Advanced Cfd Modelling Of Pulverised Biomass Combustion

Here readers will find a summary of proceedings at a highly important NATO workshop. The ARW Advanced Combustion and Aerothermal Technologies: Environmental Protection and Pollution Reductions, was held in Kiev, May 2006. The workshop was co-directed by Profs. N. Syred and A.Khalatov, winners of the NATO Scientific Prize 2002, and was organized by the Institute of Thermophysics (Ukraine) and Cardiff University, UK. The primary workshop objective was to assess the existing knowledge on advanced combustion and aerothermal technologies providing reduced environmental impact.

The use of coal is required to help satisfy the world's energy needs. Yet coal is a difficult fossil fuel to consume efficiently and cleanly. We believe that its clean and efficient use can be increased through improved technology based on a thorough understanding of fundamental physical and chemical processes that occur during consumption. The principal objective of this book is to provide a current summary of this technology. The past technology for describing and analyzing coal furnaces and combus tors has relied largely on empirical inputs for the complex flow and chemical reactions that occur while more formally treating the heat-transfer effects. GrOWing concern over control of combustion-generated air pollutants revealed a lack of understanding of the relevant fundamental physical and chemical mechanisms. Recent technical advances in computer speed and storage capacity, and in numerical prediction of recirculating turbulent flows, two-phase flows, and flows with chemical reaction have opened new opportunities for describing and modeling such complex combustion systems in greater detail. We believe that most of the requisite component models to permit a more fundamental description of coal combustion processes are available. At the same time there is worldwide interest in the use of coal, and progress in modeling of coal reaction processes has been steady.

This reference overflows with an abundance of experimental techniques, simulation strategies, and practical applications useful in the control of pollutants generated by combustion processes in the metals, minerals, chemical, petrochemical, waste, incineration, paper, glass, and foods industries. The book assists engineers as they attempt to meet e

This book is a printed edition of the Special Issue "Biomass for Energy Country Specific Show Case Studies" that was published in Energies

Issues in Energy Conversion, Transmission, and Systems: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Additional Research. The editors have built Issues in Energy Conversion, Transmission, and Systems: 2013 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Additional Research in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Energy Conversion, Transmission, and Systems: 2013 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Computational fluid dynamics (CFD), which uses numerical analysis to predict and model complex flow behaviors and transport processes, has become a mainstream tool in engineering process research and development. Complex chemical processes often involve coupling between dynamics at vastly different length and time scales, as well as coupling of different physical models. The multiscale and multiphysics nature of those problems calls for delicate modeling approaches. This book showcases recent contributions in this field, from the development of modeling methodology to its application in supporting the design, development, and optimization of engineering processes.

Cleaner Combustion and Sustainable World is the proceedings of the 7th International Symposium on Coal Combustion which has a significant international influence. It concerns basic research on coal combustion and clean utilization, techniques and equipments of pulverized coal combustion, techniques and equipments of fluidized bed combustion, basic research and techniques of emission control, basic research and application techniques of carbon capture and storage (CCS), etc. Professor Haiying Qi and Bo Zhao both work at the Tsinghua University, China

Greenhouse gas emissions and water usage are two major concerns in the power generation sector. Advanced clean coal technologies (i.e., solid sorbent CO2 capture technologies and combined wet/dry cooling system) are promising for future central power generation in order to achieve sustainable, secure, and efficient system performance. This dissertation describes research associated with advanced coal derived clean power generation, from near-term pulverized coal (PC) power plant strategies retrofitted for CO 2 capture, to long-term integrated gasification combined cycle (IGCC) power generation, to co-production IGCC with carbon capture and storage (CCS) co-fueled by coal and biomass.In this study, the post-combustion solid sorbent based CO2 capture system for the PC power plant is optimized for integration in order to minimize plant modifications and the associated downtime. Due to significantly less steam usage in sorbent regeneration, the PC plant with advanced solid sorbent CO2 capture has better performance and lower cost of electricity than the plant using conventional amine scrubbing technology. By employing a combined wet/dry cooling system, the PC plant with CO2 capture reduces water usage significantly, while the performance and water usage are a function of ambient conditions as predicted by a mathematical model, the latter of which is validated by experimental data from the literature.Pre-combustion solid sorbent based CO2 capture technologies used in the IGCC are evaluated by systems analysis and compared to Selexol TM CO2 capture. Compared with the SelexolTM approach, solid sorbent CO2 capture results in a power plant with significantly higher overall plant efficiency and more attractive economics.Computational fluid dynamics (CFD) simulation models were developed for both solid sorbent CO2 capture alone, and combined water gas shift (WGS) and solid sorbent CO2 capture in the IGCC applications. ANSYS FLUENT and User Defined Functions (UDF) were the resources adopted to incorporate the fluid mechanics, heat and mass transfer, water vaporization, adsorption equilibrium and kinetics, and WGS reaction kinetics . The CFD models were validated by experimental data, and applied to commercial size fixed bed reactor designs and simulations. It was found that (1) the CO2 breakthrough time or CO2 loading capacity is independent of reactor geometry as long

