

# Download Free Short Introduction To Comsol Multiphysics Kth

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## KEY=INTRODUCTION - CASSANDRA EDDIE

## MODELLING IN SCIENCE AND ENGINEERING

## A BRIEF INTRODUCTION TO COMSOL MULTIPHYSICS 5

This book gives the reader a brief introduction to the COMSOL Multiphysics software tool. Building COMSOL Multiphysics models in 2D or 3D will help students to consolidate their skills by applying basic theory to the real modelling of tasks that in the recent past would require months of programming and dedicated projects to solve a single problem. The examples illustrated in this book include modelling of heat transfer, the migration of a radioactive species in a channel using the Navier-Stokes equations and a chemical heterogenous reactor. These are problems that tend to be rather abstract until such time as a student applies these fundamental equations in practice. Advanced coupling between phenomena in fields such as electromagnetics with others such as heat transfer and computational fluid flow is made easy in COMSOL Multiphysics. A short introduction to the basics, concepts and techniques will allow the reader to progress rapidly and start developing his/her own models. In the second part of this book, some of the models developed in the first part are used to create model applications that can even run on a mobile phone. About the authors: António de Campos Pereira, PhD. in Physics, is an author and consultant. He is a retired researcher from the Dept. of Physics at Stockholm University. Prof. Isabel Paiva, Ph.D. in Chemical Engineering, is a researcher at C2TN at IST, the School of Engineering of the University of Lisbon. Marcus Inácio has a B.Sc. in Electrotechnical Engineering and is specialising in the field of Medical Physics at KTH, the Royal Institute of Technology in Stockholm, Sweden. Hugo de Campos Pereira is an environmental engineer from Uppsala University and a Ph.D. student specialising in the sorption of highly fluorinated compounds in soils at the Department of Soil and Environment at SLU, the Swedish University of Agricultural Sciences in Uppsala, Sweden.

## INTRODUCTION TO COMPUTATION AND MODELING FOR DIFFERENTIAL EQUATIONS

**John Wiley & Sons** Uses mathematical, numerical, and programming tools to solve differential equations for physical phenomena and engineering problems Introduction to Computation and Modeling for Differential Equations, Second Edition features the essential principles and applications of problem solving across disciplines such as engineering, physics, and chemistry. The Second Edition integrates the science of solving differential equations with mathematical, numerical, and programming tools, specifically with methods involving ordinary differential equations; numerical methods for initial value problems (IVPs); numerical methods for boundary value problems (BVPs); partial differential equations (PDEs); numerical methods for parabolic, elliptic, and hyperbolic PDEs; mathematical modeling with differential equations; numerical solutions; and finite difference and finite element methods. The author features a unique "Five-M" approach: Modeling, Mathematics, Methods, MATLAB®, and Multiphysics, which facilitates a thorough understanding of how models are created and preprocessed mathematically with scaling, classification, and approximation and also demonstrates how a problem is solved numerically using the appropriate mathematical methods. With numerous real-world examples to aid in the visualization of the solutions, Introduction to Computation and Modeling for Differential Equations, Second Edition includes: New sections on topics including variational formulation, the finite element method, examples of discretization, ansatz methods such as Galerkin's method for BVPs, parabolic and elliptic PDEs, and finite volume methods Numerous practical examples with applications in mechanics, fluid dynamics, solid mechanics, chemical engineering, heat conduction, electromagnetic field theory, and control theory, some of which are solved with computer programs MATLAB and COMSOL Multiphysics® Additional exercises that introduce new methods, projects, and problems to further illustrate possible applications A related website with select solutions to the exercises, as well as the MATLAB data sets for ordinary differential equations (ODEs) and PDEs Introduction to Computation and Modeling for Differential Equations, Second Edition is a useful textbook for upper-undergraduate and graduate-level courses in scientific computing, differential equations, ordinary differential equations, partial differential equations, and numerical methods. The book is also an excellent self-study guide for mathematics, science, computer science, physics, and engineering students, as well as an excellent reference for practitioners and consultants who use differential equations and numerical methods in everyday situations.

