

## Thermochemical Process Engineering

[#thermochemical engineering](#) [#chemical process design](#) [#energy conversion technologies](#) [#high-temperature reactions](#) [#process optimization](#)

Thermochemical Process Engineering focuses on the design, analysis, and optimization of systems where chemical reactions are driven or influenced by heat. This field is crucial for developing advanced energy conversion technologies, sustainable material production, and efficient industrial processes, often involving high-temperature reactions and sophisticated chemical process design for optimal performance and sustainability.

Our goal is to bridge the gap between research and practical application.

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### Thermochemical Process Engineering

Thermochemical Process Engineering, the latest edition in the Advances in Chemical Engineering, provides up-to-date information, comprehensively presenting updates in a systematic fashion that has made the series of great importance to organic chemists, polymer chemists, and many biological scientists since its inception in 1960. The series includes contributions from established authorities in the field who combine descriptive chemistry and mechanistic insight to create an understanding on how the chemistry drives the properties. Contains reviews by leading authorities in their respective areas Presents up-to-date reviews of the latest techniques in the modeling of catalytic processes Includes a broad mix of US and European authors, as well as academic, industrial, and research institute perspectives Provides discussions on the connections between computation and experimental methods

### Thermochemical Processing of Biomass

A comprehensive examination of the large number of possible pathways for converting biomass into fuels and power through thermochemical processes Bringing together a widely scattered body of information into a single volume, this book provides complete coverage of the many ways that thermochemical processes are used to transform biomass into fuels, chemicals and power. Fully revised and updated, this new edition highlights the substantial progress and recent developments that have been made in this rapidly growing field since publication of the first edition and incorporates up-to-date information in each chapter. Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, 2nd Edition incorporates two new chapters covering: condensed phased reactions of thermal deconstruction of biomass and life cycle analysis of thermochemical processing systems. It offers a new introductory chapter that provides a more comprehensive overview of thermochemical technologies. The book also features fresh perspectives from new authors covering such evolving areas as solvent

liquefaction and hybrid processing. Other chapters cover combustion, gasification, fast pyrolysis, upgrading of syngas and bio-oil to liquid transportation fuels, and the economics of thermochemically producing fuels and power, and more. Features contributions by a distinguished group of European and American researchers offering a broad and unified description of thermochemical processing options for biomass. Combines an overview of the current status of thermochemical biomass conversion as well as engineering aspects to appeal to the broadest audience. Edited by one of Biofuels Digest's "Top 100 People" in bioenergy for six consecutive years. *Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, 2nd Edition* will appeal to all academic researchers, process chemists, and engineers working in the field of biomass conversion to fuels and chemicals. It is also an excellent book for graduate and advanced undergraduate students studying biomass, biofuels, renewable resources, and energy and power generation.

#### A Thermochemical Heat Storage System for Households

The book offers a comprehensive report on the design and optimization of a thermochemical heat storage system for use in buildings. It combines theoretical and experimental work, with a special emphasis on model-based methods. It describes the numerical modeling of the heat exchanger, which allows recovery of about two thirds of the waste heat from both solar and thermal energy. The book also provides readers with a snapshot of current research on thermochemical storage systems, and an in-depth review of the most important concepts and methods in thermal management modeling. It represents a valuable resource for students, engineers and researchers interested in thermal energy storage processes, as well as for those dealing with modeling and 3D simulations in the field of energy and process engineering.

