Thermodynamics With Chemical Engineering Applications Cambridge Series In Chemical Engineering

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Cybernetic Modeling for Bioreaction Engineering - Doraiswami Ramkrishna 2018-10-18
Describes dynamic state of metabolic systems, while paving the way for fully predictive modeling frameworks.
Principles of Chemical Separations with Environmental Applications - Richard D. Noble 2004-03-25
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 authors first discuss the general aspects of separation technology as a unit operation. They also describe how property differences are used to generate separations, the use of separating agents, and the selection criteria for particular separation techniques. The general approach for each technology is to present the chemical and/or physical basis for the process and explain how to evaluate it for design and analysis. The book contains many worked examples and homework problems. It is an ideal textbook for undergraduate and graduate students taking courses on environmental separations or environmental engineering.
Classical Thermodynamics of Fluid Systems - Juan H. Vera 2016-11-25
This text explores the connections between different thermodynamic subjects related to fluid systems. Emphasis is placed on the clarification of concepts by returning to the conceptual foundation of thermodynamics and special effort is directed to the use of a simple nomenclature and algebra. The book presents the structural elements of classical thermodynamics of fluid systems, covers the treatment of mixtures, and shows via examples and references both the usefulness and the limitations of classical thermodynamics for the treatment of practical problems related to fluid systems. It also includes diverse selected topics of interest to researchers and advanced students and four practical appendices, including an introduction to material balances and step-by-step procedures for using the Virial EOS and the PRSV EOS for fugacities and the ASOG-KT group method for activity coefficients. The Olivera-Fuentes table of PRSV parameters for more than 800 chemical compounds and the Gmehling-Tochigi tables of ASOG interaction parameters for 43 groups are included.
Thermodynamics - William C. Reynolds 2018-09-20
Provides an essential treatment of the subject and rigorous methods to solve all kinds of energy engineering problems.
Molecular Driving Forces - Ken Dill 2010-10-21
Molecular Driving Forces, Second Edition E-book is an introductory statistical thermodynamics text that describes the principles and forces that drive chemical and biological processes. It demonstrates how the complex behaviors of molecules can result from a few simple physical processes, and how simple models provide surprisingly accurate insights into the workings of the molecular world. Widely adopted in its First Edition, Molecular Driving Forces is regarded by teachers and students as an accessible textbook that illuminates underlying principles and concepts. The Second Edition includes two brand new chapters: (1) "Microscopic Dynamics" introduces single molecule experiments; and (2) "Molecular Machines" considers how nanoscale machines and engines work. "The Logic of Thermodynamics" has been expanded to its own chapter and now covers heat, work, processes, pathways, and cycles. New practical applications, examples, and end-of-chapter questions are integrated throughout the revised and updated text, exploring topics in biology, environmental and energy science, and nanotechnology. Written in a clear and reader-friendly style, the book provides an excellent introduction to the subject for novices while remaining a valuable resource for experts.
Theory and Applications of Colloidal Suspension Rheology - Norman J. Wagner 2021-04-15
An essential text on practical application, theory and simulation, written by an international coalition of experts in the field and edited by the authors of Colloidal Suspension Rheology. This up-to-date work builds upon the prior work as a valuable guide to formulation and processing, as well as fundamental rheology of colloidal suspensions. Thematically, theory and simulation are connected to industrial application by consideration of colloidal interactions, particle properties, and suspension microstructure. Important classes of model suspensions including gels, glasses and soft particles are covered so as to develop a deeper understanding of industrial systems ranging from carbon black slurries, paints and coatings, asphalt, cement, and mine tailings, to natural suspensions such as biocolloids, protein solutions, and blood. Systematically presenting the established facts in this multidisciplinary field, this book is the perfect aid for academic researchers, graduate students, and industrial practitioners alike.
Thermodynamics for Chemical Engineers - K. E. Bett 2003-02-01
This textbook covers the thermodynamics needed by chemical engineers both in their engineering and in their chemistry; it is intended for use in all undergraduate and some graduate-level courses. The authors emphasize a rigorous yet concise presentation of the fundamental chemical concepts governing the behavior of single and multicomponent mixtures, including phase and chemical equilibria. In the application of these concepts, consideration is given to the presentation of experimentally measured thermodynamic properties, and to their prediction for real fluids and their mixtures using methods founded on statistical mechanics. Several applications involving the transfer of heat and work that are of special importance to chemical engineers are studied in detail to show the use of thermodynamics in improving performance. The book is written in SI units and contains worked examples, exercises, and problems.
The Principles of Chemical Equilibrium - K. G. Denbigh 1981-03-26
Sample Text
Combustion - Irvin Glassman 2014-12-02
Throughout its previous four editions, Combustion has made a very complex subject both enjoyable and understandable to its student readers and a pleasure for instructors to teach. With its clearly articulated physical and chemical processes of flame combustion and smooth, logical transitions to engineering applications, this new edition continues that tradition. Greatly expanded end-of-chapter problem sets and new areas of combustion engineering applications make it even easier for students to grasp the significance of combustion to a wide range of engineering practice, from transportation to energy generation to environmental impacts. Combustion engineering is the study of rapid energy and mass transfer usually through the common physical phenomena of flame oxidation. It covers the physics and chemistry of this process and the engineering applications—including power generation in internal combustion automobile engines and gas turbine engines. Renewed concerns about energy efficiency and fuel costs, along with continued concerns over toxic and particulate emissions, make this a crucial area of engineering. New chapter on new combustion concepts and technologies, including discussion on nanotechnology as related to

