The Exergy Method Of Thermal Plant Analysis

An extensive update and sequel to the successful title Renewables-Based Technology: Sustainability Assessment. Over the past decade, the field of renewable resources has grown tremendously and sustainability assessment methods have undergone significant changes and improvements. This book brings together the wide range of sustainability assessment methods in current use, together with case studies to demonstrate their applications. The book is divided into four sections as follows: Part 1 - Introduction: Discusses the growing role of renewables as resources and their applications, together with an introduction to the principles of sustainability assessment Part 2 - Assessment Methods: Presents a wide variety of sustainability assessment methods and tools that are currently used. This includes land, water-and material use analysis, energy and exergy use, carbon footprints, life cycle analysis, ecological footprints, life cycle costing, social sustainability analysis, Prosuite methodology and Seebalance (the SocioEcoEfficiency Analysis developed by BASF. Part 3 - Case Studies: Provides context buy demonstrating the application of these methods within the major industries benefiting from renewables. The case studies apply sustainability assessment methods to the production of renewable energy (wind energy, solar energy and biofuels), bio-based chemicals and bio-based materials. Part 4 - Conclusions
The European Symposium on Computer Aided Process Engineering (ESCAPE) series presents the latest innovations and achievements of leading professionals from the industrial and academic communities. The ESCAPE series serves as a forum for engineers, scientists, researchers, managers and students to present and discuss progress being made in the area of computer aided process engineering (CAPE). European industries large and small are bringing innovations into our lives, whether in the form of new technologies to address environmental problems, new products to make our homes more comfortable and energy efficient or new therapies to improve the health and well being of European citizens. Moreover, the European Industry needs to undertake research and technological initiatives in response to humanity's "Grand Challenges," described in the declaration of Lund, namely, Global Warming, Tightening Supplies of Energy, Water and Food, Ageing Societies, Public Health, Pandemics and Security. Thus, the Technical Theme of ESCAPE 21 will be "Process Systems Approaches for Addressing Grand Challenges in Energy, Environment, Health, Bioprocessing & Nanotechnologies."
An essential resource for optimizing energy systems to enhance design capability, performance and sustainability Optimization of Energy Systems comprehensively describes the thermodynamic modelling, analysis and optimization of numerous types of energy systems in various applications. It provides a new understanding of the system and the process of defining proper objective functions for determination of the most suitable design parameters for achieving enhanced efficiency, cost effectiveness and sustainability. Beginning with a general summary of thermodynamics, optimization techniques and optimization methods for thermal components, the book goes on to describe how to determine the most appropriate design parameters for more complex energy systems using various optimization methods. The results of each chapter provide potential tools for design, analysis, performance improvement, and greenhouse gas emissions reduction. Key features: Comprehensive coverage of the modelling,

analysis and optimization of many energy systems for a variety of applications. Examples, practical applications and case studies to put theory into practice. Study problems at the end of each chapter that foster critical thinking and skill development. Written in an easy-to-follow style, starting with simple systems and moving to advanced energy systems and their complexities. A unique resource for understanding cutting-edge research in the thermodynamic analysis and optimization of a wide range of energy systems, Optimization of Energy Systems is suitable for graduate and senior undergraduate students, researchers, engineers, practitioners, and scientists in the area of energy systems.

This book describes the state of the art at the interface between energy and environmental research. The contributing authors are some of the world leaders in research and education on energy and environmental topics. The coverage is worth noting for its breadth and depth. Written by leaders in research and education, this book is an excellent text or supplement for undergraduate and graduate courses on energy engineering and environmental science.

Computer aided process engineering (CAPE) tools have been very successfully used in process design and product engineering for a long time. In particular, simulation and modelling tools have enabled engineers to analyse and understand the behaviour of selected processes prior to building actual plants. The aim of design or retrofit of chemical processes is to produce profitably products that satisfy the societal needs, ensuring safe and reliable operation of each process, as well as minimising any effects on the environment. This involves the conceptual design or retrofit of plants and processes, novel manufacturing approaches, process/control system design interactions and operability, manufacturability, environmental and safety issues. Backed by current studies, this 2-volume set gives a comprehensive survey of the various approaches and latest developments on the use of CAPE in the process industry. An invaluable reference to the scientific and industrial community in the field of computer aided process and product engineering.