#### Chemical and Energy Process Engineering

Emphasizing basic mass and energy balance principles, *Chemical and Energy Process Engineering* prepares the next generation of process engineers through an exemplary survey of energy process engineering, basic thermodynamics, and the analysis of energy efficiency. By emphasizing the laws of thermodynamics and the law of mass/matter conservation, the

Thermochemical water-splitting cycle, bench-scale investigations, and process engineering : final report for the period February 1977 through December 31, 1981

A comprehensive overview of current developments and applications in biofuels production. *Process Systems Engineering for Biofuels Development* brings together the latest and most cutting-edge research on the production of biofuels. As the first book specifically devoted to process systems engineering for the production of biofuels, *Process Systems Engineering for Biofuels Development* covers theoretical, computational and experimental issues in biofuels process engineering. Written for researchers and postgraduate students working on biomass conversion and sustainable process design, as well as industrial practitioners and engineers involved in process design, modeling and optimization, this book is an indispensable guide to the newest developments in areas including: Enzyme-catalyzed biodiesel production Process analysis of biodiesel production (including kinetic modeling, simulation and optimization) The use of ultrasonification in biodiesel production Thermochemical processes for biomass transformation to biofuels Production of alternative biofuels In addition to the comprehensive overview of the subject of biofuels found in the Introduction of the book, the authors of various chapters have provided extensive discussions of the production and separation of biofuels via novel applications and techniques.

#### Process Systems Engineering for Biofuels Development

This study presents the development of an expanded biorefinery processing network for producing biofuels that combines biochemical and thermochemical conversion platforms. The expanded network is coupled to a framework that uses a superstructure based optimization approach to generate and compare a large number of alternatives at their optimal points. In this study the superstructure for thermochemical conversion route is formulated by using NREL studies of thermochemical conversion of biomass considering 3 biomass feedstocks, 2 products, 3 by-products and 18 processing intervals with combination of 72 processing intervals. This superstructure was integrated with an earlier developed superstructure for biochemical conversion routes thereby forming a formidable number of biorefinery alternatives. The expanded network was demonstrated to be versatile and useful as a

decision support tool for identifying at early stage optimal biorefinery concept with respect to technical, economic and environmental criteria.

### 23 European Symposium on Computer Aided Process Engineering

This is a convenient, one-volume reference that provides process engineers with quick information on the major equipment, processes and materials used in chemical, food, water/wastewater, fuel and other types of process engineering. The data is presented in short articles, supplemented and illustrated by tables, diagrams, charts and formulas. The data is organized in twenty short chapters with a detailed index for easy reference. Much of the data is economically presented in tables.

### Process Engineering Data Book

Process Safety Calculations, Second Edition remains to be an essential guide for students and practitioners in process safety engineering who are working on calculating and predicting risks and consequences. The book focuses on calculation procedures based on basic chemistry, thermodynamics, fluid dynamics, conservation equations, kinetics and practical models. It provides helpful calculations to demonstrate compliance with regulations and standards, such as Seveso directive(s)/COMAH, CLP regulation, ATEX directives, PED directives, REACH regulation, OSHA/NIOSH and UK ALARP, along with risk and consequence assessment, stoichiometry, thermodynamics, stress analysis and fluid-dynamics. This fully revised, updated and expanded second edition follows the same organization as the first, including the original three main parts, Fundamentals, Consequence Assessment and Quantitative Risk Assessment. However, the latter part is significantly expanded, including an appendix consisting of five fundamental thematic areas belonging to the risk assessment framework, including in-depth calculations methodologies for some fundamental monothematic macro-areas of process safety. Revised, updated and expanded new edition that includes newly developing areas of process safety that are relevant to QRA Provides engineering fundamentals to enable readers to properly approach the subject of process safety Includes a remarkable and broad numbers of calculation examples, which are completely resolved and fully explained Develops the QRA subject, consistently with the methodology applied in the big projects

### Process Safety Calculations

Advances in Chemical Engineering, Volume 58 in this long-running serial, highlights new advances in the field with this new volume presenting interesting and timely chapters written by an international board of authors. Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Advances in Chemical Engineering series

### Solar Thermochemistry

This three-volume handbook provides an overview of the key aspects of micro process engineering. Volume 1 covers the fundamentals, operations and catalysts, volume 2 examines devices, reactions and applications, with volume 3 rounding off the trilogy with system, process and plant engineering. Fluid dynamics, mixing, heat/mass transfer, purification and separation microstructured devices and microstructured reactors are explained in the first volume. Volume 2 segments microreactor design, fabrication and assembly, bulk and fine chemistry, polymerisation, fuel processing and functional materials into understandable parts. The final volume of the handbook addresses microreactor systems design and scale-up, sensing, analysis and control, chemical process engineering, economic and eco-efficiency analyses as well as microreactor plant case studies in one book. Together, this 3-volume handbook explains the science behind micro process engineering to the scale-up and their real life industrial applications.

