Thermal Performance Modeling Of Cross Flow Heat Exchangers Springerbriefs In Applied Sciences And Technology

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Duct Thermal Performance Models for Large Commercial Buildings John Wiley & Sons
Presenting contributions from renowned experts in the field, this book covers research and development in fundamental areas of heat exchangers, which include: design and theoretical development, experiments, numerical modeling and simulations. This book is intended to be a useful reference source and guide to researchers, postgraduate students, and engineers in the fields of heat exchangers, cooling, and thermal management.
Publications of the National Bureau of Standards ... Catalog John Wiley & Sons
A thermal building simulation program is a numerical model that calculates the response of the building envelopes to weather and human activity, simulates dynamic heating and cooling loads, and heating and cooling distribution systems, and models building equipment operation. The scope of the research is to supply the users of such programs with information about the dangers and benefits of simplifying the input to their models. The Introduction describes the advantages of modeling the heat transfer mechanisms in a building. The programs that perform this type of modeling have, however, limitations. The user is therefore often put in the situation of simplifying the floor plans of the building under study, but not being able to check the effects that this approximation introduces in the results of the simulation. Chapter 1 is a description of methods. It also introduces the floor plans for the office building under study and the ''reasonable'' floor plans simplifications. Chapter 2 presents DOE-2, the thermal building simulation program used in the sensitivity study. The evaluation of the accuracy of the DOE-2 program itself is also presented. Chapter 3 contains the sensitivity study. The complicated nature of the process of interpreting the temperature profile inside a space leads to the necessity of defining different building modes. The study compares the results from the model of the detailed building description with the results from the models of the same building having simplified floor plans. The conclusion is reached that a study of the effects of simplifying the floor plans of a building is important mainly for defining the cases in which this approximation is acceptable. Different results are obtained for different air conditioning/load regimes of the building. 9 refs., 24 figs.
Performance Prediction of an Air Dehumidifying Non-metallic Plate Cross Flow Heat Exchanger Firenze University Press
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.

ERDA Energy Research Abstracts BoD – Books on Demand

This book serves as a single-source reference to key machine learning (ML) applications and methods in digital and analog design and verification. Experts from academia and industry cover a wide range of the latest research on ML applications in electronic design automation (EDA), including analysis and optimization of digital design, analysis and optimization of analog design, as well as functional verification, FPGA and system level designs, design for manufacturing (DFM), and design space exploration. The authors also cover key ML methods such as classical ML, deep learning models such as convolutional neural networks (CNNs), graph neural networks (GNNs), generative adversarial networks (GANs) and optimization methods such as reinforcement learning (RL) and Bayesian optimization (BO). All of these topics are valuable to chip designers and EDA developers and researchers working in digital and analog designs and verification.

Reliability in Power Electronics and Electrical Machines: Industrial Applications and Performance Models Academic Press

Solid–Liquid Thermal Energy Storage: Modeling and Applications provides a comprehensive overview of solid–liquid phase change thermal storage. Chapters are written by specialists from both academia and industry. Using recent studies on the improvement, modeling, and new applications of these systems, the book discusses innovative solutions for any potential drawbacks. This book: Discusses experimental studies in the field of solid–liquid phase change thermal storage Reviews recent research on phase change materials Covers various innovative applications of phase change materials (PCM) on the use of sustainable and renewable energy sources Presents recent developments on the theoretical modeling of these systems Explains advanced methods for enhancement of heat transfer in PCM This book is a reference for engineers and industry professionals involved in the use of renewable energy systems, energy storage, heating systems for buildings, sustainability design, etc. It can also benefit graduate students taking courses in heat transfer, energy engineering, advanced materials, and heating systems.

Proceedings of the 6th Ocean Thermal Energy Conversion Conference Cambridge University Press

The objective of this study was to develop a methodology to analyze the air-side performance of a plastic plate-type heat exchanger. An experimental apparatus was designed and used to measure empirical data, and a numerical model was developed to analyze this data. The experimental data and the numerical model were then used to predict and analyze the thermal performance of the plastic parallel plate-type heat exchanger with mixed cross flow air and chilled water paths having both heat and mass transfer. The method used to analyze the data proved to be effective in predicting outlet fluid properties as well as heat transfer rates. The analysis method accounts for the low thermal conductivity of the PVC sheet used in the heat exchanger and the crossflow design of the heat exchanger surface.