Thermal Cycles of Heat Recovery Power Plants presents information about thermal power plant cycles suitable for waste heat recovery (WHR) in modern power plants. The author covers five thermal power cycles: organic Rankine cycle (ORC), organic flash cycle (OFC), Kalina cycle (KC), steam Rankine cycle (SRC) and steam flash cycle (SFC) with the working fluids of R123, R124, R134a, R245fa, R717 and R407C. The handbook helps the reader to understand the latest power plant technologies suitable for utilizing the waste heat generated by thermal industrial processes. Key Features: - Comprehensive modeling, simulation, analysis and optimization of 5 power cycle types with different working fluids - Clear information about the processes and solutions of thermal power cycles to augment the power generation with improved energy conversion. - Simple, reader friendly presentation - bibliographic references after each chapter for further reading This handbook is suitable for engineering students in degree courses and professionals in training programs who require resources on advanced thermal power plant operation and optimal waste heat recovery processes, respectively. It is also a handy reference for energy conversion efficiency in heat recovery power plants. The book is also of interest to any researchers interested in industrial applications of thermodynamic processes.

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This book describes the Exergy-based Input – Output (ExIO) framework, a comprehensive methodology for assessing the primary fossil fuels requirements for the production of goods and services within a given economy from a lifecycle perspective. In the ExIO approach, exergy is assumed to be the best suited thermodynamic metric for characterizing fossil fuels. The mathematical formulation of ExIO is based on Input-Output analysis, which defines boundaries in time and space for any system or product analyzed, encompassing its entire lifecycle. The Hybrid-ExIO approach has been developed to increase the accuracy of results and to analyze energy systems in detail, leading to the definition of criteria and indicators for identifying and optimizing the primary fossil fuels requirements of system products. Lastly, the Bioeconomic ExIO model has been proposed to account for the side effects that the working hours required for producing goods and services have on the total primary fossil fuels consumption. As such, the book will be of considerable interest to both researchers and engineers in industry, offering them essential guidelines on the utilization of exergy and thermoeconomic analysis.

A companion book to the textbook The Exergy Method of Thermal Plant Analysis. This Companion Book presents model solutions to the questions taken from Appendix G of the main textbook. Since the Exergy Method is a relatively new area of Applied Thermodynamics it was thought that the presentation of model solutions of problems of various types would be of some help both to teachers and to self-teaching students. The advantages of the use of exergy analysis were demonstrated by pointing out and quantifying thermodynamic losses of various plant components and plant configurations. These were discussed at the end of the solutions under Comments. It is hoped that this will give students a deeper understanding of the nature of irreversibilities of various kinds and their effect on plant performance. Dr Tadeusz J. Kotas joined the Department of Mechanical Engineering of Queen Mary College as a member of teaching staff in 1957. His main areas of interest were Mechanics of Fluids and Applied Thermodynamics, obtaining a PhD degree for his work in the former subject. His work in the latter subject focused on the Exergy Method, contributing to its development through his research and publications and to its dissemination through courses which he ran in Britain and in a number of European countries for practicing engineers and academics.

Safety in the process industries is critical for those who work with chemicals and hazardous substances or processes. The field of loss prevention is, and continues to be, of supreme importance to countless companies, municipalities and governments around the world, and Lees' is a detailed reference to defending against hazards. Recognized as the standard work for chemical and process engineering safety professionals, it provides the most complete collection of information on the theory, practice, design elements, equipment, regulations and laws covering the field of process safety. An entire library of alternative books (and cross-referencing systems) would be needed to replace or improve upon it, but everything of importance to safety professionals, engineers and managers can be found in this all-encompassing three volume reference

instead. The process safety encyclopedia, trusted worldwide for over 30 years Now available in print and online, to aid searchability and portability Over 3,600 print pages cover the full scope of process safety and loss prevention, compiling theory, practice, standards, legislation, case studies and lessons learned in one resource as opposed to multiple sources