### Micro Process Engineering, 3 Volume Set

Thermochemical surface engineering significantly improves the properties of steels. Edited by two of the world's leading authorities, this important book summarises the range of techniques and their applications. It covers nitriding, nitrocarburizing and carburizing. There are also chapters on low temperature techniques as well as boriding, sheradizing, aluminizing, chromizing, thermo-reactive deposition and diffusion. Reviews the fundamentals of surface treatments and current performance of improved materials Covers nitriding, nitrocarburizing and carburizing of iron and iron carbon alloys Examines how different thermochemical surface engineering methods can help against corrosion"

### Strategy of Process Engineering

Computer aided process engineering (CAPE) plays a key design and operations role in the process industries. This conference features presentations by CAPE specialists and addresses strategic planning, supply chain issues and the increasingly important area of sustainability audits. Experts collectively highlight the need for CAPE practitioners to embrace the three components of sustainable development: environmental, social and economic progress and the role of systematic and sophisticated CAPE tools in delivering these goals. Contributions from the international community of researchers and engineers using computing-based methods in process engineering Review of the latest developments in process systems engineering Emphasis on a systems approach in tackling industrial and societal grand challenges

### Process Engineering Calculations

Completely revised and updated to reflect the current IUPAC standards, this second edition is enlarged by five new chapters dealing with the assessment of energy potential, physical unit operations, emergency pressure relief, the reliability of risk reducing measures, and process safety and process development. Clearly structured in four parts, the first provides a general introduction and presents the theoretical, methodological and experimental aspects of thermal risk assessment. Part II is devoted to desired reactions and techniques allowing reactions to be mastered on an industrial scale, while the third part deals with secondary reactions, their characterization, and techniques to avoid triggering them. Due to the inclusion of new content and restructuring measures, the technical aspects of risk reduction are highlighted in the new section that constitutes the final part. Each chapter begins with a case history illustrating the topic in question, presenting lessons learned from the incident. Numerous examples taken from industrial practice are analyzed, and each chapter concludes with a series of exercises or case studies, allowing readers to check their understanding of the subject matter. Finally, additional control questions have been added and solutions to the exercises and problems can now be found.

### Thermochemical Surface Engineering of Steels: Improving Materials Performance

Industrial biorefineries have been identified as the most promising routes to the creation of a bio-based economy. Partial biorefineries already exist in some energy crop, forest-based, and lignocellulosic product facilities. Biorefineries: For Biomass Upgrading Facilities examines the variety of different technologies which integrated bio-based industries use to produce chemicals; biofuels; food and feed ingredients; biomaterials; and power from biomass raw materials. Conversion technologies are also covered, since biomass can be converted into useful biofuels and biochemicals via biomass upgrading and biorefinery technologies. Biorefineries: For Biomass Upgrading Facilities will prove a practical resource for chemical engineers, and fuel and environmental engineers. It will also be invaluable in academic fields, providing useful information for both researchers and students.