## INTRODUCTION TO CHEMICAL ENGINEERING COMPUTING

**John Wiley & Sons** Step-by-step instructions enable chemical engineers to master key software programs and solve complex problems Today, both students and professionals in chemical engineering must solve increasingly complex problems dealing with refineries, fuel cells, microreactors, and pharmaceutical plants, to name a few. With this book as their guide, readers learn to solve these problems using their computers and Excel®, MATLAB, Aspen Plus, and COMSOL Multiphysics. Moreover, they learn how to check their solutions and validate their results to make sure they have solved the problems correctly. Now in its Second Edition, Introduction to Chemical Engineering Computing is based on the author's firsthand teaching experience. As a result, the emphasis is on problem solving. Simple introductions help readers become conversant with each program and then tackle a broad range of problems in chemical engineering, including: Equations of state Chemical reaction equilibria Mass balances with recycle streams Thermodynamics and simulation of mass transfer equipment Process simulation Fluid flow in two and three dimensions All the chapters contain clear instructions, figures, and examples to guide readers through all the programs and types of chemical engineering problems. Problems at the end of each chapter, ranging from simple to difficult, allow readers to gradually build their skills, whether they solve the problems themselves or in teams. In addition, the book's accompanying website lists the core principles learned from each problem, both from a chemical engineering and a computational perspective. Covering a broad range of disciplines and problems within chemical engineering, Introduction to Chemical Engineering Computing is recommended for both undergraduate and graduate students as well as practicing engineers who want to know how to choose the right computer software program and tackle almost any chemical engineering problem.

## TMS 2014 143RD ANNUAL MEETING & EXHIBITION, ANNUAL MEETING SUPPLEMENTAL PROCEEDINGS

**Springer** These papers present advancements in all aspects of high temperature electrochemistry, from the fundamental to the empirical and from the theoretical to the applied. Topics involving the application of electrochemistry to the nuclear fuel cycle, chemical sensors, energy storage, materials synthesis, refractory metals and their alloys, and alkali and alkaline earth metals are included. Also included are papers that discuss various technical, economic, and environmental issues associated with plant operations and industrial practices.

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## NUMERICAL SIMULATION IN HYDRAULIC FRACTURING: MULTIPHYSICS THEORY AND APPLICATIONS

**CRC Press** The expansion of unconventional petroleum resources in the recent decade and the rapid development of computational technology have provided the opportunity to develop and apply 3D numerical modeling technology to simulate the hydraulic fracturing of shale and tight sand formations. This book presents 3D numerical modeling technologies for hydraulic fracturing developed in recent years, and introduces solutions to various 3D geomechanical problems related to hydraulic fracturing. In the solution processes of the case studies included in the book, fully coupled multi-physics modeling has been adopted, along with innovative computational techniques, such as submodeling. In practice, hydraulic fracturing is an essential project component in shale gas/oil development and tight sand oil, and provides an essential measure in the process of drilling cuttings reinjection (CRI). It is also an essential measure for widened mud weight window (MWW) when drilling through naturally fractured formations; the process of hydraulic plugging is a typical application of hydraulic fracturing. 3D modeling and numerical analysis of hydraulic fracturing is essential for the successful development of tight oil/gas formations: it provides accurate solutions for optimized stage intervals in a multistage fracking job. It also provides optimized well-spacing for the design of zipper-frac wells. Numerical estimation of casing integrity under stimulation injection in the hydraulic fracturing process is one of major concerns in the successful development of unconventional resources. This topic is also investigated numerically in this book. Numerical solutions to several other typical geomechanics problems related to hydraulic fracturing, such as fluid migration caused by fault reactivation and seismic activities, are also presented. This book can be used as a reference textbook to petroleum, geotechnical and geothermal engineers, to senior undergraduate, graduate and postgraduate students, and to geologists, hydrogeologists, geophysicists and applied mathematicians working in this field. This book is also a synthetic compendium of both the fundamentals and some of the most advanced aspects of hydraulic fracturing technology.

## ELEMENTS OF CHEMICAL REACTION ENGINEERING

**Pearson Educación** "The fourth edition of Elements of Chemical Reaction Engineering is a completely revised version of the book. It combines authoritative coverage of the principles of chemical reaction engineering with an unsurpassed focus on critical thinking and creative problem solving, employing open-ended questions and stressing the Socratic method. Clear and organized, it integrates text, visuals, and computer simulations to help readers solve even the most challenging problems through reasoning, rather than by memorizing equations."--BOOK JACKET.

## INTRODUCTION TO CHEMICAL ENGINEERING COMPUTING

**John Wiley & Sons** Step-by-step instructions enable chemical engineers to master key software programs and solve complex problems Today, both students and professionals in chemical engineering must solve increasingly complex problems dealing with refineries, fuel cells, microreactors, and pharmaceutical plants, to name a few. With this book as their guide, readers learn to solve these problems using their computers and Excel, MATLAB, Aspen Plus, and COMSOL Multiphysics. Moreover, they learn how to check their solutions and validate their results to make sure they have solved the problems correctly. Now in its Second Edition, Introduction to Chemical Engineering Computing is based on the author's firsthand teaching experience. As a result, the emphasis is on problem solving. Simple introductions help readers become conversant with each program and then tackle a broad range of problems in chemical engineering, including: Equations of state Chemical reaction equilibria Mass balances with recycle streams Thermodynamics and simulation of mass transfer equipment Process simulation Fluid flow in two and three dimensions All the chapters contain clear instructions, figures, and examples to guide readers through all the programs and types of chemical engineering problems. Problems at the end of each chapter, ranging from simple to difficult, allow readers to gradually build their skills, whether they solve the problems themselves or in teams. In addition, the book's accompanying website lists the core principles learned from each problem, both from a