Green energy is essential to the development of a sustainable society but its output can be unstable. It is therefore necessary to develop a network where both conventional and green energy systems cooperate to generate a stable, compound supply. Compound Energy Systems: Optimal Operation Methods describes the construction and operation of compound energy systems using the latest optimization methods. The authors examine the combination of traditional and alternative energy systems, which is becoming an increasingly popular solution to green energy. Important factors such as cost, efficiency and dynamic characteristics are all considered. The green energy sources discussed include fuel cells, bioethanol reformers, geo-thermal heat pumps, solar cells and wind power. This book, a distillation of information only touched upon in other books, is aimed at undergraduate and postgraduate students, scientists, engineers and industrialists with an interest in the field.

A comprehensive and rigorous introduction to thermal system designfrom a contemporary perspective Thermal Design and Optimization offers readers a lucid introductionto the latest methodologies for the design of thermal systems andemphasizes engineering economics, system simulation, andoptimization methods. The methods of exergy analysis, entropygeneration minimization, and thermoeconomics are incorporated in anevolutionary manner. This book is one of the few sources available that addresses therecommendations of the Accreditation Board for Engineering andTechnology for new courses in design engineering. Intended forclassroom use as well as self-study, the text provides a review offundamental concepts, extensive reference lists, end-of-chapterproblem sets, helpful appendices, and a comprehensive case studythat is followed throughout the text. Contents include: * Introduction to Thermal System Design * Thermodynamics, Modeling, and Design Analysis * Exergy Analysis * Heat Transfer, Modeling, and Design Analysis * Applications with Heat and Fluid Flow * Applications with Thermodynamics and Heat and Fluid Flow * Economic Analysis * Thermoeconomic Analysis and Evaluation * Thermoeconomic Optimization Thermal Design and Optimization offers engineering students,practicing engineers, and technical managers a comprehensive andrigorous introduction to thermal system design and optimizationfrom a distinctly contemporary perspective. Unlike traditionalbooks that are largely oriented toward design analysis andcomponents, this forward-thinking book aligns itself with anincreasing number of active designers who believe that moreeffective, system-oriented design methods are needed. Thermal Design and Optimization offers a lucid presentation ofthermodynamics, heat transfer, and fluid mechanics as they areapplied to the design of thermal systems. This book

broadens thescope of engineering design by placing a strong emphasis onengineering economics, system simulation, and optimizationtechniques. Opening with a concise review of fundamentals, itdevelops design methods within a framework of industrialapplications that gradually increase in complexity. Theseapplications include, among others, power generation by large andsmall systems, and cryogenic systems for the manufacturing,chemical, and food processing industries. This unique book draws on the best contemporary thinking aboutdesign and design methodology, including discussions of concurrentdesign and quality function deployment. Recent developments basedon the second law of thermodynamics are also included, especiallythe use of exergy analysis, entropy generation minimization, andthermoeconomics. To demonstrate the application of important designprinciples introduced, a single case study involving the design ofa cogeneration system is followed throughout the book. In addition, Thermal Design and Optimization is one of the best newsources available for meeting the recommendations of theAccreditation Board for Engineering and Technology for more designemphasis in engineering curricula. Supported by extensive reference lists, end-of-chapter problemsets, and helpful appendices, this is a superb text for both theclassroom and self-study, and for use in industrial design,development, and research. A detailed solutions manual is availablefrom the publisher.

A comprehensive depository of all information relating to the scientific and technological aspects of Shale Gas and Alternative Energy Conveniently arranged by energy type including Shale Gas, Wind, Geothermal, Solar, and Hydropower Perfect first-stop reference for any scientist, engineer, or student looking for practical and applied energy information Emphasizes practical applications of existing technologies, from design and maintenance, to operating and troubleshooting of energy systems and equipment Features concise yet complete entries, making it easy for users to find the required information quickly, without the need to search through long articles

In the region comprising Turkey and Greece, people have been using water from geothermal sources for bathing and washing of clothes since ancient times. This region falls within the Alpine-Himalayan orogenic belt and hence is a locus of active volcanism and tectonism and experiences frequent seismic events. This volcanic and tectonic activity has g

The ability of thermal energy storage (TES) systems to facilitate energy savings, renewable energy use and reduce environmental impact has led to a recent resurgence in their interest. The second edition of this book offers up-to-date coverage of recent energy efficient and sustainable technological methods and solutions, covering analysis, design and performance improvement as well as life-cycle costing and assessment. As well as having significantly revised the book for use as a graduate text, the authors address real-life technical and operational problems, enabling the reader to gain an understanding of the fundamental principles and practical applications of thermal energy storage technology.