### 22nd European Symposium on Computer Aided Process Engineering

Micro Fluidization: Fundamentals and Applications provides background and history on micro fluidized bed research and development, summarizes and analyzes the hydrodynamic characteristics of gas-solid micro fluidized beds, and delves into areas such as research results of delayed onsets of minimum, bubbling and slugging fluidization regimes, as well as of the advanced transitions to turbulent and fast fluidization regimes. Based on these results, the wall effects – the key mechanism resulting in the unique behavior of micro fluidization – are analyzed. Other sections discuss gas and solid mixing characteristics in terms of gas residence time distribution, gas backmixing, and solids mixing. Final sections focus on presentations of the so-called micro fluidized bed reaction analyzer (MFBRA) – a powerful tool for catalyst screening, process development, optimization of reaction parameters, studies of reaction mechanism and kinetics, among many other purposes. The book describes, in detail, the MFBRA's system design characteristics, analytic methodologies and various applications in thermochemical and catalytic reaction analysis. Includes up-to-date information (all related research results and insights) on micro fluidized beds, including how they are comprehensively summarized and analyzed Describes and explains the unique characteristics of micro fluidized beds Covers the fundamental aspects and applications related to gas-solids, liquid-solids, and gas-liquid-solids micro fluidized beds Provides up-to-date and potential applications of micro fluidized beds

### Thermal Safety of Chemical Processes

"In many modern plants, lots of time and money is spent addressing recurring problems. This guide gives you a structured, practical way to solve real-world plant processing problems, focusing on those that tend to be chronic or that require an engineering analysis. If you have a good understanding of the equipment and the specific technology involved, this systematic, methodical reasoning approach will help you quickly analyze and solve problems in your plant. It's a great reference for chemical engineers, industrial engineers, and industrial managers who are looking for techniques to improve their problem-solving skills within their organizations. It helps nonchemical engineers with some experience in the process industry and process operators with some understanding of unit operations to streamline process engineering problem solving."--Jacket.

### Biorefineries

This book will aid the chemical engineer to carry out chemical process engineering in a very practical way. The process engineer can use the excel based calculation templates effectively to do correct and proper process design. Chemical engineering is a very vast and complex field. This book aims to simplify the process engineering design. Design of a chemical plant involves one being adept in technical aspects of process engineering. The book aims at making the chemical engineer proficient in the art of process design. Included are chemical engineering basics on simulation, stoichiometry, fluid property calculation, dimensionless numbers, thermodynamics and on chemical engineering equipment like pump, compressor, steam turbine, gas turbine, flare, motor, fired heater, incinerator, heat exchanger, distillation column, fractionation column, absorber, stripper, packed column, solar evaporation pond, separator. Utility design of nitrogen, compressed air, water, effluent treatment, steam, condensate, desalination, fuel selection is covered. Many chemical engineering calculations have been included. Special process items like flame arrestor, demister, feed device, pressure reducing and desuperheating station (PRDS), vortex breaker, electric heater, manual valve have been covered. Process engineering design criteria, process control, material of construction, specialized process studies, safety studies, precommissioning and commissioning have been covered. Project engineer will also benefit from information provided on types of project (EPC, EPCM, Cost + Fee, etc) as well as interdisciplinary interaction between various engineering disciplines i.e. process, piping, mechanical, instrumentation, electrical, civil and THSE. Process engineering documentation like process design basis, process philosophies, process flow diagram (PFD), piping and instrumentation diagram (P&ID), block flow diagram (BFD), DP-DT diagram, material selection diagram (MSD), line list, summaries like utility summary, effluent and emission summary, tie in summary and flare relief load summary have been covered with blank templates. Excerpts from few chapters have been provided.

### Chemical Micro Process Engineering

This textbook provides a comprehensive introduction to chemical process engineering, linking the fundamental theory and concepts to the industrial day-to-day practice. It bridges the gap between chemical sciences and the practical chemical industry. It enables the reader to integrate fundamental knowledge of the basic disciplines, to understand the most important chemical processes, and to apply this knowledge to the practice in the industry.

### Micro Fluidization

Compiled by an expert in the field, the book provides an engineer with data they can trust. Spanning gases, liquids, and solids, all critical properties (including viscosity, thermal conductivity, and diffusion coefficient) are covered. From C1 to C100 organics and Ac to Zr inorganics, the data in this handbook is a perfect quick reference for field, lab or classroom usage. By collecting a large – but relevant – amount of information in one source, the handbook enables engineers to spend more time developing new designs and processes, and less time collecting vital properties data. This is not a theoretical treatise, but an aid to the practicing engineer in the field, on day-to-day operations and long range projects. Simplifies research and significantly reduces the amount of time spent collecting properties data. Compiled by an expert in the field, the book provides an engineer with data they can trust in design, research, development and manufacturing. A single, easy reference for critical temperature dependent properties for a wide range of hydrocarbons, including C1 to C100 organics and Ac to Zr inorganics.