chemical engineering and a computational perspective. Covering a broad range of disciplines and problems within chemical engineering, *Introduction to Chemical Engineering Computing* is recommended for both undergraduate and graduate students as well as practicing engineers who want to know how to choose the right computer software program and tackle almost any chemical engineering problem.

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## MATHEMATICAL MODELING AND SIMULATION

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### INTRODUCTION FOR SCIENTISTS AND ENGINEERS

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**John Wiley & Sons** This concise and clear introduction to the topic requires only basic knowledge of calculus and linear algebra - all other concepts and ideas are developed in the course of the book. Lucidly written so as to appeal to undergraduates and practitioners alike, it enables readers to set up simple mathematical models on their own and to interpret their results and those of others critically. To achieve this, many examples have been chosen from various fields, such as biology, ecology, economics, medicine, agricultural, chemical, electrical, mechanical and process engineering, which are subsequently discussed in detail. Based on the author's modeling and simulation experience in science and engineering and as a consultant, the book answers such basic questions as: What is a mathematical model? What types of models do exist? Which model is appropriate for a particular problem? What are simulation, parameter estimation, and validation? The book relies exclusively upon open-source software which is available to everybody free of charge. The entire book software - including 3D CFD and structural mechanics simulation software - can be used based on a free CAELinux-Live-DVD that is available in the Internet (works on most machines and operating systems).

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### TOPOLOGY OPTIMIZATION

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#### THEORY, METHODS, AND APPLICATIONS

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**Springer Science & Business Media** The topology optimization method solves the basic engineering problem of distributing a limited amount of material in a design space. The first edition of this book has become the standard text on optimal design which is concerned with the optimization of structural topology, shape and material. This edition, has been substantially revised and updated to reflect progress made in modelling and computational procedures. It also encompasses a comprehensive and unified description of the state-of-the-art of the so-called material distribution method, based on the use of mathematical programming and finite elements. Applications treated include not only structures but also materials and MEMS.

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### MULTIPHYSICS MODELING USING COMSOL 5 AND MATLAB

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**Mercury Learning and Information** COMSOL 5 and MATLAB are valuable software modeling tools for engineers and scientists. This updated edition includes five new models and explores a wide range of models in coordinate systems from 0D to 3D, introducing the numerical analysis techniques employed in COMSOL 5.6 and MATLAB software. The text presents electromagnetic, electronic, optical, thermal physics, and biomedical models as examples. It presents the fundamental concepts in the models and the step-by-step instructions needed to build each model. The companion files include all the built models for each step-by-step example presented in the text and the related animations, as specified. The book is designed to introduce modeling to an experienced engineer or can also be used for upper level undergraduate or graduate courses. **FEATURES:** Focuses on COMSOL 5.x and MATLAB models that demonstrate the use of concepts for later application in engineering, science, medicine, and biophysics for the development of devices and systems Includes companion files with executable copies of each model and related animations Includes detailed discussions of possible modeling errors and results Uses a step-by-step modeling methodology linked to the Fundamental Laws of Physics. The companion files are also available online by emailing the publisher with proof of purchase at [info@merclearning.com](mailto:info@merclearning.com).

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### NUMERICAL METHODS FOR ELLIPTIC AND PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS

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**Springer Science & Business Media** This text provides an application oriented introduction to the numerical methods for partial differential equations. It covers finite difference, finite element, and finite volume methods, interweaving theory and applications throughout. The book examines modern topics such as adaptive methods, multilevel methods, and methods for convection-dominated problems and includes detailed illustrations and extensive exercises.

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### THEORETICAL MICROFLUIDICS

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**Oxford University Press** Microfluidics is a young and rapidly expanding scientific discipline, which deals with fluids and solutions in miniaturized systems, the so-called lab-on-a-chip systems. It has applications in chemical engineering, pharmaceuticals, biotechnology and medicine. As the lab-on-a-chip systems grow in complexity, a proper theoretical understanding becomes increasingly important. The basic idea of the book is to provide a self-contained formulation of the theoretical framework of microfluidics, and at the same time give physical motivation and examples from lab-on-a-chip technology. After three chapters introducing microfluidics, the governing equations for mass, momentum and energy, and some basic flow solutions, the following 14 chapters treat hydraulic resistance/compliance, diffusion/dispersion, time-dependent flow, capillarity, electro- and magneto-hydrodynamics, thermal transport, two-phase flow, complex flow patterns and acousto-fluidics, as well as the new fields of opto- and nano-fluidics. Throughout the book simple models with analytical solutions are presented to provide the student with a thorough physical understanding of order of magnitudes and various selected microfluidic phenomena and devices. The book grew out of a set of well-tested lecture notes. It is with its many pedagogical exercises designed as a textbook for an advanced undergraduate or first-year graduate course. It is also well suited for self-study.

