

## Product Process Design Principles 3rd Edition

Table of Contents  
Part I: Product And Process Invention - Heuristics And Analysis  
Part II: Detailed Process Synthesis - Algorithmic Methods  
Part III: Detailed Design, Equipment Sizing, And Optimization - Configured Product Design  
Part IV: Plantwide Controllability Assessment  
Part V: Design Report

This book introduces readers to various tools and techniques for the design of precision, miniature products, assemblies and associated manufacturing processes. In particular, it focuses on precision mechanisms, robotic devices and their control strategies, together with case studies. In the context of manufacturing process, the book highlights micro/nano machining/forming processes using non-conventional energy sources such as lasers, EDM (electro-discharge machining), ECM (electrochemical machining), etc. Techniques for achieving optimum performance in process modeling, simulation and optimization are presented. The applications of various research tools such as FEM (finite element method), neural networks, genetic algorithms, etc. to product-process design and optimization are illustrated through case studies. The state-of-the-art material presented here provides valuable directions for product development and future research work in this area. The contents of this book will be of use to researchers and industry professionals alike.

Hailed as a groundbreaking and important textbook upon its initial publication, the latest iteration of Product Design for Manufacture and Assembly does not rest on those laurels. In addition to the expected updating of data in all chapters, this third edition has been revised to provide a top-notch textbook for university-level courses in product

This 3rd edition provides chemical engineers with process control techniques that are used in practice while offering detailed mathematical analysis. Numerous examples and simulations are used to illustrate key theoretical concepts. New exercises are integrated throughout several chapters to reinforce concepts.

The selection of the most adequate thermodynamic model in a process simulation is an issue that most process engineer has to face sooner or later. This book, conceived as a practical guide, aims at providing adequate answers by analysing the questions to be looked at. The analysis (first chapter) yields three keys that are further discussed in three different chapters. (1) A good understanding of the properties required in the process, and their method of calculation is the first key. The second chapter provides to that end in a synthetic manner the most important equations that are derived from the fundamental principles of thermodynamics. (2) An adequate description of the mixture, which is a combination of models and parameters, is the second key. The third chapter makes the link between components and models, both from a numerical (parameterisation) and physical (molecular interactions) point of view. Finally, (3) a correct view of the phase behaviour and trends in regard of the process conditions is the third key. The fourth chapter illustrates the phase behaviour and

makes model recommendations for the most significant industrial systems. A decision tree is provided at the end of this chapter. In the last chapter, the key questions are reviewed for a number of typical processes. This book is intended for process engineers, who are not specialists of thermodynamics but are confronted with this kind of problems and need a reference book, as well as process engineering students who will find an original approach to thermodynamics, complementary of traditional lectures

This book explores sustainability engineering through the lens of the manufacturing and chemical process industries to elucidate the safe and economic implementation of process designs used to transform raw materials into useful finished products. The author applies the tenets of sustainability science to develop an engineering methodology that supports the perpetual availability of raw materials through recycling/reuse/repurposing, incorporates inexhaustible supplies, such as solar energy and municipal waste, and encompasses the husbandry of these resources in a manner that minimizes negative environmental impacts. Anyone involved in the design or manufacture of chemicals, or the upgrade of existing manufacturing processes, will benefit from this book's suggestions for identifying improvement options, while adding the pivotal aspect of sustainability to the usual cost and safety equation optimization elements.

For reasons both financial and environmental, there is a perpetual need to optimize the design and operating conditions of industrial process systems in order to improve their performance, energy efficiency, profitability, safety and reliability. However, with most chemical engineering application problems having many variables with complex inter-relationships, meeting these optimization objectives can be challenging. This is where Multi-Objective Optimization (MOO) is useful to find the optimal trade-offs among two or more conflicting objectives. This book provides an overview of the recent developments and applications of MOO for modeling, design and operation of chemical, petrochemical, pharmaceutical, energy and related processes. It then covers important theoretical and computational developments as well as specific applications such as metabolic reaction networks, chromatographic systems, CO<sub>2</sub> emissions targeting for petroleum refining units, ecodesign of chemical processes, ethanol purification and cumene process design. Multi-Objective Optimization in Chemical Engineering: Developments and Applications is an invaluable resource for researchers and graduate students in chemical engineering as well as industrial practitioners and engineers involved in process design, modeling and optimization.