combustion, as well as microgravity combustion, microcombustion, and catalytic combustion—all interrelated and discussed by considering scaling issues (e.g., length and time scales) New information on sensitivity analysis of reaction mechanisms and generation and application of reduced mechanisms Expanded coverage of turbulent reactive flows to better illustrate real-world applications Important new sections on stabilization of diffusion flames—for the first time, the concept of triple flames will be introduced and discussed in the context of diffusion flame stabilization

Chemical Engineering Design and Analysis - T. Michael Duncan 2019-01-24

The go-to guide to learn the principles and practices of design and analysis in chemical engineering.

Thermodynamics - J. P. O'Connell 2011-06-30

Thermodynamics: Fundamentals for Applications is a text for a first graduate course in chemical engineering. The focus is on macroscopic thermodynamics; discussions of modeling and molecular situations are integrated throughout. Underpinning this text is the knowledge that while thermodynamics describes natural phenomena, those descriptions are the products of creative, systematic minds. Nature unfolds without reference to human concepts of energy, entropy, or fugacity. Natural complexity can be organized and studied by thermodynamics methodology. The power of thermodynamics can be used to advantage if the fundamentals are understood. This text's emphasis is on fundamentals rather than modeling. Knowledge of the basics will enhance the ability to combine them with models when applying thermodynamics to practical situations. While the goal of an engineering education is to teach effective problem solving, this text never forgets the delight of discovery, the satisfaction of grasping intricate concepts, and the stimulation of the scholarly atmosphere.

A Modern Course in Transport Phenomena - David C. Venerus 2018-03-15

Integrating nonequilibrium thermodynamics and kinetic theory, this unique text presents a novel approach to the subject of transport phenomena.

Introduction to Chemical Engineering Fluid Mechanics - William M. Deen 2016-08-15

Designed for introductory undergraduate courses in fluid mechanics for chemical engineers, this stand-alone textbook illustrates the fundamental concepts and analytical strategies in a rigorous and systematic, yet mathematically accessible manner. Using both traditional and novel applications, it examines key topics such as viscous stresses, surface tension, and the microscopic analysis of incompressible flows which enables students to understand what is important physically in a novel situation and how to use such insights in modeling. The many modern worked examples and end-of-chapter problems provide calculation practice, build confidence in analyzing physical systems, and help develop engineering judgment. The book also features a self-contained summary of the mathematics needed to understand vectors and tensors, and explains solution methods for partial differential equations. Including a full solutions manual for instructors available at www.cambridge.org/deen, this balanced textbook is the ideal resource for a one-semester course.