as the space velocity is constant, (2) the adsorption rate is the rate controlling step for CO2 capture using solid sorbent, and (3) break through occurs before the solid sorbent near the exit of the bed is fully utilized due to bulk transfer of the CO2 in the axial direction. However, a low space velocity can increase the loading of the sorbent. The CFD approach also assists in the design of effective thermal management strategies for the reactor in the case of combined WGS and solid sorbent CO 2 capture.Co-feeding of biomass along with coal and the co-production of H 2 and synthetic fuels in IGCCs is evaluated for future clean coal power generation. It was determined by systems analyses that co-feeding and co-production IGCCs are preferable for renewable energy utilization and energy security, with the co-products being produced at competitive costs.

The control of greenhouse gas emissions continues to be a major global problem. It is inter-disciplinary, both in substance and approach, and covers technical, political and economic issues involving governments, industry and the scientific community. These proceedings contain 220 papers presented at the 5th International Conference on Greenhouse Gas Control Technologies (GHGT-5) held in August 2000 at Cairns, Queensland, Australia. The papers cover the capture of carbon dioxide, geological storage of carbon dioxide, ocean storage of carbon dioxide, storage of carbon dioxide with enhanced hydrocarbon recovery, utilisation of carbon dioxide, other greenhouse gases, fuel cells, alternative energy carriers, energy efficiency, life cycle assessments and energy modelling, economics, international and national policy, trading and accounting policy, social and community issues, and reducing emission from industry and power generation.

Collection of selected, peer reviewed papers from the 4th International Conference on Advanced Design and Manufacturing Engineering (ADME 2014), July 26-27, 2014, Hangzhou, China. The 423 papers are grouped as follows: Chapter 1: Applied Engineering in Area of Heat, Fluid, Acoustic, Flow and Fields, Chapter 2: Design and Systems Dynamics in Mechanical Engineering, Chapter 3: Mechanical Strength, Reliability, Risk Analysis and Assessment, Chapter 4: CAD / CAM / CAE in Design and Engineering Research, Chapter 5: Measurement Technology, Instruments and Sensors, Detection Technologies and Methodologies, Chapter 6: Machine Vision Technology, Image and Video Processing, Chapter 7: Embedded Systems, Electronics, Circuit Technology, Electrics, Electromagnetics, Power Engineering and Communication, Chapter 8: Mechatronics, Industrial Robots, Automation and Control Technologies, Chapter 9: Computer Applications and Mathematical Modeling, Intelligent Algorithms and Optimization, Chapter 10: Green Supply Chain and the Internet of Things Development, Chapter 11: Industrial Engineering, Production Management, Operations, Quality and Control, Chapter 12: Engineering Education

This book presents the state-of-the-art in simulation on supercomputers. Leading researchers present results achieved on systems of the High Performance Computing Center Stuttgart (HLRS) for the year 2012. The reports cover all fields of computational science and engineering ranging from CFD via computational physics and chemistry to computer science with a special emphasis on industrially relevant applications. Presenting results for both vector-systems and micro-processor based systems the book allows to compare performance levels and usability of various architectures. As HLRS operates not only a large cluster system but also one of the largest NEC vector systems in the world this book gives an excellent insight also into the potential of vector systems. The book covers the main methods in high performance computing. Its outstanding results in achieving highest performance for production codes are of particular interest for both the scientist and the engineer. The book comes with a wealth of coloured illustrations and tables of results. ?