From three design partners at Google Ventures, a unique five-day process--called the sprint--for solving tough problems using design, prototyping, and testing ideas with customers.

The design and study of materials is a pivotal component to new discoveries in the various fields of science and technology. By better understanding the components and

structures of materials, researchers can increase its applications across different industries. *Materials Science and Engineering: Concepts, Methodologies, Tools, and Applications* is a compendium of the latest academic material on investigations, technologies, and techniques pertaining to analyzing the synthesis and design of new materials. Through its broad and extensive coverage on a variety of crucial topics, such as nanomaterials, biomaterials, and relevant computational methods, this multi-volume work is an essential reference source for engineers, academics, researchers, students, professionals, and practitioners seeking innovative perspectives in the field of materials science and engineering.

*Product and Process Design: Driving Innovation* is a comprehensive textbook for students and industrial professionals. It treats the combined design of innovative products and their innovative manufacturing processes, providing specific methods for BSc, MSc, PDEng and PhD courses. Students, industrial innovators and managers are guided through all design steps in all innovation stages (discovery, concept, feasibility, development, detailed engineering, and implementation) to successfully obtain novel products and their novel processes. The authors' decades of innovation experience in industry, as well as in teaching BSc, MSc, and post-academic product and process design courses, thereby including the latest design publications, culminate in this book. In April 1991 *BusinessWeek* ran a cover story entitled, "Can't Work This Thing," about the difficulties many people have with consumer products, such as cell phones and VCRs. More than 15 years later, the situation is much the same—but at a very different level of scale. The disconnect between people and technology has had society-wide consequences in the large-scale system accidents from major human error, such as those at Three Mile Island and in Chernobyl. To prevent both the individually annoying and nationally significant consequences, human capabilities and needs must be considered early and throughout system design and development. One challenge for such consideration has been providing the background and data needed for the seamless integration of humans into the design process from various perspectives: human factors engineering, manpower, personnel, training, safety and health, and, in the military, habitability and survivability. This collection of development activities has come to be called human-system integration (HSI). *Human-System Integration in the System Development Process* reviews in detail more than 20 categories of HSI methods to provide invaluable guidance and information for system designers and developers.

This book provides a global perspective on the various issues that the industry has to face as well as to provide some key global strategies that can help coping with those global challenges, such as collaboration, strategic value chain planning, and interdependency analyses. It presents literature reviews, strategic research orientations, assessment of some current key issues, and state-of-the-art methodologies.

Over the last 20 years, fundamental design concepts and advanced computer modeling have revolutionized process design for chemical engineering. Team work and creative problem solving are still the building blocks of successful design, but new design concepts and novel mathematical programming models based on computer-based tools have taken out much of the guess-work. This book presents the new revolutionary knowledge, taking a systematic approach to design at all levels.

Accompanied by CD-ROM: Simulation of process flowsheets.

This textbook presents a general multi-objective optimization framework for optimizing chemical processes by implementing a link between process simulators and metaheuristic techniques. The proposed approach is general and shows how to implement links between different process simulators such as Aspen Plus®, HYSIS®, Super Pro Designer® linked to a variety of metaheuristic techniques implemented in Matlab®, Excel®, C++, and others, eliminating the numerical complications through the optimization process. Furthermore, the proposed framework allows the use of thermodynamic, design and constitutive equations implemented in the process simulator to implement any process. Aimed at graduate and undergraduate students, it presents introductory chapters for process simulators and metaheuristic optimization techniques and provides several worked exercises as well as proposed exercises. In addition, accompanying tutorial videos clearly explaining the implemented methodologies are available online. Also, some Matlab® routines are included as electronic supporting material.

Process synthesis and process intensification are becoming state-of-the-art scientific fields that provide the methods and tools to improve process technologies in terms of high energy efficiency, low capital investment, low emissions, improved safety, and less hazardous byproducts to achieve sustainable products and processes. The book covers manufacturing processes from both fossil- and biomass-based feedstocks for graduate students.