Thermodynamics - Sanford Klein 2011-10-10

This book differs from other thermodynamics texts in its objective which is to provide engineers with the concepts, tools, and experience needed to solve practical real-world energy problems. The presentation integrates computer tools (e.g., EES) with thermodynamic concepts to allow engineering students and practising engineers to solve problems they would otherwise not be able to solve. The use of examples, solved and explained in detail, and supported with property diagrams that are drawn to scale, is ubiquitous in this textbook. The examples are not trivial, drill problems, but rather complex and timely real world problems that are of interest by themselves. As with the presentation, the solutions to these examples are complete and do not skip steps. Similarly the book includes numerous end of chapter problems, both typeset and online. Most of these problems are more detailed than those found in other thermodynamics textbooks. The supplements include complete solutions to all exercises, software downloads, and additional content on selected topics. These are available at the book web site www.cambridge.org/KleinandNellis.

Optimization in Chemical Engineering - Suman Dutta 2016-03-11

Optimization is used to determine the most appropriate value of variables under given conditions. The primary focus of using optimisation techniques is to measure the maximum or minimum value of a function depending on the circumstances. This book discusses problem formulation and problem solving with the help of algorithms such as secant method, quasi-Newton method, linear programming and dynamic programming. It also explains important chemical processes such as fluid flow systems, heat exchangers, chemical reactors and distillation systems using solved examples. The book begins by explaining the fundamental concepts followed by an elucidation of various modern techniques including trust-region methods, Levenberg–Marquardt algorithms, stochastic optimization, simulated annealing and statistical optimization. It studies the multi-objective optimization technique and its applications in chemical engineering and also discusses the theory and applications of various optimization software tools including LINGO, MATLAB, MINITAB and GAMS.

Introductory Chemical Engineering Thermodynamics - J. Richard Elliott 2012-02-06

A Practical, Up-to-Date Introduction to Applied Thermodynamics, Including Coverage of Process Simulation Models and an Introduction to Biological Systems Introductory Chemical Engineering Thermodynamics, Second Edition, helps readers master the fundamentals of applied thermodynamics as practiced today: with extensive development of molecular perspectives that enables adaptation to fields including biological systems, environmental applications, and nanotechnology. This text is distinctive in making molecular perspectives accessible at the introductory level and connecting properties with practical implications. Features of the second edition include Hierarchical instruction with increasing levels of detail: Content requiring deeper levels of theory is clearly delineated in separate sections and chapters Early introduction to the overall perspective of composite systems like distillation columns, reactive processes, and biological systems Learning objectives, problem-solving strategies for energy balances and phase equilibria, chapter summaries, and “important equations” for every chapter Extensive practical examples, especially coverage of non-ideal mixtures, which include water contamination via hydrocarbons, polymer blending/recycling, oxygenated fuels, hydrogen bonding, osmotic pressure, electrolyte solutions, zwitterions and biological molecules, and other contemporary issues Supporting software in formats for both MATLAB® and spreadsheets Online supplemental sections and resources including instructor slides, ConcepTests, coursecast videos, and other useful resources

Optimization for Chemical and Biochemical Engineering - Vassilios S. Vassiliadis 2021-01-14

"Optimization for Chemical and Biochemical Engineering - Theory, Algorithms, Modeling and Applications"--

Molecular Physical Chemistry for Engineers - John T. Yates 2007-08-31

This text emphasizes the behaviour of material from the molecular point of view. It is for engineering students who have a background in chemistry and physics and in thermodynamics. A background in calculus and differential equations is assumed. Each chapter includes a vast array of exercises, for which a Student Solutions Manual is also available.

Mass and Heat Transfer - T. W. Fraser Russell 2008-02-11

This text allows instructors to teach a course on heat and mass transfer that will equip students with the pragmatic, applied skills required by the modern chemical industry. This new approach is a combined presentation of heat and mass transfer, maintaining mathematical rigor while keeping mathematical analysis to a minimum. This allows students to develop a strong conceptual understanding, and teaches them how to become proficient in engineering analysis of mass contactors and heat exchangers and the transport theory used as a basis for determining how critical coefficients depend upon physical properties and fluid motions. Students will first study the engineering analysis and design of equipment important in experiments and for the processing of material at the commercial scale. The second part of the book presents the fundamentals of transport phenomena relevant to these applications. A complete teaching package includes a comprehensive instructor's guide, exercises, case studies, and project assignments.

Chemical Engineering Design and Analysis - T. Michael Duncan 1998-08-28

This 1998 book introduces the basics of engineering design and analysis for beginning chemical engineering undergraduate students.