Energy Research Abstracts Springer

Thermofluid Modeling for Sustainable Energy Applications provides a collection of the most recent, cutting-edge developments in the application of fluid mechanics modeling to energy systems and energy efficient technology. Each chapter introduces relevant theories alongside detailed, real-life case studies that demonstrate the value of thermofluid modeling and simulation as an integral part of the engineering process. Research problems and modeling solutions across a range of energy efficiency scenarios are presented by experts, helping users build a sustainable engineering knowledge base. The text offers novel examples of the use of computation fluid dynamics in relation to hot topics, including passive air cooling and thermal storage. It is a valuable resource for academics, engineers, and students undertaking research in thermal engineering. Includes contributions from experts in energy efficiency modeling across a range of engineering fields Places thermofluid modeling and simulation at the center of engineering design and development, with theory supported by detailed, real-life case studies Features hot topics in energy and sustainability engineering, including thermal storage and passive air cooling Provides a valuable resource for academics, engineers, and students undertaking research in thermal engineering

Applied Mechanics Reviews BoD – Books on Demand

A comprehensive review of state-of-the-art CCHP modeling, optimization, and operation theory and practice This book was written by an international author team at the forefront of combined cooling, heating, and power (CCHP) systems R&D. It offers systematic coverage of state-of-the-art mathematical modeling, structure optimization, and CCHP system operation, supplemented with numerous illustrative case studies and examples. CCHP systems are an exciting emerging energy technology offering significant economic and environmental benefits. Combined Cooling, Heating, and Power Systems: Modelling, Optimization, and Operation is a timely response to ongoing efforts to maximize the efficiency of that technology. It begins with a survey of CCHP systems from the technological and societal perspectives, offering readers a broad and stimulating overview of the field. It then digs down into topics crucial for optimal CCHP operation. Discussions of each topic are carefully structured, walking readers from introduction and background to technical details. A set of new methodologies for the modeling, optimization and control of CCHP systems are presented within a unified framework. And the authors demonstrate innovative solutions to a variety of CCHP systems problems using new approaches to optimal power flow, load forecasting, and system operation design. Provides a comprehensive review of state-of-the-art of CCHP system development Presents new methodologies for mathematical modeling, optimization, and advanced control Combines theoretical rigor with real-world application perspectives Features numerous examples demonstrating an array of new design strategies Reflects the combined experience of veteran researchers in the field whose contributions are well recognized within the energy community Offers excellent background reading for students currently enrolled in the growing number of courses on energy systems at universities worldwide Timely, authoritative, and offering a balanced presentation of theory and practice, Combined Cooling, Heating, and Power Systems: Modelling, Optimization, and Operation is a valuable resource forresearchers, design practitioners, and graduate students in the areas of control theory, energy management, and energy systems design.

Publications Springer

Semiannual, with semiannual and annual indexes. References to all scientific and technical literature coming from DOE, its laboratories, energy centers, and contractors. Includes all works deriving from DOE, other related government-sponsored information, and foreign nonnuclear information. Arranged under 39 categories, e.g., Biomedical sciences, basic studies; Biomedical sciences, applied studies; Health and safety; and Fusion energy. Entry gives bibliographical information and abstract. Corporate, author, subject, report number indexes.

Building Performance Analysis CRC Press

This book deals with certain aspects of material science, particularly with the release of thermal energy associated with bond breaking. It clearly establishes the connection between heat transfer rates and product quality. The editors then sharply draw the thermal distinctions between the various categories of welding processes, and demonstrate how these distinctions are translated into simulation model uniqueness. The book discusses the incorporation of radiative heat transfer processes into the simulation model.