"The book provides a practical guide to chemical process design and integration for students and practicing process engineers in industry"--

While various software packages have become quite useful for performing unit operations and other kinds of processes in chemical engineering, the fundamental theory and methods of calculation must also be understood in order to effectively test the validity of these packages and verify the results. Computer Methods in Chemical Engineering presents the most commonly used simulation software, along with the theory involved. It covers chemical engineering thermodynamics, fluid mechanics, material and energy balances, mass transfer operations, reactor design, and computer applications in chemical engineering. Through this book, students learn: What chemical engineers do The functions and theoretical background of basic chemical engineering unit operations How to simulate chemical processes using software packages How to size chemical process units manually and with software How to fit experimental data How to solve linear and nonlinear algebraic equations as well as ordinary differential equations Along with exercises and references, each chapter contains a theoretical description of process units followed by numerous examples that are solved step by step via hand calculations and computer simulation using Hysys/Unisim, PRO/II, Aspen Plus, and SuperPro Designer. Adhering to the Accreditation Board for Engineering and Technology (ABET) criteria, the book gives students the tools needed to solve real problems involving thermodynamics and fluid-phase equilibria, fluid flow, material and energy balances, heat exchangers, reactor design, distillation, absorption, and liquid–liquid extraction.

The Essentials of Instructional Design, 3rd Edition introduces the essential elements of instructional design (ID) to students who are new to ID. The key procedures within the ID process—learner analysis, task analysis, needs analysis, developing goals and objectives, organizing instruction, developing instructional activities, assessing learner achievement and evaluating the success of the instructional design—are covered in complete chapters that describe and provide examples of how the procedure is accomplished using the best known instructional design models. Unlike most other ID books, The Essentials of Instructional Design provides an overview of the principles and practice of ID without placing emphasis on any one ID model. Offering the voices of instructional designers from a number of professional settings and providing real-life examples from across sectors, students learn how professional organizations put the various ID processes into practice. This introductory textbook provides students with the information they need to make informed decisions as they design and develop instruction, offering them a variety of possible approaches for each step in the ID process and clearly explaining the strengths and challenges associated with each approach.

One of the most important objective in this text describes the strategies and approaches for the design of chemical processes. It covers economic (optimization) and environmental issues. The latest design strategies are described, most of which have been improved significantly with the advent of computers, mathematical programming methods, and artificial intelligence. Various methods are utilized to perform the extensive calculations and provide graphical results that are visualized easily, including the usage of computer programs for simulation and design optimization.

Sustainable practices within the mining and energy sectors are assuming greater significance due to uncertainty and change within the global economy and safety, security, and health concerns. This book examines sustainability issues facing the mining and energy sectors by addressing six major themes: Mining and Mineral Processing; Metallurgy and Recycling; Environment; Energy; Socioeconomic and Regulatory; and Sustainable Materials and Fleets.

Emphasizing an integrated transdisciplinary approach, it deliberates on optimizing mining productivity and energy efficiency and discusses integrated waste management practices. It discusses risk management, cost cutting, and integration of sustainable practices for long-term business value. It gives a comprehensive outlook for sustainable mineral futures from academic and industry perspectives covering mine to mill optimization, waste, risk and water management, improved efficiencies in mining tools and equipment, and performance indicators for sustainable developments. It covers how innovation and research underpin management of natural resources including sustainable carbon management. •Focuses on mining and mineral processing, metallurgy and recycling, the environment, energy, socioeconomic and regulatory issues, and sustainable materials and fleets. •Describes metallurgy and recycling and

uses economic, environmental and social parameter analyses to identify areas for improvement in iron, steel, aluminium, lead, zinc, copper, and gold production.

- Discusses current research on mining, performance indicators for sustainable development, sustainability in mining equipment, risk and safety management, and renewable energy resources
- Covers alternative and conventional energy sources for the mineral sector as well water treatment and remediation and energy sustainability in mining.
- Provides an overview of sustainable carbon management.
- Offers an interdisciplinary approach with international focus.

Separation Process Principles with Applications Using Process Simulator, 4th Edition is the most comprehensive and up-to-date treatment of the major separation operations in the chemical industry. The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice. Completely rewritten to enhance clarity, this fourth edition provides engineers with a strong understanding of the field. With the help of an additional co-author, the text presents new information on bioseparations throughout the chapters. A new chapter on mechanical separations covers settling, filtration and centrifugation including mechanical separations in biotechnology and cell lysis. Boxes help highlight fundamental equations. Numerous new examples and exercises are integrated throughout as well.

Part I: Process design -- Introduction to design -- Process flowsheet development -- Utilities and energy efficient design -- Process simulation -- Instrumentation and process control -- Materials of construction -- Capital cost estimating -- Estimating revenues and production costs -- Economic evaluation of projects -- Safety and loss prevention -- General site considerations -- Optimization in design -- Part II: Plant design -- Equipment selection, specification and design -- Design of pressure vessels -- Design of reactors and mixers -- Separation of fluids -- Separation columns (distillation, absorption and extraction) -- Specification and design of solids-handling equipment -- Heat transfer equipment -- Transport and storage of fluids.