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### PROCEEDINGS, 2019, MAXENT 2019

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**MDPI** This Proceedings book presents papers from the 39th International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering, MaxEnt 2019. The workshop took place at the Max Planck Institute for Plasma Physics in Garching near Munich, Germany, from 30 June to 5 July 2019, and invited contributions on all aspects of probabilistic inference, including novel techniques, applications, and work that sheds new light on the foundations of inference. Addressed are inverse and uncertainty quantification (UQ) and problems arising from a large variety of applications, such as earth science, astrophysics, material and plasma science, imaging in geophysics and medicine, nondestructive testing, density estimation, remote sensing, Gaussian process (GP) regression, optimal experimental design, data assimilation, and data mining.

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### ATOMIC TRANSITION PROBABILITIES

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#### A CRITICAL DATA COMPILATION

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### PERMANENT MAGNET SYNCHRONOUS MACHINES

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**MDPI** Interest in permanent magnet synchronous machines (PMSMs) is continuously increasing worldwide, especially with the increased use of renewable energy and the electrification of transports. This book contains the successful submissions of fifteen papers to a Special Issue of *Energies* on the subject area of "Permanent Magnet Synchronous Machines". The focus is on permanent magnet synchronous machines and the electrical systems they are connected to. The presented work represents a wide range of areas. Studies of control systems, both for permanent magnet synchronous machines and for brushless DC motors, are presented and experimentally verified. Design studies of generators for wind power, wave power and hydro power are presented. Finite element method simulations and analytical design methods are used. The presented studies represent several of the different research fields on permanent magnet machines and electric drives.

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### PRINCIPLES OF FUEL CELLS

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**CRC Press** The book is engineering oriented and covers a large variety of topics ranging from fundamental principles to performance evaluation and applications. It is written systematically and completely on the subject with a summary of state-of-the-art fuel cell technology, filling the need for a timely resource. This is a unique book serving academic researchers, engineers, as well as people working in the fuel cell industry. It is also of substantial interest to students, engineers, and scientists in mechanical engineering, chemistry and chemical engineering, electrochemistry, materials science and engineering, power generation and propulsion systems, and automobile engineering.

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### PLASMONICS AND ITS APPLICATIONS

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**MDPI** Plasmonics is a rapidly developing field that combines fundamental research and applications ranging from areas such as physics to engineering, chemistry, biology, medicine, food sciences, and the environmental sciences. Plasmonics appeared in the 1950s with the discovery of surface plasmon polaritons. Plasmonics then went through a novel propulsion in the mid-1970s, when surface-enhanced Raman scattering was discovered. Nevertheless, it is in this last decade that a very significant explosion of plasmonics and its applications has occurred. Thus, this book provides a snapshot of the current advances in these various areas of plasmonics and its applications, such as engineering, sensing, surface-enhanced fluorescence, catalysis, and photovoltaic devices.

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### GAS-SOLID REACTIONS

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**Elsevier** Gas-Solid Reactions describes gas-solid reaction systems, focusing on the four phenomena—external mass transfer, pore diffusion, adsorption/desorption, and chemical reaction. This book consists of eight chapters. After the introduction provided in Chapter 1, the basic components of gas-solid reactions are reviewed in Chapter 2. Chapter 3 describes the reactions of individual nonporous solid particles, while Chapter 4 elaborates the reaction of single porous particles. Solid-solid reactions proceeding through gaseous intermediates are considered in Chapter 5. Chapter 6 deals with the experimental approaches to the study of gas-solid reaction systems. How information on single-particle behavior may be used for the design of multiparticle, large-scale assemblies, and packed- and fluidized-bed reaction systems is deliberated in Chapter 7. The last chapter covers the specific gas-solid reaction systems, including some statistical indices indicating the economic importance of the systems and processes it's based on. This publication is recommended for practicing engineers engaged in process research, development, and design in the many fields where gas-solid reactions are important.