Engineering Chemistry - Shikha Agarwal 2019-05-23

Written in lucid language, the book offers a detailed treatment of fundamental concepts of chemistry and its engineering applications.

Molecular Engineering Thermodynamics - Juan J. de Pablo 2014-07-10

Building up gradually from first principles, this unique introduction to

modern thermodynamics integrates classical, statistical and molecular approaches and is especially designed to support students studying chemical and biochemical engineering. In addition to covering traditional problems in engineering thermodynamics in the context of biology and materials chemistry, students are also introduced to the thermodynamics of DNA, proteins, polymers and surfaces. It includes over 80 detailed worked examples, covering a broad range of scenarios such as fuel cell efficiency, DNA/protein binding, semiconductor manufacturing and polymer foaming, emphasizing the practical real-world applications of thermodynamic principles; more than 300 carefully tailored homework problems, designed to stretch and extend students' understanding of key topics, accompanied by an online solution manual for instructors; and all the necessary mathematical background, plus resources summarizing commonly used symbols, useful equations of state, microscopic balances for open systems, and links to useful online tools and datasets.

Thermodynamics - Stephen R. Turns 2006-03-06

The focus of Thermodynamics: Concepts and Applications is on traditional thermodynamics topics, but structurally the book introduces the thermal-fluid sciences. Chapter 2 includes essentially all material related to thermodynamic properties clearly showing the hierarchy of thermodynamic state relationships. Element conservation is considered in Chapter 3 as a way of expressing conservation of mass. Constant-pressure and volume combustion are considered in Chapter 5 - Energy Conservation. Chemical and phase equilibria are treated as a consequence of the 2nd law in Chapter 6. 2nd law topics are introduced hierarchically in one chapter, important structure for a beginner. The book is designed for the instructor to select topics and combine them with material from other chapters seamlessly. Pedagogical devices include: learning objectives, chapter overviews and summaries, historical perspectives, and numerous examples, questions and problems and lavish illustrations. Students are encouraged to use the National Institute of Science and Technology (NIST) online properties database.

Energy Conversion Engineering - Ahmed F. Ghoniem 2021-11-11

This unique textbook equips students with the theoretical and practical tools needed to model, design, and build efficient and clean low-carbon energy systems. Students are introduced to thermodynamics principles including chemical and electrochemical thermodynamics, moving onto applications in real-world energy systems, demonstrating the connection between fundamental concepts and theoretical analysis, modelling, application, and design. Topics gradually increase in complexity, nurturing student confidence as they build towards the use of advanced concepts and models for low to zero carbon energy conversion systems. The textbook covers conventional and emerging renewable energy conversion systems, including efficient fuel cells, carbon capture cycles, biomass utilisation, geothermal and solar thermal systems, hydrogen and low-carbon fuels. Featuring numerous worked examples, over 100 multi-component homework problems, and online instructor resources including lecture slides, solutions, and sample term projects, this textbook is the perfect teaching resource for an advanced undergraduate and graduate-level course in energy conversion engineering.

Introduction to Chemical Engineering Fluid Mechanics - William M. Deen 2016-08-15

Presents the fundamentals of chemical engineering fluid mechanics with an emphasis on valid and practical approximations in modeling.

Thermodynamics and Statistical Mechanics - M. Scott Shell 2015-04-16

Learn classical thermodynamics alongside statistical mechanics and how macroscopic and microscopic ideas interweave with this fresh approach to the subjects.

Principles of Thermodynamics - Jean-Philippe Ansermet 2019-01-03

An introductory textbook presenting the key concepts and applications of thermodynamics, including numerous worked examples and exercises.

Introduction to Computational Fluid Dynamics - Anil W. Date 2005-08-08

Introduction to Computational Fluid Dynamics is a textbook for advanced undergraduate and first year graduate students in mechanical, aerospace and chemical engineering. The book emphasizes understanding CFD through physical principles and examples. The author follows a consistent philosophy of control volume formulation of the fundamental laws of fluid motion and energy transfer, and introduces a novel notion of 'smoothing pressure correction' for solution of flow equations on collocated grids within the framework of the well-known SIMPLE algorithm. The subject matter is developed by considering pure conduction/diffusion, convective transport in 2-dimensional boundary layers and in fully elliptic flow situations and phase-change problems in succession. The book includes chapters on discretization of equations for transport of mass, momentum and energy on Cartesian, structured curvilinear and unstructured meshes, solution of discretised equations, numerical grid generation and convergence enhancement. Practising engineers will find this particularly useful for reference and for continuing education.