Energy Systems Engineering is one of the most exciting and fastest growing fields in engineering. Modeling and simulation plays a key role in Energy Systems Engineering because it is the primary basis on which energy system design, control, optimization, and analysis are based. This book contains a specially curated collection of recent research articles on the modeling and simulation of energy systems written by top experts around the world from universities and research labs, such as Massachusetts Institute of Technology, Yale University, Norwegian University of Science and Technology, National Energy Technology Laboratory of the US Department of Energy, University of Technology Sydney, McMaster University, Queens University, Purdue University, the University of Connecticut, Technical University of Denmark, the University of Toronto, Technische Universität Berlin, Texas A&M, the University of Pennsylvania, and many more. The key research themes covered include energy systems design, control systems, flexible operations, operational strategies, and systems analysis. The addressed areas of application include electric power generation, refrigeration cycles, natural gas liquefaction, shale gas treatment, concentrated solar power, waste-to-energy systems, micro-gas turbines, carbon dioxide capture systems, energy storage, petroleum refinery unit operations, Brayton cycles, to name but a few.

An essential resource for understanding the potential role for biomass energy with carbon capture and storage in addressing climate change Biomass Energy with Carbon Capture and Storage (BECCS) offers a comprehensive review of the characteristics of BECCS technologies in relation to its various applications. The authors — a team of expert professionals — bring together in one volume the technical, scientific, social, economic and governance issues relating to the potential deployment of BECCS as a key approach to climate change mitigation. The text contains information on the current and future opportunities and constraints for biomass energy, explores the technologies involved in BECCS systems and the performance characteristics of a variety of technical systems. In addition, the text includes an examination of the role of BECCS in climate change mitigation, carbon accounting across the supply chain and policy frameworks. The authors also offer a review of the social and ethical aspects as well as the costs and economics of BECCS. This important text: Reveals the role BECCS could play in the transition to a low-carbon economy Discusses the wide variety of technical and non-technical constraints of BECCS Presents the basics of biomass energy systems Reviews the technical and engineering issues pertinent to BECCS Explores the societal implications of BECCS systems Written for academics and research professionals, Biomass Energy with Carbon Capture and Storage (BECCS) brings together in one volume

the issues surrounding BECCS in an accessible and authoritative manner.

Provides the advances in modelling and simulation on supercomputers. Presenting results achieved on systems of the High Performance Computing Center Stuttgart (HLRS) for the year 2005, these reports cover various fields of computational science and engineering, ranging from CFD via computational physics and chemistry to computer science.

This book covers various technological aspects of sustainable energy ecosystems and processes that improve energy efficiency, and reduce and sequestrate carbon dioxide (CO2) and other greenhouse emissions. Papers emphasize the need for sustainable technologies in extractive metallurgy, materials processing and manufacturing industries with reduced energy consumption and CO2 emission. Industrial energy efficient technologies include innovative ore beneficiation, smelting technologies, recycling, and waste heat recovery. The book also contains contributions from all areas of non-nuclear and non-traditional energy sources, including renewable energy sources such as solar, wind, and biomass. Papers from the following symposia are presented in the book: Energy Technologies and Carbon Dioxide Management Recycling and Sustainability Update Magnetic Materials for Energy Applications V Sustainable Energy and Layered Double Hydroxides

This book presents innovative and interdisciplinary applications of advanced technologies. It includes the scientific outcomes of the 9th DAYS OF BHAAAS (Bosnian-Herzegovinian American Academy of Arts and Sciences) held in Banja Vru?ica, Tesli?, Bosnia and Herzegovina on May 25–28, 2017. This unique book offers a comprehensive, multidisciplinary and interdisciplinary overview of the latest developments in a broad section of technologies and methodologies, viewed through the prism of applications in computing, networking, information technology, robotics, complex systems, communications, energy, mechanical engineering, economics and medicine, to name just a few.

Create affordable solid fuel blends that will burn efficiently while reducing the carbon footprint. Solid Fuel Blending Handbook: Principles, Practices, and Problems describes a new generation of solid fuel blending processes. The book includes discussions on such topics as flame structure and combustion performance, boiler efficiency, capacity as influenced by flue gas volume and temperature, slagging and fouling, corrosion, and emissions. Attention is given to the major types of combustion systems including stokers, pulverized coal, cyclone, and fluidized bed boilers. Specific topics considered include chlorine in one or more coals, alkali metals (e.g., K, Na) and alkali earth elements, and related topics. Coals of consideration include Appalachian, Interior Province, and Western bituminous coals; Powder River Basin (PRB) and other subbituminous coals; Fort Union and Gulf Coast lignites, and many of the off-shore coals (e.g., Adaro coal, an Indonesian subbituminous coal with very low sulfur; other off-shore coals from Germany, Poland, Australia, South Africa, Columbia, and more). Interactions between fuels and the potential for blends to be different from the parent coals will be a critical focus of this of the book. One stop source to solid fuel types and blending processes Evaluate combustion systems and calculate their efficiency Recognize the interactions between fuels and their potential energy output Be aware of the Environmental Aspects of Fuel Blending