### Process Engineering Problem Solving

Innovations in Thermochemical Technologies for Biofuel Processing broadly covers current technologies in alternate fuels and chemical production, a few of which include biomass-to-liquid, bio-

mass-to-gas and gas-to-liquid biomass conversion technologies. The topics in this book include elaborative discussions on biomass feedstocks, biomass-to-liquid technologies (liquefaction, pyrolysis and transesterification), biomass-to-gas technologies (gasification), gas-to-liquid technologies (syngas fermentation and Fischer-Tropsch synthesis), co-processing technologies, fuel upgrading technologies (hydrotreating and reforming), novel catalyst development for biorefining, biorefining process optimization, unit operations, reaction kinetics, artificial neural network, and much more. The book comprehensively discusses the strengths, weaknesses, opportunities and threats of notable biofuels (e.g., bio-oil, biocrude oil, biodiesel, bioethanol, biobutanol, bio-jet fuels, biohydrogen, biomethane, synthesis gas, hydrocarbon fuels, etc.). Addresses solutions for clean fuel, energy security, waste management, waste valorization, reduced greenhouse gas emissions, carbon capture and sequestration, circular economy and climate change mitigation. Includes applications of thermochemical conversion and reforming technologies for waste biomass to biofuels. Covers current technologies in alternate fuels and chemicals production, a few of which include conversion technologies (i.e., liquefaction, gasification, pyrolysis, torrefaction, transesterification, organic transformation, carbon-carbon and carbon-heteroatom coupling reactions, oxidation, and reforming processes, etc.), hydrotreating technologies (i.e., hydrogenation, hydrodesulfurization, hydrodenitrogenation, hydrodearomatization and hydrodemetalization) and catalytic processes.

#### Mihir's Handbook of Chemical Process Engineering (Excerpts)

This book is a beginners introduction to chemical thermodynamics for engineers. In the textbook efforts have been made to visualize as clearly as possible the main concepts of thermodynamic quantities such as enthalpy and entropy, thus making them more perceivable. Furthermore, intricate formulae in thermodynamics have been discussed as functionally unified sets of formulae to understand their meaning rather than to mathematically derive them in detail. In this textbook, the affinity of irreversible processes, defined by the second law of thermodynamics, has been treated as the main subject, rather than the equilibrium of chemical reactions. The concept of affinity is applicable in general not only to the processes of chemical reactions but also to all kinds of irreversible processes. This textbook also includes electrochemical thermodynamics in which, instead of the classical phenomenological approach, molecular science provides an advanced understanding of the reactions of charged particles such as ions and electrons at the electrodes. Recently, engineering thermodynamics has introduced a new thermodynamic potential called exergy, which essentially is related to the concept of the affinity of irreversible processes. This textbook discusses the relation between exergy and affinity and explains the exergy balance diagram and exergy vector diagram applicable to exergy analyses in chemical manufacturing processes. This textbook is written in the hope that the readers understand in a broad way the fundamental concepts of energy and exergy from chemical thermodynamics in practical applications. Finishing this book, the readers may easily step forward further into an advanced text of their specified line. - Visualizes the main concepts of thermodynamics to show the meaning of the quantities and formulae. - Focuses mainly on the affinity of irreversible processes and the related concept of exergy. - Provides an advanced understanding of electrochemical thermodynamics.