Statistical Thermodynamics and Stochastic Kinetics - Yiannis N. Kaznessis 2011-12-01

Presenting the key principles of thermodynamics from a microscopic point of view, this book provides engineers with the knowledge they need to apply thermodynamics and solve engineering challenges at the molecular level. It clearly explains the concepts of entropy and free energy, emphasizing key ideas used in equilibrium applications, whilst stochastic processes, such as stochastic reaction kinetics, are also covered. It provides a classical microscopic interpretation of thermodynamic properties, which is key for engineers, rather than focusing on more esoteric concepts of statistical mechanics and quantum mechanics. Coverage of molecular dynamics and Monte Carlo simulations as natural extensions of the theoretical treatment of statistical thermodynamics is also included, teaching readers how to use computer simulations and thus enabling them to understand and engineer the microcosm. Featuring many worked examples and over 100 end-of-chapter exercises, it is ideal for use in the classroom as well as for self-study.

Numerical Methods for Chemical Engineering - Kenneth J Beers 2007

Applications of numerical mathematics and scientific computing to chemical engineering.

Chemical Production Scheduling - Christos T. Maravelias 2021-04-30

Understand common scheduling as well as other advanced operational problems with this valuable reference from a recognized leader in the field. Beginning with basic principles and an overview of linear and mixed-integer programming, this unified treatment introduces the fundamental ideas underpinning most modeling approaches, and will allow you to easily develop your own models. With more than 150 figures, the basic concepts and ideas behind the development of different approaches are clearly illustrated. Addresses a wide range of problems arising in diverse industrial sectors, from oil and gas to fine chemicals, and from commodity chemicals to food manufacturing. A perfect resource for engineering and computer science students, researchers working in the area, and industrial practitioners.

Thermodynamics : Fundamentals For Applications - HAILE

Thermodynamics: Fundamentals and Applications is a text for a first graduate course in Chemical Engineering. The focus is on macroscopic thermodynamics; discussions of modeling and molecular situations are integrated throughout. Underpinning this text is the knowledge that while thermodynamics describes natural phenomena, those descriptions are the products of creative, systematic minds. Nature unfolds without reference to human concepts of energy, entropy, or fugacity. Natural complexity can be organized and studied by thermodynamics methodology. The power of thermodynamics can be used to advantage if the fundamentals are understood. This text s emphasis is on fundamentals rather than modeling. Knowledge of the basics will enhance the ability to combine them with models when applying thermodynamics to practical situations. While the goal of an engineering education is to teach effective problem solving, this text never forgets the delight of discovery, the satisfaction of grasping intricate concepts, and the stimulation of the scholarly atmosphere.

Gibbs Energy and Helmholtz Energy - Emmerich Wilhelm 2021-09-15

This book contains the latest information on all aspects of the most important chemical thermodynamic properties of Gibbs energy and Helmholtz energy, as related to fluids. Both the Gibbs energy and Helmholtz energy are very important in the fields of thermodynamics and material properties as many other properties are obtained from the temperature or pressure dependence. Bringing all the information into one authoritative survey, the book is written by acknowledged world experts in their respective fields. Each of the chapters will cover theory, experimental methods and techniques and results for all types of liquids and vapours. This book is the fourth in the series of Thermodynamic Properties related to liquids, solutions and vapours, edited by Emmerich Wilhelm and Trevor Letcher. The previous books were: Heat Capacities (2010), Volume Properties (2015), and Enthalpy (2017). This book fills the gap in fundamental thermodynamic properties and is the last in the series.

Thermodynamics with Chemical Engineering Applications - Elias I. Franses 2014-08-25

Master the principles of thermodynamics, and understand their practical

real-world applications, with this deep and intuitive undergraduate textbook.