Thermofluid Modeling for Energy Efficiency Applications John Wiley & Sons

Doctoral Thesis on the topic of Modeling and Performance Analysis of Alternative Heat Exchangers for Heavy Vehicles Popular Science Description: Low fuel consumption, and reduced exhaust emissions, as well as improved performance and durability become much more important than before for the vehicle industry. These requirements lead to a number of additional equipment installed in the vehicles. All these efforts increase the operating temperature in the engine compartment and reduce the available free space in the vehicle. In order to keep the engine working at its optimal condition, a huge amount of heat has to be removed from the engine to the surrounding air. In modern heavy vehicles, this heat is so huge that a conventional heat exchanger (HEX) cannot handle it easily. In addition, more and more electric powertrains are introduced to heavy vehicles. Because of the increased demand in cooling power, a larger heat exchanger size with a huge cooling surface area is required for the vehicle cooling system. However, the space in such vehicles is limited. It is impossible to increase the size of the conventional HEX to dissipate the required amount of heat from the vehicle. All these factors imply a need for a revolution of the HEX design in vehicles. Based on literature review, there are two ideas available for developing an alternative heat exchanger for heavy vehicles: 1) Changing the position of heat exchangers: Moving the HEX from the front of the vehicles to the roof of the driver compartment, which might increase the possibility to increase the size of the HEX. Based on the air flowing direction and the engine coolant direction, a countercurrent flow HEX is introduced at the roof position instead of a cross flow HEX. 2) Introducing new materials: Using graphite foam as a thermal material for HEXs in vehicles. Nowadays aluminum HEXs are very common in the vehicle industry. Due to the increasing cooling power and the space limitation in vehicles, a highly compact HEX is required. Graphite foam has even higher thermal conductivity, large specific surface area, and low density. These characteristics imply that graphite foam is a potentially good thermal material for HEXs (instead of the conventional aluminum HEX). However, due to its porous structure, the flow resistance of graphite foam is very high. In order to find an appropriate fin configuration with good performance in the HEX, a computational method is applied to simulate the performance of the HEX with different fin configurations. The numerical model is verified by experimental results from literature. The analysis of the results shows: 1) The overall size and weight of a countercurrent flow HEX can be reduced compared to the cross flow HEX because of the high power density and high compactness factor achieved by the countercurrent flow HEX. 2) Because of the high thermal conductivity and low density of the graphite foam, the graphite foam wavy corrugated fin provides higher power density and higher compactness factor than an aluminum louver fin. A graphite foam fin with two-side dimples exhibits higher coefficient of performance (COP) than an aluminum louver fin, and it becomes very efficient in energy saving. Thus, the graphite foam has a very high potential as an alternative material for heat exchanger applications. The countercurrent flow HEXs made from graphite foam can be designed to be much lighter and smaller than the convectional cross flow aluminum HEXs. A light and compact HEX is not only good for the thermal management of the vehicle, but also it reduces the weight of the vehicle which has an effect on the fuel consumption and overall cost. The present work is based on a research project "Development of new cooling systems for heavy vehicles - for reduced fuel consumption and lower carbon dioxide emission," which has been financially supported partly by the Swedish Energy Agency (STEM).

Scientific and Technical Aerospace Reports CRC Press

This monograph introduces a numerical computational methodology for thermal performance modeling of cross-flow heat exchangers, with applications in chemical, refrigeration and automobile industries. This methodology allows obtaining effectiveness-number of transfer units (e-NTU) data and has been used for simulating several standard and complex flow arrangements configurations of cross-flow heat exchangers. Simulated results have been validated through comparisons with results from available exact and approximate analytical solutions. Very accurate results have been obtained over wide ranges of NTU and C* values in all cases. The proposed procedure constitutes a useful research tool for both theoretical and experimental studies of cross-flow heat exchangers. The following are the unique features of the book: - The monograph includes the computational code named HETE (Heat Exchanger Thermal Effectiveness) in Chapter 5. A version of this code is available for downloading. - The computational procedure could be used for reducing experimental data using the effectiveness - NTU (e-NTU) method in research and industrial laboratories. - Even after more than one century in heat exchanger research, the search

for new flow arrangements with higher effectiveness still is an unsolved problem. The present methodology could be a useful tool in pursuing that goal.

Advances in Heat Transfer Enhancement Springer

This new book focuses on important research related to the mathematical modelling of engineering and environmental processes, manufacturing, and industrial systems. It includes heat transfer, fluid mechanics, CFD, and transport phenomena; solid mechanics and mechanics of metals; electromagnets and MHD; reliability modelling and system optimisation; finite volume, finite element, and boundary element procedures; decision sciences in an industrial and manufacturing context; civil engineering systems and structures; mineral and energy resources; relevant software engineering issues associated with CAD and CAE; and materials and metallurgical engineering.

The Effect of Simplifying the Building Description on the Numerical Modeling of Its Thermal Performance Elsevier

This Brief addresses the phenomena of heat transfer enhancement. A companion edition in the SpringerBrief Subseries on Thermal Engineering and Applied Science to three other monographs including “Critical Heat Flux in Flow Boiling in Microchannels,” this volume is idea for professionals, researchers, and graduate students concerned with electronic cooling.

Machine Learning Applications in Electronic Design Automation Academic Press

Despite the potential for significant energy savings by reducing duct leakage or other thermal losses from duct systems in large commercial buildings, California Title 24 has no provisions to credit energy-efficient duct systems in these buildings. A substantial reason is the lack of readily available simulation tools to demonstrate the energy-saving benefits associated with efficient duct systems in large commercial buildings. The overall goal of the Efficient Distribution Systems (EDS) project within the PIER High Performance Commercial Building Systems Program is to bridge the gaps in current duct thermal performance modeling capabilities, and to expand our understanding of duct thermal performance in California large commercial buildings. As steps toward this goal, our strategy in the EDS project involves two parts: (1) developing a whole-building energy simulation approach for analyzing duct thermal performance in large commercial buildings, and (2) using the tool to identify the energy impacts of duct leakage in California large commercial buildings, in support of future recommendations to address duct performance in the Title 24 Energy Efficiency Standards for Nonresidential Buildings. The specific technical objectives for the EDS project were to: (1) Identify a near-term whole-building energy simulation approach that can be used in the impacts analysis task of this project (see Objective 3), with little or no modification. A secondary objective is to recommend how to proceed with long-term development of an improved compliance tool for Title 24 that addresses duct thermal performance. (2) Develop an Alternative Calculation Method (ACM) change proposal to include a new metric for thermal distribution system efficiency in the reporting requirements for the 2005 Title 24 Standards. The metric will facilitate future comparisons of different system types using a common ''yardstick''. (3) Using the selected near-term simulation approach, assess the impacts of duct system improvements in California large commercial buildings, over a range of building vintages and climates. This assessment will provide a solid foundation for future efforts that address the energy efficiency of large commercial duct systems in Title 24. This report describes our work to address Objective 1, which includes a review of past modeling efforts related to duct thermal performance, and recommends near- and long-term modeling approaches for analyzing duct thermal performance in large commercial buildings.