This unique handbook presents both the theory and application of biomass combustion and co-firing, from basic principles to industrial combustion and environmental impact, in a clear and comprehensive manner. It offers a solid grounding on biomass combustion, and advice on improving combustion systems. Written by leading international academics and industrial experts, and prepared under the auspices of the IEA Bioenergy Implementing Agreement, the handbook is an essential resource for anyone interested in biomass combustion and co-firing technologies varying from domestic woodstoves to utility-scale power generation. The book covers subjects including biomass fuel pre-treatment and logistics, modelling the combustion process and ash-related issues, as well as featuring an overview of the current R&D needs regarding biomass combustion.

Dust Explosion Dynamics focuses on the combustion science that governs the behavior of the three primary hazards of combustible dust: dust explosions, flash fires, and smoldering. It explores the use of fundamental principles to evaluate the magnitude of combustible dust hazards in a variety of settings. Models are developed to describe dust combustion phenomena using the principles of thermodynamics, transport phenomena, and chemical kinetics. Simple, tractable models are described first and compared with experimental data, followed by more sophisticated models to help with future challenges. Dr. Ogle introduces the reader to just enough combustion science so that they may read, interpret, and use the scientific literature published on combustible dusts. This introductory text is intended to be a practical guide to the application of combustible dust models, suitable for both students and experienced engineers. It will help you to describe the dynamics of explosions and fires involving dust and evaluate their consequences which in turn will help you prevent damage to property, injury and loss of life from combustible dust accidents. Demonstrates how the fundamental principles of combustion science can be applied to understand the ignition, propagation, and extinction of dust explosions Explores fundamental concepts through model-building and comparisons with empirical data Provides detailed examples to give a thorough insight into the hazards of combustible dust as well as an introduction to relevant scientific literature

Harness State-of-the-Art Computational Modeling Tools Computational Modeling of Pulverized Coal Fired Boilers successfully establishes the use of computational modeling as an effective means to simulate and enhance boiler performance. This text factors in how computational flow models can provide a framework for developing a greater understanding of the underlying processes in PC boilers. It also provides a detailed account of the methodology of computational modeling of pulverized coal boilers, as well as an apt approach to modeling complex processes occurring in PC boilers in a manageable way. Connects Modeling with Real-Life Applications Restricted to the combustion side of the boiler (the authors assume some prior background of reaction engineering and numerical techniques), the book describes the individual aspects of combustion and heat recovery sections of PC boilers that can be used to further improve the design methodologies, optimize boiler performance, and solve practical boiler-related problems. The book provides guidelines on implementing the material in commercial CFD solvers, summarizes key points, and presents relevant case studies. It can also be used to model larger boilers based on conventional, super-critical, or ultra-super critical technologies as well as based on oxy-fuel technologies. Consisting of six chapters, this functional text: Provides a general introduction Explains the overall approach and methodology Explores kinetics of coal pyrolysis (devolatilization) and combustion and methods of its evaluation Presents computational flow modeling approach to simulate pulverized coal fired boiler Covers modeling aspects from formulation of model equations to simulation methodology Determines typical results obtained with computational flow models Discusses the phenomenological models or reactor network models Includes practical applications of computational modeling Computational Modeling of Pulverized Coal Fired Boilers explores the potential of computational models for better

engineering of pulverized coal boilers, providing an ideal resource for practicing engineers working in utility industries. It also benefits boiler design companies, industrial consultants, R & D laboratories, and engineering scientists/research students.