#### Process Engineering

This book highlights the processes of biomass thermochemical conversion, covering topics from combustion and gasification, to pyrolysis and liquefaction. Heat, power, biofuels and green chemicals can all be produced by these thermochemical processes. The different scales of investigation are presented: from the bioenergy chains, to the reactors and molecular mechanisms. The author uses current research and data to present bioenergy chains from forest to final use, including the biomass supply chains, as well as the life cycle assessment of different process chains. Biomass conversion reactors are also presented, detailing their technologies for combustion, gasification and syngas up-grading systems, pyrolysis and bio-oil upgrading. The physical-chemical mechanisms occurring in all these reactors are presented highlighting the main pathways for gas, char and bio-oil formation from biomass. This book offers an overview of biomass valorization for students, engineers or developers in chemistry, chemical, environmental or mechanical engineering.

#### Thermophysical Properties of Chemicals and Hydrocarbons

Drawing on his own extensive experience, Jones provides rules of thumb essential for the new engineer in industry. Covering responsibilities such as project management, installation of new facilities and

implementation of contracts, this book offers a wealth of experience and knowledge, helping newer process engineers to find a foothold in their chosen industry.

#### Innovations in Thermochemical Technologies for Biofuel Processing

While teaching the Numerical Methods for Engineers course over the last 15 years, the author found a need for a new textbook, one that was less elementary, provided applications and problems better suited for chemical engineers, and contained instruction in Visual Basic for Applications (VBA). This led to six years of developing teaching notes that

#### Chemical Energy and Exergy

The 17th European Symposium on Computer Aided Process Engineering contains papers presented at the 17th European Symposium of Computer Aided Process Engineering (ESCAPE 17) held in Bucharest, Romania, from 27-30 May 2007. The ESCAPE series serves as a forum for scientists and engineers from academia and industry to discuss progress achieved in the area of Computer Aided Process Engineering (CAPE). The main goal was to emphasize the continuity in research of innovative concepts and systematic design methods as well the diversity of applications emerged from the demands of sustainable development. ESCAPE 17 highlights the progress software technology needed for implementing simulation based tools. The symposium is based on 5 themes and 27 topics, following the main trends in CAPE area: Modelling, Process and Products Design, Optimisation and Optimal Control and Operation, System Biology and Biological Processes, Process Integration and Sustainable Development. Participants from 50 countries attended and invited speakers presented 5 plenary lectures tackling broad subjects and 10 keynote lectures. Satellite events added a plus to the scientific dimension to this symposium. \* All contributions are included on the CD-ROM attached to the book \* Attendance from 50 countries with invited speakers presenting 5 plenary lectures tackling broad subjects and 10 keynote lectures

#### Manual for Process Engineering Calculations

This book develops the theory of chemical thermodynamics from first principles, demonstrates its relevance across scientific and engineering disciplines, and shows how thermodynamics can be used as a practical tool for understanding natural phenomena and developing and improving technologies and products. Concepts such as internal energy, enthalpy, entropy, and Gibbs energy are explained using ideas and experiences familiar to students, and realistic examples are given so the usefulness and pervasiveness of thermodynamics becomes apparent. The worked examples illustrate key ideas and demonstrate important types of calculations, and the problems at the end of chapters are designed to reinforce important concepts and show the broad range of applications. Most can be solved using digitized data from open access databases and a spreadsheet. Answers are provided for the numerical problems. A particular theme of the book is the calculation of the equilibrium composition of systems, both reactive and non-reactive, and this includes the principles of Gibbs energy minimization. The overall approach leads to the intelligent use of thermodynamic software packages but, while these are discussed and their use demonstrated, they are not the focus of the book, the aim being to provide the necessary foundations. Another unique aspect is the inclusion of three applications chapters: heat and energy aspects of processing; the thermodynamics of metal production and recycling; and applications of electrochemistry. This book is aimed primarily at students of chemistry, chemical engineering, applied science, materials science, and metallurgy, though it will be also useful for students undertaking courses in geology and environmental science. A solutions manual is available for instructors.