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### CHEMICAL REACTOR MODELING

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#### MULTIPHASE REACTIVE FLOWS

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**Springer Science & Business Media** *Chemical Reactor Modeling* closes the gap between *Chemical Reaction Engineering* and *Fluid Mechanics*. The second edition consists of two volumes: *Volume 1: Fundamentals*. *Volume 2: Chemical Engineering Applications* In volume 1 most of the fundamental theory is presented. A few numerical model simulation application examples are given to elucidate the

link between theory and applications. In volume 2 the chemical reactor equipment to be modeled are described. Several engineering models are introduced and discussed. A survey of the frequently used numerical methods, algorithms and schemes is provided. A few practical engineering applications of the modeling tools are presented and discussed. The working principles of several experimental techniques employed in order to get data for model validation are outlined. The monograph is based on lectures regularly taught in the fourth and fifth years graduate courses in transport phenomena and chemical reactor modeling and in a post graduate course in modern reactor modeling at the Norwegian University of Science and Technology, Department of Chemical Engineering, Trondheim, Norway. The objective of the book is to present the fundamentals of the single-fluid and multi-fluid models for the analysis of single and multiphase reactive flows in chemical reactors with a chemical reactor engineering rather than mathematical bias. Organized into 13 chapters, it combines theoretical aspects and practical applications and covers some of the recent research in several areas of chemical reactor engineering. This book contains a survey of the modern literature in the field of chemical reactor modeling.

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## MOLECULAR COMMUNICATION

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**Cambridge University Press** A comprehensive guide written by pioneers in the field, providing a detailed introduction to the state of the art in molecular communication.

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## COMSOL HEAT TRANSFER MODELS

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**Multiphysics Modeling** This book guides the reader through the process of model creation for heat transfer analysis with the finite element method. The book describes thermal imaging experiments that demonstrate how such models can be validated. It presents application examples, such as heating water in a kettle, to basement insulation, a heated seat, molten rock, pipe flow, and an innovative extended surface. A companion disc provides the files so models can be run (using COMSOL or other software) in order to observe real-world behavior of the applications. Historical background information is provided to show the progression of heat transfer science and mathematical modeling from the earliest developments to the most recent advances in technology. Features: Includes example models that enable the reader to implement conceptual material in practical scenarios with broad industrial applications Includes companion files with models and geometry files created with COMSOL Multiphysics(R) or imported from a third-party CAD tool.

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## OPTIMIZATION IN PRACTICE WITH MATLAB

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**Cambridge University Press** This textbook is designed for students and industry practitioners for a first course in optimization integrating MATLAB® software.

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## ITERATIVE SOLUTION METHODS

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**Cambridge University Press** A valuable resource book for students, tutors and researchers using iterative methods.

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## BRAIN AND HUMAN BODY MODELING 2020

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**Springer Nature** The 41st Annual International Conference of the IEEE EMBS, took place between July 23 and 27, 2019, in Berlin, Germany. The focus was on "Biomedical engineering ranging from wellness to intensive care." This conference provided an opportunity for researchers from academia and industry to discuss a variety of topics relevant to EMBS and hosted the 4th Annual Invited Session on Computational Human Models. At this session, a bevy of research related to the development of human phantoms was presented, together with a substantial variety of practical applications explored through simulation.

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## HEAT PIPE DESIGN AND TECHNOLOGY

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## MODERN APPLICATIONS FOR PRACTICAL THERMAL MANAGEMENT

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**Springer** This book provides a practical study of modern heat pipe engineering, discussing how it can be optimized for use on a wider scale. An introduction to operational and design principles, this book offers a review of heat and mass transfer theory relevant to performance, leading into and exploration of the use of heat pipes, particularly in high-heat flux applications and in situations in which there is any combination of non-uniform heat loading, limited airflow over the heat generating components, and space or weight constraints. Key implementation challenges are tackled, including load-balancing, materials characteristics, operating temperature ranges, thermal resistance, and operating orientation. With its presentation of mathematical models to calculate heat transfer limitations and temperature gradient of both high- and low-temperature heat pipes, the book compares calculated results with the available experimental data. It also includes a series of computer programs developed by the author to support presented data, aid design, and predict performance.

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## PROPAGATION OF SOUND IN POROUS MEDIA

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## MODELLING SOUND ABSORBING MATERIALS

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**Springer Science & Business Media** This book has grown out of the research activities of the author in the fields of sound propagation in porous media and modelling of acoustic materials. It is assumed that the reader has a background of advanced calculus, including an introduction to differential equations, complex variables and matrix algebra. A prior exposure to theory of elasticity would be advantageous. Chapters 1-3 deal with sound propagation of plane waves in solids and fluids, and the topics of acoustic impedance and reflection coefficient are given a large emphasis. The topic of flow resistivity is presented in Chapter 2. Chapter 4 deals with sound propagation in porous materials having cylindrical pores. The topics of effective density, and of tortuosity, are presented. The thermal exchanges between the frame and the fluid, and the behaviour of the bulk modulus of the fluid, are described in this simple context. Chapter 5 is concerned with sound propagation in other porous materials, and the recent notions of characteristic dimensions, which describe thermal exchanges and the viscous forces at high frequencies, are introduced. In Chapter 6, the case of porous media having an elastic frame is considered in the context of Biot theory, where new topics described in Chapter 5 have been included.