The Handbook of Biomass Combustion and Co-firingRoutledge

ABSTRACT The current work briefly reviews the formation mechanisms and reduction approaches of the pollutants SOx and NOx in coal combustion and focuses on the simulation of the lower-cost in-furnace measures ƒ{ the dry additive process (DAP) for SOx reduction and the reburning as well as the advanced reburning (hybrid reburning/SNCR) techniques for NOx reduction. In addition, the influence of sulfur compounds on NOx formation is investigated. The major workings include: Simulation of the dry additive desulfurization process (DAP): Different models ƒ{ shrinking core model (SCM), pore model (PM) and grain model (GM) ƒ{ are implemented to describe the gas-particle reaction. Relevant processes such as the sintering of the additive, the self-retention by coal ash, the thermal equilibrium of the sulfation reaction are accounted for and modeled. A comprehensive model for the DAP with calcium based additives is subsequently established and integrated into a combustion CFD (computational fluid dynamics) code AIOLOS, in both Eulerian and Lagrangian schemes. The model is verified with experiments on a test reactor. Mechanism reduction and simulation of reburning/SNCR Processes: A method for reduction of kinetic mechanisms is introduced. A program tool is developed for automatic reduction of detailed reaction mechanisms. Reduced mechanisms for reburning and hybrid reburning/SNCR processes are developed and implemented into the CFD code. CFD-calculations with the reduced mechanisms are performed and compared with experimental measurements to comprehensively evaluate the simulation approach. It is shown that the detailed simulation is capable of modeling the complex reburning and SNCR processes with acceptable computing time and achieves reasonable results in wide parameter ranges. Study of the influence of sulfur compounds on NOx formation: The effect of SO2 on NOx formation is experimentally investigated and analysed with kinetic mechanisms. It is indicated that the presence of SO2 inhabits the NOx formation and reduce the NOx emissions in normal air-rich combustion. Under air-staging conditions, SO2 addition has no obvious influence on the final NOx emissions.

This introduction reviews why combustion and radiation are important, as well as the technical challenges posed by radiation. Emphasis is on interactions among turbulence, chemistry and radiation (turbulence-chemistry-radiation interactions – TCRI) in Reynolds-averaged and large-eddy simulations. Subsequent chapters cover: chemically reacting turbulent flows; radiation properties, Reynolds transport equation (RTE) solution methods, and TCRI; radiation effects in laminar flames; TCRI in turbulent flames; and high-pressure combustion systems. This Brief presents integrated approach that includes radiation at the outset, rather than as an afterthought. It stands as the most recent developments in physical modeling, numerical algorithms, and applications collected in one monograph.

This work contains 20 peer reviewed papes representing the work of 49 researchers from around the world. It explores such critical topics as: fluidization fundamentals; circulating fluidized beds; advances in fluid-particle glow property measurementcomputer simulation of fluid-partic le systems; applications of particle technology in polymer and rubber processing; and particle interaction and mixing.

Computational Fluid Dynamics enables engineers to model and predict fluid flow in powerful, visually impressive ways and is one of the core engineering design tools, essential to the study and future work of many engineers. This textbook is designed to explcitly meet the needs engineering students taking a first course in CFD or computer-aided engineering. Fully course matched, with the most extensive and rigorous pedagogy and features of any book in the field, it is certain to be a key text. The only course text available specifically designed to give an applications-lead, commercial software oriented approach to understanding and using Computational Fluid Dynamics (CFD). Meets the needs of all engineering disciplines that use CFD. The perfect CFD teaching resource: clear, straightforward text, step-by-step explanation of mathematical foundations, detailed worked examples, end-of-chapter knowledge check exercises, and homework assignment questions

A wide variety of technologies and products have already become widespread in our society. However, policies have not been well-implemented to effectively reduce energy consumptions and CO2 emissions by promoting low-carbon technologies and products. This Special Issue focuses on studies targeting specific products (e.g., motor vehicle, household dishwashers, etc.) and/or technologies (e.g., information and communication technology, transport technology, CO2 capture technology, etc.) and quantifying resource and energy consumptions and CO2 emissions associated with products and technology systems using the reliable inventory database. Thus, this Special Issue provides important studies on how demand- and supply-side policies can contribute to reducing energy consumptions and CO2 emissions from consumption- and production-based perspectives.

Thermal power plants are one of the most important process industries for engineering professionals. Over the past decades, the power sector is facing a number of critical issues; however, the most fundamental challenge is meeting the growing power demand in sustainable and efficient ways. Practicing power plant engineers not only look after operation and maintenance of the plant, but, also look after range of activities including research and development, starting from power generation to environmental aspects of power plants. The book Thermal Power Plants - Advanced Applications introduces analysis of plant performance, energy efficiency, combustion, heat transfer, renewable power generation, catalytic reduction of dissolved oxygen and environmental aspects of combustion residues. This book addresses issues related to both coal fired and steam power plants. The book is suitable for both undergraduate and research higher degree students, and of course for practicing power plant engineers.

