

Mathematical Modeling of Industrial Transport Processes

Editors

Peng Xu Zhonghua Wu Arun S. Mujumdar

Edition 2



Mathematical Modeling Of Transport Phenomena Processes

**Tanase Gh. Dobre, José G. Sanchez
Marcano**



Mathematical Modeling Of Transport Phenomena Processes:

Mathematical Modeling of Transport Phenomena Processes Jaroslav F. Stanislav, 1982 **Modelling in Transport Phenomena** İsmail Tosun, 2002

Modelling in Transport Phenomena A Conceptual Approach aims to show students how to translate the inventory rate equation into mathematical terms at both the macroscopic and microscopic levels. The emphasis is on obtaining the equation representing a physical phenomenon and its interpretation. The book begins with a discussion of basic concepts and their characteristics. It then explains the terms appearing in the inventory rate equation including rate of input and rate of output. The rate of generation in transport of mass, momentum and energy is also described. Subsequent chapters detail the application of inventory rate equations at the macroscopic and microscopic levels. This book is intended as an undergraduate textbook for an introductory Transport Phenomena course in the junior year. It can also be used in unit operations courses in conjunction with standard textbooks. Although it is written for students majoring in chemical engineering, it can also serve as a reference or supplementary text in environmental, mechanical, petroleum and civil engineering courses.

Modeling in Transport Phenomena İsmail Tosun, 2007-07-17

Modeling in Transport Phenomena Second Edition presents and clearly explains with example problems the basic concepts and their applications to fluid flow, heat transfer, mass transfer, chemical reaction engineering and thermodynamics. A balanced approach is presented between analysis and synthesis; students will understand how to use the solution in engineering analysis. Systematic derivations of the equations and the physical significance of each term are given in detail for students to easily understand and follow up the material. There is a strong incentive in science and engineering to understand why a phenomenon behaves the way it does. For this purpose, a complicated real life problem is transformed into a mathematically tractable problem while preserving the essential features of it. Such a process known as mathematical modeling requires understanding of the basic concepts. This book teaches students these basic concepts and shows the similarities between them. Answers to all problems are provided, allowing students to check their solutions. Emphasis is on how to get the model equation representing a physical phenomenon and not on exploiting various numerical techniques to solve mathematical equations. A balanced approach is presented between analysis and synthesis; students will understand how to use the solution in engineering analysis. Systematic derivations of the equations as well as the physical significance of each term are given in detail. Many more problems and examples are given than in the first edition; answers provided.

Mathematical Modeling of Food Processing Mohammed M. Farid, 2010-05-21

Written by international experts from industry, research centers and academia, **Mathematical Modeling of Food Processing** discusses the physical and mathematical analysis of transport phenomena associated with food processing. The models presented describe many of the important physical and biological transformations that occur in food during process.

Modelling in Transport Phenomena İsmail Tosun, 2002-08-15

Modelling in Transport Phenomena A Conceptual Approach aims to show students how to translate the inventory rate equation into mathematical terms at both the

macroscopic and microscopic levels The emphasis is on obtaining the equation representing a physical phenomenon and its interpretation The book begins with a discussion of basic concepts and their characteristics It then explains the terms appearing in the inventory rate equation including rate of input and rate of output The rate of generation in transport of mass momentum and energy is also described Subsequent chapters detail the application of inventory rate equations at the macroscopic and microscopic levels This book is intended as an undergraduate textbook for an introductory Transport Phenomena course in the junior year It can also be used in unit operations courses in conjunction with standard textbooks Although it is written for students majoring in chemical engineering it can also serve as a reference or supplementary text in environmental mechanical petroleum and civil engineering courses

Mathematical Simulation in Glass Technology

Dieter Krause, Horst Loch, 2012-12-06 This book entitled Mathematical Simulation in Glass Technology is one of a series reporting on research and development activities on products and processes conducted by the Schott Group The scientifically founded development of new products and technical processes has traditionally been of vital importance to Schott and has always been performed on a scale determined by the prospects for application of our special glasses Since the reconstruction of the Schott Glaswerke in Mainz the scale has increased enormously The range of expert knowledge required could never have been supplied by Schott alone It is also a tradition in our company to cultivate collaboration with customers universities and research institutes Publications in numerous technical journals which since 1969 we have edited to a regular schedule as Forschungsberichte research reports describe the results of these cooperations They contain up to date information on various topics for the expert but are not suited as survey material for those whose standpoint is more remote This is the point where we would like to place our series to stimulate the exchange of thoughts so that we can consider from different points of view the possibilities offered by those incredibly versatile materials glass and glass ceramics We would like to share the knowledge won through our research and development at Schott in cooperation with the users of our materials with scientists and engineers interested customers and friends and with the employees of our firm