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## APPLIED POLYMER SCIENCE

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**Springer Nature** This companion volume to "Fundamental Polymer Science" (Gedde and Hedenqvist, 2019) offers detailed insights from leading practitioners into experimental methods, simulation and modelling, mechanical and transport properties, processing, and sustainability issues. Separate chapters are devoted to thermal analysis, microscopy, spectroscopy, scattering methods, and chromatography. Special problems and pitfalls related to the study of polymers are addressed. Careful editing for consistency and cross-referencing among the chapters, high-quality graphics, worked-out examples, and numerous references to the specialist literature make "Applied Polymer Science" an essential reference for advanced students and practicing chemists, physicists, and engineers who want to solve problems with the use of polymeric materials.

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## INTELLIGENT COMPUTING TECHNIQUES FOR SMART ENERGY SYSTEMS

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## PROCEEDINGS OF ICTSES 2018

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**Springer Nature** The book compiles the research works related to smart solutions concept in context to smart energy systems, maintaining electrical grid discipline and resiliency, computational collective intelligence consisted of interaction between smart devices, smart environments and smart interactions, as well as information technology support for such areas. It includes high-quality papers presented in the International Conference on Intelligent Computing Techniques for Smart Energy Systems organized by Manipal University Jaipur. This book will motivate scholars to work in these areas. The book also prophesies their approach to be used for the business and the humanitarian technology development as research proposal to various government organizations for funding approval.

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## COMPACT HEAT EXCHANGERS

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## SELECTION, DESIGN AND OPERATION

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**Elsevier** This book presents the ideas and industrial concepts in compact heat exchanger technology that have been developed in the last 10 years or so. Historically, the development and application of compact heat exchangers and their surfaces has taken place in a piecemeal fashion in a number of rather unrelated areas, principally those of the automotive and prime mover, aerospace, cryogenic and refrigeration sectors. Much detailed technology, familiar in one sector, progressed only slowly over the boundary into another sector. This compartmentalisation was a feature both of the user industries themselves, and also of the supplier, or manufacturing industries. These barriers are now breaking down, with valuable cross-fertilisation taking place. One of the industrial sectors that is waking up to the challenges of compact heat exchangers is that broadly defined as the process sector. If there is a bias in the book, it is towards this sector. Here, in many cases, the technical challenges are severe, since high pressures and temperatures are often involved, and working fluids can be corrosive, reactive or toxic. The opportunities, however, are correspondingly high, since compacts can offer a combination of lower capital or installed cost, lower temperature differences (and hence running costs), and lower inventory. In some cases they give the opportunity for a radical re-think of the process design, by the introduction of process intensification (PI) concepts such as combining process elements in one unit. An example of this is reaction and heat exchange, which offers, among other advantages, significantly lower by-product production. To stimulate future research, the author includes coverage of hitherto neglected approaches, such as that of the Second Law (of Thermodynamics), pioneered by Bejan and co-workers. The justification for this is that there is increasing interest in life-cycle and sustainable approaches to industrial activity as a whole, often involving exergy (Second Law) analysis. Heat exchangers, being fundamental components of energy and process systems, are both savers and spenders of exergy, according to interpretation.

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## MODERN DIAGNOSTIC X-RAY SOURCES

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## TECHNOLOGY, MANUFACTURING, RELIABILITY

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**CRC Press** Now fully updated, the second edition of Modern Diagnostic X-Ray Sources: Technology, Manufacturing, Reliability gives an up-to-date summary of X-ray source technology and design for applications in modern diagnostic medical imaging. It lays a sound groundwork for education and advanced training in the physics of X-ray production, X-ray interactions with matter, and imaging modalities and assesses their prospects. The book begins with a comprehensive and easy-to-read historical overview of X-ray tube and generator development, including key achievements leading up to the current technological and economic state of the field. The book covers the physics of X-ray generation, including the process of constructing X-ray source devices. The stand-alone chapters can be read in order or in selections. They take you inside diagnostic X-ray tubes, illustrating their design, functions, metrics for validation, and interfaces. The detailed descriptions enable objective comparison and benchmarking. This detailed presentation of X-ray tube creation and functions enables you to understand how to optimize tube efficiency, particularly with consideration for economics and environmental

care. It also simplifies faultfinding. Along with covering the past and current state of the field, the book assesses the future regarding developing new X-ray sources that can enhance performance and yield greater benefits to the scientific community and to the public. After heading international R&D, marketing and advanced development for X-ray sources with Philips, and working in the X-ray industry for more than four decades, Rolf Behling retired in 2020 and is now the owner of the consulting firm XtraininX, Germany. He holds numerous patents and is continuously publishing, consulting and training.