This volume focuses on technological advances relevant to establishing biofuels as a viable alternative to fossil fuels by overcoming current limitations. The progressive depletion of fossil fuels due to their large-scale utilization and their environmental consequences, notably global warming, increase the need for sustainable and cleaner energy options. Renewable biofuels – like biohydrogen, biomethane, biogas, ethanol and butanol – represent attractive energy sources to meet the growing global demand, thanks to sustainable and cost-efficient production approaches based on cellulosic biomass. Currently, the commercialization of these technologies is hindered by technical and economic limitations, such as biomass complexity and pre-treatment, enzyme hydrolysis, production efficiency as well as storage and cost. As such, this book presents economically viable and sustainable approaches to improve existing biofuel technologies and appeals to anyone with an interest in biofuels as renewable energy options and their practical implementation.

The latest research innovations and enhanced technologies have altered the discipline of materials science and engineering. As a direct result of these developments, new trends in Materials Science and Engineering (MSE) pedagogy have emerged that require attention. The Handbook of Research on Recent Developments in Materials Science and Corrosion Engineering Education brings together innovative and current advances in the curriculum design and course content of MSE education programs. Focusing on the application of instructional strategies, pedagogical frameworks, and career preparation techniques, this book is an essential reference source for academicians, engineering practitioners, researchers, and industry professionals interested in emerging and future trends in MSE training and education. Praise for the first edition: "This excellent text will be useful to every system engineer (SE) regardless of the domain. It covers ALL relevant SE material and does so in a very clear, methodical fashion. The breadth and depth of the author's presentation of SE principles and practices is outstanding." –Philip Allen This textbook presents a comprehensive, step-by-step guide to System Engineering analysis, design, and development via an integrated set of concepts, principles, practices, and methodologies. The methods presented in this text apply to any type of human system -- small, medium, and large organizational systems and system development projects delivering engineered systems or services across multiple business sectors such as medical, transportation, financial, educational, governmental, aerospace and defense, utilities, political, and charity, among others. Provides a common focal point for "bridging the gap" between and unifying System Users, System Acquirers, multi-discipline System Engineering, and Project, Functional, and Executive Management education, knowledge, and decision-making for developing systems, products, or services Each chapter provides definitions of key terms, guiding principles, examples, author's notes, real-world examples, and exercises, which highlight and reinforce key SE & D concepts and practices Addresses concepts employed in Model-Based Systems Engineering (MBSE), Model-Driven Design (MDD), Unified Modeling Language (UML/TM) / Systems Modeling Language (SysML/TM), and Agile/Spiral/V-Model Development such as user needs, stories, and use cases analysis; specification development; system architecture development; User-Centric System Design (UCSD); interface definition & control; system integration & test; and Verification & Validation (V&V) Highlights/introduces a new 21st Century Systems Engineering & Development (SE&D) paradigm that is easy to understand and implement. Provides practices that are critical staging points for technical decision making such as Technical Strategy Development; Life Cycle requirements; Phases, Modes, & States; SE Process; Requirements Derivation; System Architecture Development, User-Centric System Design (UCSD); Engineering Standards, Coordinate Systems, and Conventions; et al. Thoroughly illustrated, with end-of-chapter exercises and numerous case studies and examples, Systems Engineering Analysis, Design, and Development, Second Edition is a primary textbook for multi-discipline, engineering, system analysis, and project management undergraduate/graduate level students and a valuable reference for professionals.

This book discusses the biorefinery of biomass feedstocks. In-depth chapters highlight the scientific and technical aspects and present a techno-economic analysis of such systems. By using a TEA approach, the authors present feasible pathways for conversion of biomass (both residual biomass, energy crops and algae biomass), showing the different possibilities for the production of biochemical materials, biofuels, and fertilizers. The concepts presented in this book will link companies, investors, and governments by providing a framework that will help reduce pollutants and create a biomass related economy that incorporates the newest developments and technologies in the area.

