction to the various modeling and simulation techniques employed in spray forming, and shows how they are applied in process analysis and development. The author begins by deriving and describing the main models. He then presents their application in the simulation of the key features of spray forming. Wherever possible he discusses theoretical results with reference to experimental data.

...makes an ideal reference book for the metal spray community ... It presents the topic in an easy-to-access manner, making it suitable for those new to the topic ... a very useful book for those already working in this area ... a nice well-presented book, which I believe will become a classic for the metal sprayforming industry.'

Journal of Process Mechanical Engineering

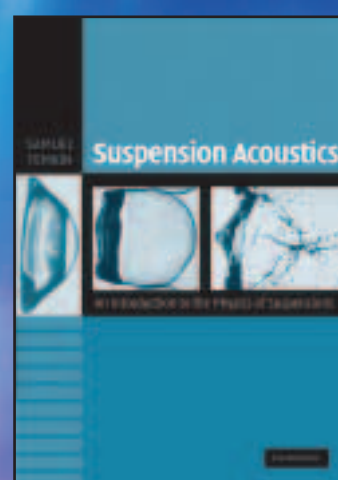
Features

- A detailed introduction to the various modelling and simulation techniques employed in metal spray forming
- Shows how theoretical concepts are applied in practice
- Highlights characteristic modelling features that may be useful in the simulation of related spray processes

Contents

1. Introduction; 2. Spray forming of metals; 3. Modeling of engineering processes; 4. Fluid disintegration; 5. Spray; 6. Compaction; 7. The integral modeling approach; 8. Summary and outlook; Appendices.

2004	286pp	199 illustrations		
0 521 82098 7		Hardback	£60.00	



FORTHCOMING

Suspension Acoustics

An Introduction to the Physics of Suspensions

Samuel Temkin

Rutgers University, New Jersey, USA

Examines, from a fundamental point of view, the response of single particles in fluids and uses the results of such a detailed examination to consider suspension motions as a whole, paying particular attention to acoustic motions, that is to the propagation of sound waves. Such propagation is examined from different perspectives in a unified manner that applies to several particle-fluid combinations. Among the possible applications of the theory presented, the book discusses the characterization of suspensions by acoustic means and the agglomeration of particles with sound waves.

Features

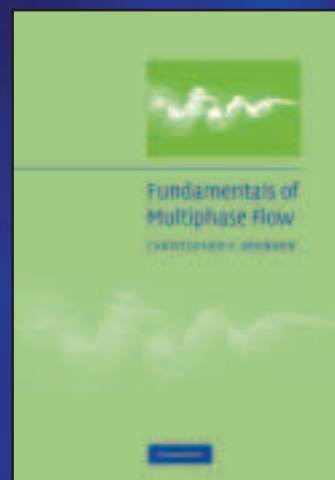
- A unified approach to treat the subject
- Written by a leading expert in the field
- Suitable for use as an introduction to suspension physics

Contents

1. Preliminaries; 2. Conservation equations; 3. Rigid particle heat transfer at Re; 4. Translation motion at Re; 5. Shape deformations; 6. Volume pulsations; 7. Thermodynamics of suspensions; 8. The two phase model; 9. Sound propagation in suspensions; 10. Application and extensions.

July 2005	432pp	156 illustrations		
0 521 84757 5		Hardback	£60.00	

Please order from your local bookseller



FORTHCOMING

Fundamentals of Multiphase Flow

Christopher E. Brennen

California Institute of Technology, USA

This book provides a coherent and unified treatment of multiphase flows with an emphasis on the underlying physical phenomena.

Multiphase flows are flows of mixtures of separate substances, such as bubbles of gas in liquids, solid particles in air, and so on. They are abundant in nature, in industrial processes and in our bodies. The subject of multiphase flows encompasses, a host of different technological contexts, a wide spectrum of different scales, a broad range of engineering disciplines and a multitude of different analytical approaches. Fundamentals of Multiphase Flow is intended as an important reference text both for researchers and engineers who must deal with the problems of multiphase flows and for scientists interested in the basic phenomena. The aim is to bring much of this fundamental understanding together into one book, presenting a unifying approach to the fundamental ideas of multiphase flows.

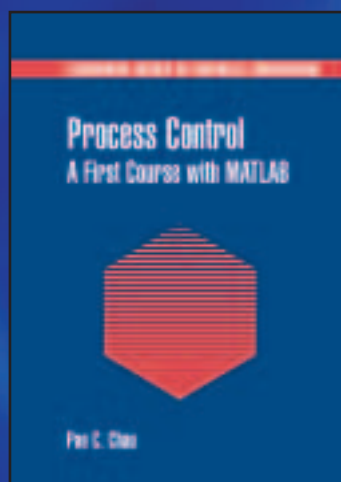
Features

- Focus is on presenting a unified treatment of the fundamentals of multiphase flows
- Emphasizes the ubiquity of multiphase flows and the range of contexts in which they need to be understood

Contents

1. Introduction to multiphase flow; 2. Single particle motion; 3. Bubble or droplet translation; 4. Bubble growth and collapse; 5. Cavitation; 6. Boiling and condensation; 7. Flow patterns; 8. Internal flow energy conversion; 9. Homogenous flows; 10. Flows with bubble dynamics; 11. Flows with gas dynamics; 12. Sprays; 13. Granular flows; 14. Drift flux models; 15. System instabilities; 16. Kinematic waves.