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## MULTIPHYSICS MODELLING AND SIMULATION FOR SYSTEMS DESIGN AND MONITORING

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### PROCEEDINGS OF THE MULTIPHYSICS MODELLING AND SIMULATION FOR SYSTEMS DESIGN CONFERENCE, MMSSD 2014, 17-19 DECEMBER, SOUSSE, TUNISIA

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**Springer** This book reports on the state of the art in the field of multiphysics systems. It consists of accurately reviewed contributions to the MMSSD'2014 conference, which was held from December 17 to 19, 2014 in Hammamet, Tunisia. The different chapters, covering new theories, methods and a number of case studies, provide readers with an up-to-date picture of multiphysics modeling and simulation. They highlight the role played by high-performance computing and newly available software in promoting the study of multiphysics coupling effects, and show how these technologies can be practically implemented to bring about significant improvements in the field of design, control and monitoring of machines. In addition to providing a detailed description of the methods and their applications, the book also identifies new research issues, challenges and opportunities, thus providing researchers and practitioners with both technical information to support their daily work and a new source of inspiration for their future research.

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## ENGINEERING DIELECTRICS

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### VOLUME 1: CORONA MEASUREMENT AND INTERPRETATION - STP 669

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ASTM International

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## MULTI-SCALE MODELING AND CHARACTERIZATION OF INFRASTRUCTURE MATERIALS

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### PROCEEDINGS OF THE INTERNATIONAL RILEM SYMPOSIUM STOCKHOLM, JUNE 2013

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**Springer Science & Business Media** The micro- and nano-modification of infrastructure materials and the associated multi-scale characterization and simulation has the potential to open up whole new uses and classes of materials, with wide-ranging implications for society. The use of multi-scale characterization and simulation brings the ability to target changes at the very small scale that predictably effect the bulk behavior of the material and thus allowing for the optimization of material behavior and performance. The International RILEM Symposium on Multi-Scale Modeling and Characterization of Infrastructure Materials (Stockholm, June 10-12, 2013) brought together key researchers from around the world to present their findings and ongoing research in this field in a focused environment with extended discussion times. From asphalt to concrete, from chemistry to mechanics, from nano- to macro-scale: the collection of topics covered by the Symposium represents the width and depth of the currently ongoing efforts of developing more sustainable infrastructure materials. Researchers, practitioners, undergraduates and graduate students engaged in infrastructure materials or multi-scale characterization and modeling efforts can use this book as a comprehensive reference, to learn about the currently ongoing research efforts in this field or as an inspiration for new research ideas to enhance the long-term performance of infrastructure materials from a fundamental perspective. The Symposium was held under the auspices of the RILEM Technical Committee on Nanotechnology-Based Bituminous Materials 231-NBM and the Transport Research Board (TRB) Technical Committee on Characteristics of Asphalt Materials AFK20.

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## HANDBOOK OF COIL WINDING

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### TECHNOLOGIES FOR EFFICIENT ELECTRICAL WOUND PRODUCTS AND THEIR AUTOMATED PRODUCTION

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**Springer** This book presents the current coil winding methods, their associated technologies and the associated automation techniques. From the introduction as a forming joining process, over the physical properties of coils, the semifinished products (wire, coil body, insulation) are introduced. In the process chain, different winding methods are used for magnet wire winding. Finally, the automation of these processes is described.

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## COMPACT HEAT EXCHANGERS

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### SELECTION, APPLICATION, DESIGN AND EVALUATION

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**Springer** This book describes the fundamentals and applications of compact heat exchangers in energy generation. The text focuses on their efficiency impacts on power systems, particularly emphasizing alternative energy sources such as Concentrated Solar Power and nuclear plants. The various types of compact heat exchanger surfaces and designs are given thorough consideration before the author turns his attention to describing how these compact heat exchangers can be applied to innovative plant designs, and how to conduct operational and safety analyses to optimize thermal efficiency. The book is written at an undergraduate level, but will be useful to practicing engineers and scientists as well.