Thermodynamics - J. P. O'Connell 2005-05-16

Thermodynamics: Fundamentals and Applications is a 2005 text for a first graduate course in Chemical Engineering. The focus is on macroscopic thermodynamics; discussions of modeling and molecular situations are integrated throughout. Underpinning this text is the knowledge that while thermodynamics describes natural phenomena, those descriptions are the products of creative, systematic minds. Nature unfolds without reference to human concepts of energy, entropy, or fugacity. Natural complexity can be organized and studied by thermodynamics methodology. The power of thermodynamics can be used to advantage if the fundamentals are understood. This text's emphasis is on fundamentals rather than modeling. Knowledge of the basics will enhance the ability to combine them with models when applying thermodynamics to practical situations. While the goal of an engineering education is to teach effective problem solving, this text never forgets the delight of discovery, the satisfaction of grasping intricate concepts, and the stimulation of the scholarly atmosphere.

Lectures in Classical Thermodynamics with an Introduction to Statistical Mechanics - Daniel Blankschtein 2021-03-15

This textbook facilitates students' ability to apply fundamental principles and concepts in classical thermodynamics to solve challenging problems relevant to industry and everyday life. It also introduces the reader to the fundamentals of statistical mechanics, including understanding how the microscopic properties of atoms and molecules, and their associated intermolecular interactions, can be accounted for to calculate various average properties of macroscopic systems. The author emphasizes application of the fundamental principles outlined above to the calculation of a variety of thermodynamic properties, to the estimation of conversion efficiencies for work production by heat interactions, and to the solution of practical thermodynamic problems related to the behavior of non-ideal pure fluids and fluid mixtures, including phase equilibria and chemical reaction equilibria. The book contains detailed solutions to many challenging sample problems in classical thermodynamics and statistical mechanics that will help the reader crystallize the material taught. Class-tested and perfected over 30 years of use by nine-time Best Teaching Award recipient Professor Daniel Blankschtein of the Department of Chemical Engineering at MIT, the book is ideal for students of Chemical and Mechanical Engineering, Chemistry, and Materials Science, who will benefit greatly from in-depth discussions and pedagogical explanations of key concepts. Distills critical concepts, methods, and applications from leading full-length textbooks, along with the author's own deep understanding of the material taught, into a concise yet rigorous graduate and advanced undergraduate text; Enriches the standard curriculum with succinct, problem-based learning strategies derived from the content of 50 lectures given over the years in the Department of Chemical Engineering at MIT; Reinforces concepts covered with detailed solutions to illuminating and challenging homework problems.

Numerical Methods with Chemical Engineering Applications - Kevin D. Dorfman 2017-01-11

This undergraduate textbook integrates the teaching of numerical methods and programming with problems from core chemical engineering subjects.

Fundamentals of Chemical Engineering Thermodynamics - Themis Matsoukas 2013

Fundamentals of Chemical Engineering Thermodynamics is the clearest and most well-organized introduction to thermodynamics theory and calculations for all chemical engineering undergraduates. This brand-new text makes thermodynamics far easier to teach and learn. Drawing on his award-winning courses at Penn State, Dr. Themis Matsoukas organizes the text for more effective learning, focuses on why as well as how, offers imagery that helps students conceptualize the equations, and illuminates thermodynamics with relevant examples from within and beyond the chemical engineering discipline. Matsoukas presents solved problems in every chapter, ranging from basic calculations to realistic safety and environmental applications.

Statistical Thermodynamics - Normand M. Laurendeau 2005-11-21

This 2006 textbook discusses the fundamentals and applications of statistical thermodynamics for beginning graduate students in the physical and engineering sciences. Building on the prototypical Maxwell–Boltzmann method and maintaining a step-by-step development of the subject, this book assumes the reader has no previous exposure to statistics, quantum mechanics or spectroscopy. The book begins with the essentials of statistical thermodynamics, pauses to recover needed knowledge from quantum mechanics and spectroscopy, and then moves on to applications involving ideal gases, the solid state and radiation. A full introduction to kinetic theory is provided, including its applications to transport phenomena and chemical kinetics. A highlight of the textbook is its discussion of modern applications, such as laser-based diagnostics. The book concludes with a thorough presentation of the ensemble method, featuring its use for real gases. Numerous examples and prompted homework problems enrich the text.

Molecular Engineering Thermodynamics - Juan J. de Pablo 2014-07-10

A unique introduction to modern thermodynamics, integrating classical, statistical and molecular approaches, designed for students studying chemical and biochemical engineering.