Beginning with a general summary of thermodynamics, fluid mechanics and heat transfer, this book goes on to discuss practical applications with chapters that include TES systems, environmental impact, energy savings, energy and exergy analyses, numerical modeling and simulation, case studies and new techniques and performance assessment methods.

Exergy MethodTechnical and Ecological ApplicationsWIT Press

A comprehensive assessment of the methodologies of thermodynamic optimization, exergy analysis and thermoeconomics, and their application to the design of efficient and environmentally sound energy systems. The chapters are organized in a sequence that begins with pure thermodynamics and progresses towards the blending of thermodynamics with other disciplines, such as heat transfer and cost accounting. Three methods of analysis stand out: entropy generation minimization, exergy (or availability) analysis, and thermoeconomics. The book reviews current directions in a field that is both extremely important and intellectually alive. Additionally, new directions for research on thermodynamics and optimization are revealed.

Pressurized fluidized bed combustion (PFBC) is one of the newest of the coal-based generation technologies available commercially. This authoritative volume contains an excellent balance of the theoretical and practical aspects of PFBC technology, including economics, the fundamental theory of plant design and sorbent characterization, using the results obtained from a wide range of pilot-scale and full-scale demonstration units

This collection focuses on energy efficient technologies including innovative ore beneficiation, smelting technologies, recycling and waste heat recovery. The volume also covers various technological aspects of sustainable energy ecosystems, processes that improve energy efficiency, reduce thermal emissions, and reduce carbon dioxide and other greenhouse emissions. Papers addressing renewable energy resources for metals and materials production, waste heat recovery and other industrial energy efficient technologies, new concepts or devices for energy generation and conversion, energy efficiency improvement in process engineering, sustainability and life cycle assessment of energy systems, as well as the thermodynamics and modeling for sustainable metallurgical processes are included. This volume also includes topics on CO2 sequestration and reduction in greenhouse gas emissions from process engineering, sustainable technologies in extractive metallurgy, as well as the materials processing and manufacturing industries with reduced energy consumption and CO2 emission. Contributions from all areas of non-nuclear and non-traditional energy sources, such as solar, wind, and biomass are also included in this volume.Papers from the following symposia are presented in the book:Energy Technologies and CO2 ManagementAdvanced Materials for Energy Conversion and Storage Deriving Value from Challenging Waste Streams: Recycling and Sustainability Joint SessionSolar Cell SiliconStored Renewable Energy in Coal

This book deals with exergy and its applications to various energy systems and applications as a potential tool for design, analysis and optimization, and its role in minimizing and/or eliminating environmental impacts and providing sustainable development. In this regard, several key topics ranging from the basics of the thermodynamic concepts to advanced exergy analysis techniques in a wide range of applications are covered as outlined in the contents. - Comprehensive coverage of exergy and its applications - Connects exergy with three essential areas in terms of energy, environment and sustainable development - Presents the most up-to-date information in the area with recent developments - Provides a number of illustrative examples, practical applications, and case studies - Easy to follow style, starting from the basics to the advanced systems

Exergy, Energy System Analysis, and Optimization theme is a component of the Encyclopedia of Energy Sciences, Engineering and Technology Resources which is part of the global

Encyclopedia of Life Support Systems (EOLSS), an integrated compendium of twenty one Encyclopedias. These three volumes are organized into five different topics which represent the main scientific areas of the theme: 1. Exergy and Thermodynamic Analysis; 2. Thermoeconomic Analysis; 3. Modeling, Simulation and Optimization in Energy Systems; 4. Artificial Intelligence and Expert Systems in Energy Systems Analysis; 5. Sustainability Considerations in the Modeling of Energy Systems. Fundamentals and applications of characteristic methods are presented in these volumes. These three volumes are aimed at the following five major target audiences: University and College Students, Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers and NGOs.