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## SCIENTIFIC COMPUTING IN ELECTRICAL ENGINEERING SCIE 2010

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**Springer Science & Business Media** Selected from papers presented at the 8th Scientific Computation in Electrical Engineering conference in Toulouse in 2010, the contributions to this volume cover every angle of numerically modelling electronic and electrical systems, including computational electromagnetics, circuit theory and simulation and device modelling. On computational electromagnetics, the chapters examine cutting-edge material ranging from low-frequency electrical machine modelling problems to issues in high-frequency scattering. Regarding circuit theory and simulation, the book details the most advanced techniques for modelling networks with many thousands of components. Modelling devices at microscopic levels is covered by a number of fundamental mathematical physics papers, while numerous papers on model order reduction help engineers and systems designers to bring their modelling of industrial-scale systems within the reach of present-day computational power. Complementing these more specific papers, the volume also contains a selection of mathematical methods which can be used in any application domain.

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## LONG-TERM RELIABILITY OF NANOMETER VLSI SYSTEMS

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### MODELING, ANALYSIS AND OPTIMIZATION

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**Springer Nature** This book provides readers with a detailed reference regarding two of the most important long-term reliability and aging effects on nanometer integrated systems, electromigrations (EM) for interconnect and biased temperature instability (BTI) for CMOS devices. The authors discuss in detail recent developments in the modeling, analysis and optimization of the reliability effects from EM and BTI induced failures at the circuit, architecture and system levels of abstraction. Readers will benefit from a focus on topics such as recently developed, physics-based EM modeling, EM modeling for multi-segment wires, new EM-aware power grid analysis, and system level EM-induced reliability optimization and management techniques. Reviews classic Electromigration (EM) models, as well as existing EM failure models and discusses the limitations of those models; Introduces a dynamic EM model to address transient stress evolution, in which wires are stressed under time-varying current flows, and the EM recovery effects. Also includes new, parameterized equivalent DC current based EM models to address the recovery and transient effects; Presents a cross-layer approach to transistor aging modeling, analysis and mitigation, spanning multiple abstraction levels; Equips readers for EM-induced dynamic reliability management and energy or lifetime optimization techniques, for many-core dark silicon microprocessors, embedded systems, lower power many-core processors and datacenters.

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## ACTIVATED SLUDGE MODELS

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**IWA Publishing** This book has been produced to give a total overview of the Activated Sludge Model (ASM) family at the start of 2000 and to give the reader easy access to the different models in their original versions. It thus presents ASM1, ASM2, ASM2d and ASM3 together for the first time. Modelling of activated sludge processes has become a common part of the design and operation of wastewater treatment plants. Today models are being used in design, control, teaching and research. Contents ASM3: Introduction, Comparison of ASM1 and ASM3, ASM3: Definition of compounds in the model, ASM3: Definition of processes in the Model, ASM3: Stoichiometry, ASM3: Kinetics, Limitations of ASM3, Aspects of application of ASM3, ASM3C: A Carbon based model, Conclusion ASM 2d: Introduction, Conceptual Approach, ASM 2d, Typical Wastewater Characteristics and Kinetic and Stoichiometric Constants, Limitations, Conclusion ASM 2: Introduction, ASM 2, Typical Wastewater Characteristics and Kinetic and Stoichiometric Constants, Wastewater Characterization for Activated Sludge Processes, Calibration of the ASM 2, Model Limitations, Conclusion, Bibliography ASM 1: Introduction, Method of Model Presentation, Model Incorporating Carbon Oxidation Nitrification and Denitrification, Characterization of Wastewater and Estimation of Parameter Values, Typical Parameter Ranges, Default Values, and Effects of Environmental Factors, Assumptions, Restrictions and Constraints, Implementation of the Activated Sludge Model Scientific and Technical Report No.9

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## THERMO-HYDRO-MECHANICAL-CHEMICAL PROCESSES IN FRACTURED POROUS MEDIA: MODELLING AND BENCHMARKING

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### BENCHMARKING INITIATIVES

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**Springer** This book presents a new suite of benchmarks for and examples of porous media mechanics collected over the last two years. It continues the assembly of benchmarks and examples for porous media mechanics published in 2014. The book covers various applications in the geosciences, geotechnics, geothermal energy, and geological waste deposition. The analysis of thermo-hydro-mechanical-chemical (THMC) processes is essential to many applications in environmental engineering, such as geological waste deposition, geothermal energy utilisation, carbon capture and storage, water resources management, hydrology, and even climate change. In order to assess the feasibility and safety of geotechnical applications, process-based modelling is the only tool that can effectively quantify future scenarios, a fact which also creates a huge burden of responsibility concerning the reliability of computational tools. The book shows that benchmarking offers a suitable methodology for verifying the quality of modelling tools based on best practices, and together with code comparison fosters community efforts. It also provides a brief introduction to the DECOVALEX, SeSBench and MOMAS initiatives. This benchmark book is part of the OpenGeoSys initiative – an open source project designed to share knowledge and experience in environmental analysis and scientific computation.