Written by a highly regarded author with industrial and academic experience, this new edition of an established bestselling book provides practical guidance for students, researchers, and those in chemical engineering. The book includes a new section on sustainable energy, with

sections on carbon capture and sequestration, as a result of increasing environmental awareness; and a companion website that includes problems, worked solutions, and Excel spreadsheets to enable students to carry out complex calculations.

The chemical industry is changing, going beyond commodity chemicals to a palette of higher value added products. This groundbreaking book, now revised and expanded, documents this change and shows how to meet the challenges implied. Presenting a four-step design process - needs, ideas, selection, manufacture - the authors supply readers with a simple design template that can be applied to a wide variety of products. Four new chapters on commodities, devices, molecules/drugs and microstructures show how this template can be applied to products including oxygen for emphysema patients, pharmaceuticals like taxol, dietary supplements like lutein, and beverages which are more satisfying. For different groups of products the authors supply both strategies for design and summaries of relevant science. Economic analysis is expanded, emphasizing the importance of speed-to-market, selling ideas to investors and an expectation of limited time in the market. Extra examples, homework problems and a solutions manual are available.

Armed with this book, chemical engineers will have a collection of modern strategies for the design of chemical products and processes. It emphasizes a systematic approach and integrates product design more thoroughly throughout the chapters. New case studies on process design are included to make the concepts more relevant. The social aspects and economics of product design are introduced, and the Stage-Gate Product Development Process is explored in parallel tracks for several chemical products. The accompanying registration card grants access to a companion website that also provides chemical engineers with numerous examples of the simulator input and output, with frame-by-frame instructions to discuss the nature of the models provided for the processing units.

The biorefinery, integration of processes and technologies for biomass conversion, demands efficient utilization of all components. Hydrothermal processing is a potential clean technology to convert raw materials such as lignocellulosic and aquatic biomass into bioenergy and high added-value compounds. This book aims to show fundamental concepts and key technological developments that enabled industrial application of hydrothermal processing. The scope of this book is primarily for scientists working in the biorefinery field as well as engineers from industry and potential investors in biofuels. Therefore, the information in this book will provide an overview of this technology applied to lignocellulosic materials and aquatic biomass, and especially new knowledge. Critically, this book brings together experts in the application of hydrothermal processes on lignocellulosic and aquatic biomass.

In this era of global competition, the demands of customers are growing, and the quest for quality has never been more urgent. Quality has evolved from a concept into a strategy for long-term viability. The third edition of Principles of Total Quality explains this strategy for both the service and manufacturing sectors. This edition addresses the theme of reliability against the backdrop of increasing litigation in the area of product performance. New chapters also introduce and provide a historical perspective for Six Sigma, and discuss practical applications of the concepts of service excellence within healthcare organizations. The book also expands its analysis of management of process quality, customer focus and satisfaction, organizing for TQM, control charts for variables, and quality function deployment.

This second edition of The Principles of Beautiful Web Design is the ideal book for people who can build websites, but are seeking the skills and knowledge to visually enhance their sites. This book will teach you how to: Understand the process of what makes "good design," from discovery through to implementation Use color effectively, develop color schemes, and create a palette Create pleasing layouts using grids, the rule of thirds, and symmetry Employ textures:

lines, points, shapes, volumes, and depth Apply typography to make ordinary designs look great Choose, edit, and position effective imagery And lots more... This revised, easy-to-follow guide is illustrated with beautiful, full-color examples, and leads readers through the process of creating great designs from start to finish. It also features: Updated information about grid-based design How to design for mobile resolutions Information about the future of web fonts including @font-face Common user-interface patterns and resources

This is the second edition of the text "Bioreaction Engineering Principles" by Jens Nielsen and John Villadsen, originally published in 1994 by Plenum Press (now part of Kluwer). Time runs fast in Biotechnology, and when Kluwer Plenum stopped reprinting the first edition and asked us to make a second, revised edition we happily accepted. A text on bioreactions written in the early 1990's will not reflect the enormous development of experimental as well as theoretical aspects of cellular reactions during the past decade. In the preface to the first edition we admitted to be newcomers in the field. One of us (JV) has had 10 more years of job training in biotechnology, and the younger author (IN) has now received international recognition for his work with the hottest topics of "modern" biotechnology. Furthermore we are happy to have induced Gunnar Liden, professor of chemical reaction engineering at our sister university in Lund, Sweden to join us as co-author of the second edition. His contribution, especially on the chemical engineering aspects of "real" bioreactors has been of the greatest value. Chapter 8 of the present edition is largely unchanged from the first edition. We wish to thank professor Martin Hjortso from LSU for his substantial help with this chapter.