In engineering design and development, reliable and accurate computational methods are requested to replace or complement expensive and time consuming experimental trial and error work. Tremendous advancements have been achieved during recent years due to improved numerical solutions of non-linear partial differential equations and computer developments to achieve efficient and rapid calculations. Nevertheless, to further progress in computational methods will require developments in theoretical and predictive procedures – both basic and innovative – and in applied research. Accurate experimental investigations are needed to validate the numerical calculations. This book contains the edited versions of the papers presented at the Tenth International Conference on Advanced Computational Methods and Experimental Measurements in Heat Transfer and Mass Transfer held in Maribor, Slovenia in July 2008. The objective of this conference series is to provide a forum for presentation and discussion of advanced topics, new approaches and application of advanced computational methods and experimental measurements to heat and mass transfer problems. The contributed papers are grouped in the following appropriate sections to provide better access for readers: Natural and forced convection; Heat exchangers; Advances in computational methods; Heat recovery; Heat transfer; Modelling and experiments.

The concept of sustainable development was first introduced by the Brundtland Commission almost 20 years ago and has received increased attention during the past decade. It is now an essential part of any energy activities. This is a research-based textbook which can be used by senior undergraduate students, graduate students, engineers, practitioners, scientists, researchers in the area of sustainable energy systems and aimed to address some key pillars: better efficiency, better cost effectiveness, better use of energy resources, better environment, better energy security, and better sustainable development. It also includes some cutting-edge topics, such hydrogen and fuel cells, renewable, clean combustion technologies, CO2 abatement technologies, and some potential tools (exergy, constructal theory, etc.) for design, analysis and performance improvement.

The book presents a series of articles devoted to modeling, simulation, and optimization of processes, mainly chemical. General methods for process modeling and numerical simulation are described with flowsheeting. Population balances are addressed in detail with application to crystal production; energy saving is frequently optimized, including exergy analysis. The coupling between process simulation and computational fluid dynamics is studied for air classification and bubble columns. Pressure swing adsorption, reactive distillation, and nanofiltration are explained in general and applied to particular processes. The synthesis of carbon dots is solved by the design of experiments method. A safety study addresses the consequences of gas explosion.

Primarily this book describes the thermodynamics of gas turbine cycles. The search for high gas turbine efficiency has produced many variations on the simple "open circuit" plant, involving the use of heat exchangers, reheating and intercooling, water and steam injection, cogeneration and combined cycle plants. These are described fully in the text. A review of recent proposals for a number of novel gas turbine cycles is also included. In the past few

years work has been directed towards developing gas turbines which produce less carbon dioxide, or plants from which the CO2 can be disposed of; the implications of a carbon tax on electricity pricing are considered. In presenting this wide survey of gas turbine cycles for power generation the author calls on both his academic experience (at Cambridge and Liverpool Universities, the Gas Turbine Laboratory at MIT and Penn State University) and his industrial work (primarily with Rolls Royce, plc.) The book will be essential reading for final year and masters students in mechanical engineering, and for practising engineers.

International Conference on Advances in Power Generation from Renewable Energy Sources (APGRES-2020)

This publication, Our Fragile World: Challenges and Opportunities for Sustainable Development, presents perspectives of several important subjects that are covered in greater detail and depth in the Encyclopedia of Life Support Systems (EOLSS). The contributions to the two volumes provide an integrated presentation of knowledge and worldviews related to the state of: Earth's natural resources, social resources, institutional resources, and economic and financial resources. They present the vision and thinking of over 200 authors in support of efforts to solve the complex problems connected with sustainable development, and to secure perennial life support on "The Blue Planet'. These contributions are holistic, informative, forward looking, and will be of interest to a broad readership. This volume presents contributions with focus on the Natural and Social Dimensions of sustainable Development in to two sections: NATURAL SYSTEMS AND RESOURCES (Natural Systems and Climate Change ; - Natural Resources Management). - SOCIO-CULTURAL ISSUES (Human Security, Peace, and Socio-Cultural issues; Equity and Ethical issues).