Fossil fuels are widely used for electricity generation and heating, creating greenhouse gas emissions and other toxic pollutants, which should be minimised according to the most recent environmental legislation. The utilisation of solid fuels with biogenic origin could contribute to the minimisation of these emissions. Solid Biofuels for Energy presents the current status of the engineering disciplines in this specific area, providing an improved background on the energy exploitation options of solid biomass. Within this framework, all thematic priorities related to the solid bioenergy potential and standardisation, commercialised and emerging energy technologies, and quality of solid residues are presented. Special attention has been given to biomass co-firing with coal, since it has the highest potential for commercial application, while combustion and gasification are more promising for units of medium to small scale. This strong practical focus is evident throughout the book, particularly in discussions of: • international standards for solid biofuel specifications; • supply, cost and sustainability of solid biofuels; • technical issues and non-technical barriers in biomass/coal co-firing; and • biomass combustion and gasification characteristics. Solid Biofuels for Energy is an informative reference, written for researchers and postgraduate students working in the field of biomass. It can also be a useful guide for chemical and mechanical engineers, involved in the environment and energy production sectors.

The book provides highly specialized researchers and practitioners with a major contribution to mathematical models' developments for energy systems. First, dynamic process simulation models based on mixture flow and two-fluid models are developed for combined-cycle power plants, pulverised coal-fired power plants, concentrated solar power plant and municipal waste incineration. Operation data, obtained from different power stations, are used to investigate the capability of dynamic models to predict the behaviour of real processes and to analyse the influence of modeling assumptions on simulation results. Then, a computational fluid dynamics (CFD) simulation programme, so-called DEMEST, is developed. Here, the fluid-solid, particle-particle and particle-wall interactions are modeled by tracking all individual particles. To this purpose, the deterministic Euler-Lagrange/Discrete Element Method (DEM) is applied and further improved. An emphasis is given to the determination of inter-phase values, such as volumetric void fraction, momentum and heat transfers, using a new procedure known as the offset-method and to the particle-grid method allowing the refinement of the grid resolution independently from particle size. Model validation is described in detail. Moreover, thermochemical reaction models for solid fuel combustion are developed based on quasi-single-phase, two-fluid and Euler-Lagrange/MP-PIC

models. Measurements obtained from actual power plants are used for validation and comparison of the developed numerical models.

Although many books have been written on computational fluid dynamics (CFD) and many written on combustion, most contain very limited coverage of the combination of CFD and industrial combustion. Furthermore, most of these books are written at an advanced academic level, emphasize theory over practice, and provide little help to engineers who need to use CFD for combustion modeling. Computational Fluid Dynamics in Industrial Combustion fills this gap in the literature. Focusing on topics of interest to the practicing engineer, it codifies the many relevant books, papers, and reports written on this combined subject into a single, coherent reference. It looks at each topic from a somewhat narrow perspective to see how that topic affects modeling in industrial combustion. The editor and his team of expert authors address these topics within three main sections: Modeling Techniques-The basics of CFD modeling in combustion Industrial Applications-Specific applications of CFD in the steel, aluminum, glass, gas turbine, and petrochemical industries Advanced Techniques-Subjects rarely addressed in other texts, including design optimization, simulation, and visualization Rapid increases in computing power and significant advances in commercial CFD codes have led to a tremendous increase in the application of CFD to industrial combustion. Thorough and clearly representing the techniques and issues confronted in industry, Computational Fluid Dynamics in Industrial Combustion will help bring you quickly up to date on current methods and gain the ability to set up and solve the various types of problems you will encounter.

This is a useful reference book focusing on state-of-the-art concepts explaining the mechanisms of the process as well as basic engineering methodologies for calculating heat transfer in furnaces firing pulverized coal, gas, and fuel oil. Solving these problems is especially relevant to high reliability and efficiency in furnace chambers. One of the most complex problems in heat transfer analysis is the calculation of heat transfer. That is why this book provides such extensive material on the conditions of combustion, motion of gases and mass transfer when burning different fuels. The accuracy of such data as thermophysical properties of a layer of impurities on waterwall tubes as well as the radiative properties of flame, especially of its solid particles is imperative and therefore studied in this book.