The fourth edition enhanced eBook update of Product and Process Design Principles contains many new resources and supplements including new videos, quiz questions with answer-specific feedback, and real-world case studies to support student comprehension. Product and Process Design Principles covers material for process design courses in the chemical engineering curriculum—demonstrating how process design and product design are interlinked and their importance for modern applications. Presenting a systematic approach, this fully-updated new edition describes modern strategies for the design of chemical products and processes. The text presents two parallel tracks—product design and process design—which enables instructors to easily show how product designs lead to new chemical processes and, alternatively, teach product design as separate course. Divided into five parts, the fourth edition begins with a broad introduction to product design followed by a comprehensive introduction to process synthesis and analysis. Succeeding chapters cover the products and processes of design synthesis, design analysis, and design reports. The final part of the book presents ten case studies which look at product and process designs such as for Vitamin C tablets, conductive ink for printed electronics, and home hemodialysis devices. Effective pedagogical tools are thoroughly and consistently implemented throughout the text.

The Leading Integrated Chemical Process Design Guide: Now with New Problems, New Projects, and More More than ever, effective design is the focal point of sound chemical engineering. Analysis, Synthesis, and Design of Chemical Processes, Third Edition, presents design as a creative process that integrates both the big picture and the small details—and knows which to stress when, and why. Realistic from start to finish, this book moves readers beyond classroom exercises into open-ended, real-world process problem solving. The authors introduce integrated techniques for every facet of the discipline, from finance to operations, new plant design to existing process optimization. This fully updated Third Edition presents entirely new problems at the end of every chapter. It also adds extensive coverage of batch process design, including realistic examples of equipment sizing for batch sequencing; batch scheduling for multi-product plants; improving production via intermediate storage and parallel equipment; and new optimization techniques specifically for batch processes. Coverage includes Conceptualizing and analyzing chemical processes: flow diagrams, tracing, process conditions, and more Chemical process economics: analyzing capital and manufacturing costs, and predicting or assessing profitability Synthesizing and optimizing chemical processing: experience-based principles, BFD/PFD, simulations, and more Analyzing process performance via I/O models, performance curves, and other tools Process troubleshooting and “debottlenecking” Chemical engineering design and society: ethics, professionalism, health, safety, and new “green engineering” techniques Participating successfully in chemical engineering design teams Analysis, Synthesis, and Design of Chemical Processes, Third Edition, draws on nearly 35 years of innovative chemical engineering instruction at West Virginia University. It includes suggested curricula for both single-semester and year-long design courses; case studies and design projects with practical applications; and appendixes with current equipment cost data and preliminary design information for eleven chemical processes—including seven brand new to this edition. A detailed reference for the practicing engineer, Air Pollution Control Technology Handbook, Second Edition focuses on air pollution control systems and outlines the basic process engineering and cost estimation required for its design. Written by seasoned experts in the field, this book offers a fundamental understanding of the factors resulting in air pollution and covers the techniques and equations used for air pollution control. Anyone with an engineering or science background can effectively select techniques for control, review alternative design methods and equipment proposals from vendors, and initiate cost studies of control equipment using this book. This second edition of a bestseller includes new methods for designing control equipment, enhanced material on air pollution science, updates on major advances in the field, and explains the importance of a strategy for identifying the most cost-effective design. The book also covers: New legislation and updates on air regulation New advances in process integration design techniques The atmospheric and health effects of air pollution

Air Pollution Control Technology Handbook, Second Edition helps combat the solution problem with extensive coverage of air pollution control processes. Fully updated with new legislation, air regulations, and extensive reviews of the design of control equipment, this book serves as an ideal reference for industry professionals or anyone with an engineering or science background needing a basic introduction to air pollution control equipment design.

The 24th European Symposium on Computer Aided Process Engineering creates an international forum where scientific and industrial contributions of computer-aided techniques are presented with applications in process modeling and simulation, process synthesis and design, operation, and process optimization. The organizers have broadened the boundaries of Process Systems Engineering by inviting contributions at different scales of modeling and demonstrating vertical and horizontal integration. Contributions range from applications at the molecular level to the strategic level of the supply chain and sustainable development. They cover major classical themes, at the same time exploring a new range of applications that address the production of renewable forms of energy, environmental footprints and sustainable use of resources and water.

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