We live in interesting times in which life as we know it is being threatened by manmade changes to the atmosphere in which we live. On the global scale, concern is focused on climate change due to greenhouse gas emissions, and on a national scale, atmospheric pollution produced by combustion processes is of concern. A possible approach is through the development of new ideas and innovative processes to the current practices. Among the available options, multi-generation processes such as the trigeneration cycle, battery storage system, solar power plants and heat pumps have been widely studied, as they potentially allow for greater efficiency, lower costs, and reduced emissions. On the other hand, some researchers had been working to increase the potential of energy generation process through heat recovery under the steam generator, organic Rankine cycle, and absorption chillers. In this Special Issue on "Thermal Systems" of fundamental or applied and numerical or experimental investigation, many new concepts in thermal systems and energy utilization were explored and published as original research papers in this “Special Issue”.

This book comprises select proceedings of the International Conference on Future Learning Aspects of Mechanical Engineering (FLAME 2018). The book gives an overview of recent developments in the field of thermal and fluid engineering, and covers theoretical and experimental fluid dynamics, numerical methods in heat transfer and fluid mechanics, different modes of heat transfer, multiphase transport and phase change, fluid machinery, turbo machinery, and fluid power. The book is primarily intended for researchers and professionals working in the field of fluid dynamics and thermal engineering.

Thermal Energy Storage Systems and Applications Provides students and engineers with up-to-date information on methods, models, and approaches in thermal energy storage systems and their applications in thermal management and elsewhere Thermal energy storage (TES) systems have become a vital technology for renewable energy systems and are increasingly being used in commercial and industrial applications including space and water heating, cooling, and air conditioning. TES technology has the potential to be a sustainable, cost-effective, and eco-friendly approach for facilitating more effective use of thermal equipment and correcting the imbalance that can occur between the supply and demand of energy. The

Third Edition of Thermal Energy Storage: Systems and Applications contains detailed coverage of new methodologies, models, experimental works, and methods in the rapidly growing field. Extensively revised and updated throughout, this comprehensive volume covers integrated systems with energy storage options, environmental impact and sustainability, design, analysis, assessment criteria, advanced tools in exergy and extended exergy, and more. New and expanded chapters address topics such as renewable energy systems in which thermal energy storage is essential, sensible and latent TES systems, and numerical modelling, simulation, and analysis of TES systems. Integrating academic research and practical information, this new edition: Discusses a variety of practical TES applications, their technical features, and potential benefits Explores recent developments and future directions in energy storage technologies Covers the latest generation of thermal storage systems and a wide range of applications Features new chapters, case studies, and chapter problems throughout the text Includes pertinent background information on thermodynamics, fluid flow, and heat transfer Contains numerous illustrative examples, full references, and appendices with conversion factors and thermophysical properties of various materials Thermal Energy Storage: Systems and Applications, Third Edition is the perfect textbook for advanced undergraduate and graduate courses in mechanical, chemical, and electrical engineering, and a highly useful reference for energy engineers and researchers.

Sustainable Assessment Method for Energy Systems provides the reader with a new method for energy system evaluation. It is widely recognized that future energy strategies will have to deal with energy as a complex issue that incorporates environmental, economic, social, cultural, educational, and material resource attributes. Sustainable Assessment Method for Energy Systems offers a new methodology based on multi-criteria indicators for the evaluation of energy as a system.