#### The Industrial Practice of Chemical Process Engineering

Computer-aided process engineering (CAPE) plays a key design and operations role in the process industries, from the molecular scale through managing complex manufacturing sites. The research interests cover a wide range of interdisciplinary problems related to the current needs of society and industry. ESCAPE 23 brings together researchers and practitioners of computer-aided process engineering interested in modeling, simulation and optimization, synthesis and design, automation and control, and education. The proceedings present and evaluate emerging as well as established research methods and concepts, as well as industrial case studies. Contributions from the international community using computer-based methods in process engineering Reviews the latest developments in process systems engineering Emphasis on industrial and societal challenges

## Thermochemical Conversion of Biomass for the Production of Energy and Chemicals

Cereals, legumes, oilseeds, fruits, and vegetables are the most important food crops in the world, with cereal grains contributing the bulk of food calories and proteins worldwide. Generally, the supply of grains and other food can be enhanced by increasing production and by reducing postharvest losses. While food production has increased significantly

## Elements of Chemical Process Engineering

Chemical Process Engineering presents a systematic approach to solving design problems by listing the needed equations, calculating degrees-of-freedom, developing calculation procedures to generate process specifications- mostly pressures, temperatures, compositions, and flow rates- and sizing equipment. This illustrative reference/text tabulates numerous easy-to-follow calculation procedures as well as the relationships needed for sizing commonly used equipment.

## Numerical Methods for Chemical Engineers Using Excel, VBA, and MATLAB

As the range of feedstocks, process technologies and products expand, biorefineries will become increasingly complex manufacturing systems. *Biorefineries and Chemical Processes: Design, Integration and Sustainability Analysis* presents process modelling and integration, and whole system life cycle analysis tools for the synthesis, design, operation and sustainable development of biorefinery and chemical processes. Topics covered include: Introduction: An introduction to the concept and development of biorefineries. Tools: Included here are the methods for detailed economic and environmental impact analyses; combined economic value and environmental impact analysis; life cycle assessment (LCA); multi-criteria analysis; heat integration and utility system design; mathematical programming based optimization and genetic algorithms. Process synthesis and design: Focuses on modern unit operations and innovative process flowsheets. Discusses thermochemical and biochemical processing of biomass, production of chemicals and polymers from biomass, and processes for carbon dioxide capture. Biorefinery systems: Presents biorefinery process synthesis using whole system analysis. Discusses bio-oil and algae biorefineries, integrated fuel cells and renewables, and heterogeneous catalytic reactors. Companion website: Four case studies, additional exercises and examples are available online, together with three supplementary chapters which address waste and emission minimization, energy storage and control systems, and the optimization and reuse of water. This textbook is designed to bridge a gap between engineering design and sustainability assessment, for advanced students and practicing process designers and engineers.

## 17th European Symposium on Computed Aided Process Engineering

A step-by-step guide for students (and faculty) on the use of Aspen in teaching thermodynamics • Easily-accessible modern computational techniques opening up new vistas in teaching thermodynamics • A range of applications of Aspen Plus in the prediction and calculation of thermodynamic properties and phase behavior using the state-of-the art methods • Encourages students to develop engineering insight by doing repetitive calculations with changes in parameters and/or models • Calculations and application examples in a step-by-step manner designed for out-of-classroom self-study • Makes it possible to easily integrate Aspen Plus into thermodynamics courses without using in-class time • Stresses the application of thermodynamics to real problems

## Chemical Thermodynamics

The ESCAPE symposia address the applications of computer aids to all aspects of process engineering. The primary objective is the interchange of information on industrial needs, new technology developments and research opportunities. With industrialists and academia contributing from all over the world, this set of proceedings provides an overview of current international computer-aided process engineering (CAPE). This book is intended for chemical and process engineers, design engineers and computer-aided specialists.



## 23rd European Symposium on Computer Aided Process Engineering

Food materials are processed prior to their consumption using different processing technologies that improve their shelf life and maintain their physicochemical, biological, and sensory qualities. Introduction to Advanced Food Process Engineering provides a general reference on various aspects of processing, packaging, storage, and quality control

## Postharvest Technology and Food Process Engineering

Fossil Energy Update