June 2005	368pp	195 illustrations
0 521 84804 0	Hardback	£50.00



Process Control

A First Course with MATLAB

Pao C. Chau

University of California, San Diego, USA

Covers the most essential aspects of process control for a two-semester introductory course. Theory and analysis of process control are well-presented, and MATLAB is employed as a powerful yet approachable computational tool.

Contents

1. Introduction; 2. Mathematical preliminaries; 3. Dynamic response; 4. State space representation; 5. Analysis of PID control systems; 6. Design and tuning of single-loop control systems; 7. Stability of closed-loop systems; 8. Frequency response analysis; 9. Design of state space systems; 10. Multiloop systems; MATLAB tutorial sessions; References; Homework problems.

2002	328pp	131 illustrations	162 exercises
0 521 00255 9		Paperback	£32.00
0 521 80760 3		Hardback	£85.00

Diffusion

Mass Transfer in Fluid Systems

Second edition
E. L. Cussler

University of Minnesota, USA

Written in informal style, the book clearly describes diffusion in fluids and emphasises physical insight and basic concepts. The new edition adds coverage of unit operations, more worked examples, and homework problems.

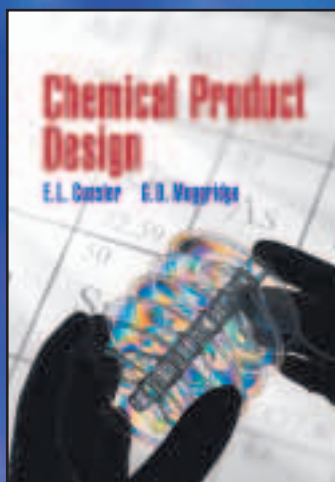
'Written in a refreshing style ... the emphasis of the book is on the applications of diffusion equations.'

Times Higher Education Supplement

Contents

Part I. Fundamentals of Diffusion; Part II. Diffusion Coefficients; Part III. Mass Transfer; Part IV. Diffusion Coupled with Other Processes.

1997	600pp	267 illustrations	193 exercises
0 521 56477 8		Paperback	£36.00



Chemical Product Design

E. L. Cussler
University of Minnesota, USA
and G. D. Moggridge
University of Cambridge, UK

Chemical engineering students and beginning chemical engineers will find this text an inviting introduction to chemical product design. It expands the scope of chemical engineering design to encompass both process design and product design. The authors use a four-step procedure for chemical product design – needs, ideas, selection, and manufacture – drawing numerous examples from industry to illustrate the discussion.

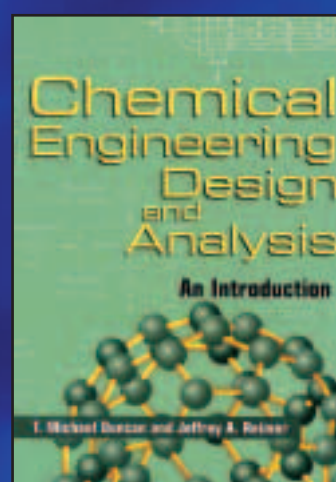
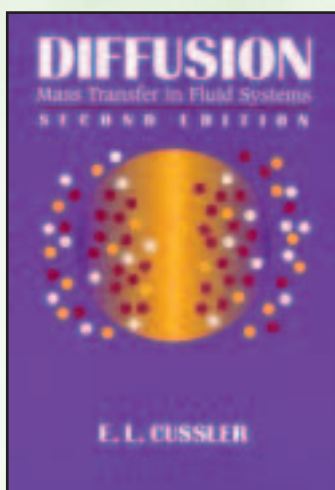
'The set of problems grouped at the end is superb and marvellously eclectic. many are ideal for novel 'design projects' for final year chemical engineering courses.'

Chemistry in Britain

Contents

1. An introduction to chemical product design; 2. Needs; 3. Ideas; 4. Selection; 5. Product manufacture; 6. Specialty chemical manufacture; 7. Economic concerns.

2001	248pp	44 illustrations
0 521 79633 4		Paperback
		£22.99



Chemical Engineering Design and Analysis

An Introduction

T. Michael Duncan

Cornell University, New York, USA

and Jeffrey A. Reimer

University of California, Berkeley, USA

Introduces the fundamental steps in design and three methods of analysis: mathematical modeling, graphical methods, and dimensional analysis. Examines designing and analyzing chemical processes and processing units in order to assess product quality, economics, safety, and environmental impact.

'With the current popular trend of industrial production engaged firmly in novel materials and biotechnology, there is now an undeniable need for chemical engineering students to be introduced to batch processing, multiple steady-state and cyclic processing applications at a very early stage. The authors' introduction of these highly relevant concepts is both informative and thorough; far superior to any material I have come across in other entry-level undergraduate textbooks.'

Chemistry in Britain

Contents

Preface; 1. An overview of chemical engineering; 2. Process design; 3. Mathematical modeling; 4. Graphical analysis; 5. Dimensional analysis and dynamic scaling; 6. Transient systems; Appendices; Glossary; Index.

1998	400pp	364 illustrations	160 exercises
0 521 63956 5		Paperback	£33.00

Information is correct at the time of going to press but is subject to change without notice.



CAMBRIDGE
UNIVERSITY PRESS
www.cambridge.org

ISBN 0-521-92745-5



9 780521 927451 >