From engineering fluid mechanics to power systems, information coding theory and other fields, entropy is key to maximizing performance in engineering systems. It serves a vital role in achieving the upper limits of efficiency of industrial processes and quality of manufactured products. Entropy based design (EBD) can shed new light on various flow processes, ranging from optimized flow configurations in an aircraft engine to highly ordered crystal structures in a turbine blade. Entropy Based Design of Fluid Engineering Systems provides an overview of EBD as an emerging technology with applications to aerospace, microfluidics, heat transfer, and other disciplines. The text extends past analytical methods of Entropy Generation Minimization to numerical simulations involving more complex configurations and experimental measurement techniques. The book begins with an extensive development of basic concepts, including the mathematical properties of entropy and exergy, as well as statistical and numerical formulations of the second law. It then goes on to describe topics related to incompressible flows and the Second Law in microfluidic systems. The authors develop computational and experimental methods for identifying problem regions within a system through the local rates of entropy production. With these techniques, designers can use EBD to focus on particular regions where design modifications can be made to improve system performance. Numerous case studies illustrate the concepts in each chapter, and cover an array of applications including supersonic flows, condensation and turbulence. A one-of-a-kind reference, Entropy Based Design of Fluid Engineering Systems outlines new advances showing how local irreversibilities can be detected in complex configurations so that engineering devices can be re-designed locally to improve overall performance.

This book introduces two of the most exciting heat pumping technologies, the coabsorbent and the thermal recovery (mechanical vapor) compression, characterized by a high potential in primary energy savings and environmental protection. New cycles with potential applications of nontruncated, truncated, hybrid truncated, and multi-effect coabsorbent types are introduced in this work. Thermal-to-work recovery compression

(TWRC) is the first of two particular methods explored here, including how superheat is converted into work, which diminishes the compressor work input. In the second method, thermal-to-thermal recovery compression (TTRC), the superheat is converted into useful cooling and/or heating, and added to the cycle output effect via the coabsorbent technology. These and other methods of discharge gas superheat recovery are analyzed for single-, two-, three-, and multi-stage compression cooling and heating, ammonia and ammonia-water cycles, and the effectiveness results are given. The author presents absorption-related topics, including the divided-device method for mass and heat transfer analysis, and truncation as a unique method for a better source-task match. Along with advanced gax recovery, the first and second principles of COP and exergy calculation, the ideal point approaching (i.p.a.) effect and the two-point theory of mass and heat transfer, the book also addresses the new wording of the Laplace equation, the Marangoni effect true explanation, and the new mass and heat exchangers based on this effect. The work goes on to explore coabsorbent separate and combined cooling, heating, and power (CHP) production and advanced water-lithium bromide cycle air-conditioning, as well as analyzing high-efficiency ammonia-water heat-driven heating and industrial low-temperature cooling, in detail. Readers will learn how coabsorbent technology is based on classic absorption, but is more general. It is capable of offering effective solutions for all cooling and heating applications (industry, agriculture, district, household, etc.), provided that two supplying heat-sink sources with temperatures outdistanced by a minimum of 12-15oC are available. This book has clear and concise presentation and illustrates the theory and applications with diagrams, tables, and flowcharts.

The exergy method makes it possible to detect and quantify the possibilities of improving thermal and chemical processes and systems. The introduction of the concept thermo-ecological cost (cumulative consumption of non-renewable natural exergy resources) generated large application possibilities of exergy in ecology. This book contains a short presentation on the basic principles of exergy analysis and discusses new achievements in the field over the last 15 years. One of the most important issues considered by the distinguished author is the economy of non-renewable natural exergy. Previously discussed only in scientific journals, other important new problems highlighted include: calculation of the chemical exergy of all the stable chemical elements, global natural and anthropogenic exergy losses, practical guidelines for improvement of the thermodynamic imperfection of thermal processes and systems, development of the determination methods of partial exergy losses in thermal systems, evaluation of the natural mineral capital of the Earth, and the application of exergy for the determination of a pro-ecological tax.A basic knowledge of thermodynamics is assumed, and the book is therefore most appropriate for graduate students and engineers working in the field of energy and ecological management.

This Special Issue addresses the general problem of a proper match between the demands of energy users and the units for energy conversion and storage, by means of proper design and operation of the overall energy system configuration. The focus is either on systems including single plants or groups of plants, connected or not to one or more energy distribution networks. In both cases, the optimum design and operation involve decisions about thermodynamic processes, about the type, number, design parameters of components/plants, and storage capacities, and about mutual

interconnections and the interconnections with the distribution grids. The problem is absolutely general, encompassing design and operation of energy systems for single houses, groups of houses, industries, industrial districts, municipal areas, regions and countries. The presented papers show that similar approaches can be used in different applications, although a general standard has not been achieved yet.