Fossil-fuel power plants account for the majority of worldwide power generation. Increasing global energy demands, coupled with issues of ageing and inefficient power plants, have led to new power plant construction programmes. As cheaper fossil fuel resources are exhausted and emissions criteria are tightened, utilities are turning to power plants designed with performance in mind to satisfy requirements for improved capacity, efficiency, and environmental characteristics. Advanced power plant materials, design and technology provides a comprehensive reference on the state of the art of gas-fired and coal-fired power plants, their major components and performance improvement options. Part one critically reviews advanced power plant designs which target both higher efficiency and flexible operation, including reviews of combined cycle technology and materials performance issues. Part two reviews major plant components for improved operation, including advanced membrane technology for both hydrogen (H2) and carbon dioxide (CO2) separation, as well as flue gas handling technologies for improved emissions control of sulphur oxides (SOx), nitrogen oxides (NOx), mercury, ash and particulates. The section concludes with coverage of high-temperature sensors, and monitoring and control technology that are essential to power plant operation and performance optimisation. Part three begins with coverage of low-rank coal upgrading and biomass resource utilisation for improved power plant fuel flexibility. Routes to improve the environmental impact are also reviewed, with chapters detailing the integration of underground coal gasification and the application of carbon dioxide (CO2) capture and storage. Finally, improved generation performance is reviewed with coverage of syngas and hydrogen (H2) production from fossil-fuel feedstocks. With its distinguished international team of contributors, Advanced power plant materials, design and technology is a standard reference for all power plant engineers and operators, as well as to academics and researchers in this field. Provides a comprehensive reference on the state-of-the-art gas-fired and coal-fired power plants, their major components and performance improvement options Examines major plant components for improved operation as well as flue gas handling technologies for improved emissions control Routes to improve environmental impact are discussed with chapters detailing the integration of underground coal gasification

New Trends in Coal Conversion: Combustion, Gasification, Emissions, and Coking covers the latest advancements in coal utilization, including coal conversion processes and mitigation of environmental impacts, providing an up-to-date source of information for a cleaner and more environmentally friendly use of coal, with a particular emphasis on the two biggest users of coal—utilities and the steel industry. Coverage includes recent advances in combustion co-firing, gasification, and on the minimization of trace element and CO2 emissions that is ideal for plant engineers, researchers, and quality control engineers in electric utilities and steelmaking. Other sections cover new advances in clean coal technologies for the steel industry, technological advances in conventional by-products, the heat-recovery/non-recovering cokemaking process, and the increasing use of low-quality coals in coking blends. Readers will learn how to make more effective use of coal resources, deliver higher productivity, save energy and reduce the environmental impact of their coal utilization. Provides the current state-of-the-art and ongoing activities within coal conversion processes, with an emphasis on emerging technologies for the reduction of CO2 and trace elements Discusses innovations in cokemaking for improved efficiency, energy savings and reduced environmental impact Include case studies and examples throughout the book

This textbook explores both the theoretical foundation of the Finite Volume Method (FVM) and its applications in Computational Fluid Dynamics (CFD). Readers will discover a thorough explanation of the FVM numerics and algorithms used for the simulation of incompressible and compressible fluid flows, along with a detailed examination of the components needed for the development of a collocated unstructured pressure-based CFD solver. Two particular CFD codes are explored. The first is uFVM, a three-dimensional unstructured pressure-based finite volume academic CFD code, implemented within Matlab. The second is OpenFOAM®, an open source framework used in the development of a range of CFD programs for the simulation of industrial scale flow problems. With over 220 figures, numerous examples and more than one hundred exercise on FVM numerics, programming, and applications, this textbook is suitable for use in an introductory course on the FVM, in an advanced course on numerics, and as a reference for CFD programmers and researchers.

Over the past few decades, exciting developments have taken place in the field of combustion technology. The present edited volume intends to cover recent developments and provide a broad perspective of the key challenges that characterize the field. The target audience for this book includes engineers involved in combustion system design, operational planning and maintenance. Manufacturers and combustion technology researchers will also benefit from the timely and accurate information provided in this work. The volume is organized into five main sections comprising 15 chapters overall: - Coal and Biofuel Combustion - Waste Combustion - Combustion and Biofuels in Reciprocating Engines - Chemical Looping and Catalysis - Fundamental and Emerging Topics in Combustion Technology