Transient Performance of Parallel-flow and Cross-flow Direct Transfer Type Heat Exchangers with a Step Temperature Change on the Minimum Capacity Rate Fluid Stream John Wiley & Sons

This book deals with certain aspects of material science, particularly with the release of thermal energy associated with bond breaking. It clearly establishes the connection between heat transfer rates and product quality. The editors then sharply draw the thermal distinctions between the various categories of welding processes, and demonstrate how these distinctions are translated into simulation model uniqueness. The book discusses the incorporation of radiative heat transfer processes into the simulation model.

Solid-Liquid Thermal Energy Storage BoD – Books on Demand

Comprehensive and unique source integrates the material usually distributed among a half a dozen sources. * Presents a unified approach to modeling of new designs and develops the skills for complex engineering analysis. * Provides industrial insight to the applications of the basic theory developed.

Bringing Thermoelectricity into Reality IGI Global

In modern industries, electrical energy conversion systems consist of two main parts: electrical machines and power electronic converters. With global electricity use at an all-time high, uninterrupted operation of electrical power converters is essential. Reliability in Power Electronics and Electrical Machines: Industrial Applications and Performance Models provides an in-depth analysis of reliability in electrical energy converters as well as strategies for designing dependable power electronic converters and electrical machines. Featuring a comprehensive discussion on the topics of reliability design and measurement, failure mechanisms, and specific issues pertaining to quality, efficiency, and durability, this timely reference source offers practical examples and research-based results for use by engineers, researchers, and advanced-level students.

Thermal Performance Modeling of Cross-Flow Heat Exchangers CreateSpace

This monograph introduces a numerical computational methodology for thermal performance modeling of cross-flow heat exchangers, with applications in chemical, refrigeration and automobile industries. This methodology allows obtaining effectiveness-number of transfer units (e-NTU) data and has been used for simulating several standard and complex flow arrangements configurations of cross-flow heat exchangers. Simulated results have been validated through comparisons with results from available exact and approximate analytical solutions. Very accurate results have been obtained over wide ranges of NTU and C* values in all cases. The proposed procedure constitutes a useful research tool for both theoretical and experimental studies of cross-flow heat exchangers. The following are the unique features of the book: - The monograph includes the computational code named HETE (Heat Exchanger Thermal Effectiveness) in Chapter 5. A version of this code is available for downloading. - The computational procedure could be used for reducing experimental data using the effectiveness - NTU (e-NTU) method in research and industrial laboratories. - Even after more than one century in heat exchanger research, the search for new flow arrangements with higher effectiveness still is an unsolved problem. The present methodology could be a useful tool in pursuing that goal.

Simulation Model of the Thermal Performance of Cooling Coils Springer Nature

Explores and brings together the existent body of knowledge on building performance analysis Building performance is an important yet surprisingly complex concept. This book presents a comprehensive and systematic overview of the subject. It provides a working definition of building performance, and an in-depth discussion of the role building performance plays throughout the building life cycle. The book also explores the perspectives of various stakeholders, the functions of buildings, performance requirements, performance quantification (both predicted and measured), criteria for success, and the challenges of using performance analysis in practice. Building Performance Analysis starts by introducing the subject of building performance: its key terms, definitions, history, and challenges. It then develops a theoretical foundation for the subject, explores the complexity of performance assessment, and the way that performance analysis impacts on actual buildings. In doing so, it attempts to answer the following questions: What is building performance? How can building performance be measured and analyzed? How does the analysis of building performance guide the improvement of buildings? And what can the building domain learn from the way performance is handled in other disciplines? Assembles the current body of knowledge on building performance analysis in one unique resource Offers deep insights into the complexity of using building performance analysis throughout the entire building life cycle, including design, operation and management Contributes an emergent theory of building performance and its analysis Building Performance Analysis will appeal to the building science community, both from industry and academia. It specifically targets advanced students in architectural engineering, building services design, building performance simulation and similar fields who hold an interest in ensuring that buildings meet the needs of their stakeholders.