Heat Transfer topics are commonly of a very complex nature. Often different mechanisms like heat conduction, convection, thermal radiation, and non-linear phenomena, such as temperature-dependent thermophysical properties, and phase changes occur simultaneously. New developments in numerical solution methods of partial differential equations and access to high-speed, efficient and cheap computers have led to dramatic advances during recent years. This book publishes papers from the Ninth International Conference on Advanced Computational Methods and Experimental Measurements in Heat and Mass Transfer, exploring new approaches to the numerical solutions of heat and mass transfer problems and their experimental measurement. Papers encompass a number of topics such as: Diffusion and Convection; Conduction; Natural and Forced Convection; Heat and Mass Transfer Interaction; Casting, Welding, Forging and other Processes; Heat Exchanges; Atmospheric Studies; Advances in Computational Methods; Modelling and Experiments; Micro and Nano Scale Heat and Mass Transfer; Energy Systems; Energy Balance Studies; Thermal Material Characterization; Applications in Biology; Applications in Ecological Buildings; Case Studies.

The Exergy Method of Thermal Plant Analysis aims to discuss the history, related concepts, applications, and development of the Exergy Method - analysis technique that uses the Second Law of Thermodynamics as the basis of evaluation of thermodynamic loss. The book, after an introduction to thermodynamics and its related concepts, covers concepts related to exergy, such as physical and chemical exergy, exergy concepts for a control method and a closed-system analysis, the exergy analysis of simple processes, and the thermocentric applications of exergy. A seven-part appendix is also included. Appendices A-D covers miscellaneous information on exergy, and Appendix E features charts of thermodynamic properties. Appendix F is a glossary of terms, and Appendix G contains the list of references. The text is recommended for physicists who would like to know more about the Exergy Method, its underlying principles, and its applications not only in thermal plant analysis but also in certain areas.

Six new chapters (14-19) deal with topics of current interest: multi-component convection diffusion, convection in a compressible fluid, convenction with temperature dependent viscosity and thermal conductivity, penetrative convection, nonlinear stability in ocean circulation models, and numerical solution of eigenvalue problems.

As perhaps the most promising of all the renewable energy sources available today, solar energy is becoming increasingly important in the drive to achieve energy independence and climate balance. This new book is the masterwork from world-renowned expert Dr. Soteris Kalogirou, who has championed solar energy for decades. The book includes all areas of solar energy engineering, from the fundamentals to the highest level of current research. The author includes pivotal subjects such as solar collectors, solar water heating, solar space heating and cooling, industrial process heat, solar desalination, photovoltaics, solar thermal power systems, and modeling of solar

systems, including the use of artificial intelligence systems in solar energy systems, modeling and performance prediction. *Written by one of the world's most renowned experts in solar energy *Covers the hottest new developments in solar technology, such as solar cooling and desalination *Packed with quick look up tables and schematic diagrams for the most commonly used systems today'

Although the exergy method has been featured as the subject of many publishing papers in scientific and engineering journals and at conferences, very few comprehensive books on this subject have been published so far. Practical Approach to Exergy and Thermoeconomic Analyses of Industrial Processes details the exergetic and thermoeconomic analyses of industrial processes using Aspen Plus and a novel Microsoft Excel Application developed by the authors which can be applied to industrial processes across the board. Employing a practical approach to an innovative and complex energy process, every chapter contains extensive explanations of a complex and real case and numerous examples whose solution demonstrates the application of theory to a wide range of real and practical problems. Illustrations, tables and graphs support and illustrate the new methodology to build a deep understanding of the real employment of the fuel used and the cost formation and increase inside the process. Practical Approach to Exergy and Thermoeconomic Analyses of Industrial Processes provides users, students and practitioners of process analysis, power plant design and fuel use optimization, with a broad introduction and approach to computer aided process optimization. It also serves as a comprehensive guide to the operational application of the MHBT to real cases analysis.