Chemical Engineering

Tanase Gh. Dobre, José G. Sanchez Marcano, 2007-06-18 A description of the use of computer aided modeling and simulation in the development integration and optimization of industrial processes The two authors elucidate the entire procedure step by step from basic mathematical modeling to result interpretation and full scale process performance analysis They further demonstrate similitude comparisons of experimental results from different systems as a tool for broadening the applicability of the calculation methods Throughout the book adopts a very practical approach addressing actual problems and projects likely to be encountered by the reader as well as fundamentals and solution strategies for complex problems It is thus equally useful for student and professional engineers and chemists involved in industrial process and production plant design construction or upgrading

Modeling Multiphase Materials Processes Manabu Iguchi, Olusegun J. Ilegbusi, 2010-11-10

Modeling Multiphase Materials Processes Gas Liquid Systems describes the methodology and application of physical and

mathematical modeling to multi phase flow phenomena in materials processing The book focuses on systems involving gas liquid interaction the most prevalent in current metallurgical processes The performance characteristics of these processes are largely dependent on transport phenomena This volume covers the inherent characteristics that complicate the modeling of transport phenomena in such systems including complex multiphase structure intense turbulence opacity of fluid high temperature coupled heat and mass transfer chemical reactions in some cases and poor wettability of the reactor walls Also discussed are solutions based on experimental and numerical modeling of bubbling jet systems recent advances in the modeling of nanoscale multi phase phenomena and multiphase flows in micro scale and nano scale channels and reactors Modeling Multiphase Materials Processes Gas Liquid Systems will prove a valuable reference for researchers and engineers working in mathematical modeling and materials processing

Dynamic Modeling of Transport Process Systems C. A. Silebi, William E. Schiesser, 2012-12-02 This book presents a methodology for the development and computer implementation of dynamic models for transport process systems Rather than developing the general equations of transport phenomena it develops the equations required specifically for each new example application These equations are generally of two types ordinary differential equations ODEs and partial differential equations PDEs for which time is an independent variable The computer based methodology presented is general purpose and can be applied to most applications requiring the numerical integration of initial value ODEs PDEs A set of approximately two hundred applications of ODEs and PDEs developed by the authors are listed in Appendix 8

Applied Mathematical Modelling of Engineering Problems N.V. Hritonenko, Yuri P. Yatsenko, 2013-04-17 The subject of the book is the know how of applied mathematical modelling how to construct specific models and adjust them to a new engineering environment or more precise realistic assumptions how to analyze models for the purpose of investigating real life phenomena and how the models can extend our knowledge about a specific engineering process Two major sources of the book are the stock of classic models and the authors wide experience in the field The book provides a theoretical background to guide the development of practical models and their investigation It considers general modelling techniques explains basic underlying physical laws and shows how to transform them into a set of mathematical equations The emphasis is placed on common features of the modelling process in various applications as well as on complications and generalizations of models The book covers a variety of applications mechanical acoustical physical and electrical water transportation and contamination processes bioengineering and population control production systems and technical equipment renovation Mathematical tools include partial and ordinary differential equations difference and integral equations the calculus of variations optimal control bifurcation methods and related subjects

Advances in Food Process Engineering Research and Applications Stavros Yanniotis, Petros Taoukis, Nikolaos G. Stoforos, Vaio T. Karathanos, 2013-10-21 This is the second publication stemming from the International Congress on Engineering in Food the first being Food Engineering Interfaces based on the last ICEF10 The theme of ICEF 11 held in Athens Greece in May 2011 is

Food Process Engineering in a Changing World The conference explored the ways food engineering contributes to the solutions of vital problems in a world of increasing population and complexity that is under the severe constraints of limited resources of raw materials energy and environment The book comprised of 32 chapters features an interdisciplinary focus including food materials science engineering properties of foods advances in food process technology novel food processes functional foods food waste engineering food process design and economics modeling food safety and quality and innovation management

Advanced Materials Processing and Manufacturing Yogesh Jaluria, 2018-05-24 This book focuses on advanced processing of new and emerging materials and advanced manufacturing systems based on thermal transport and fluid flow It examines recent areas of considerable growth in new and emerging manufacturing techniques and materials such as fiber optics manufacture of electronic components polymeric and composite materials alloys microscale components and new devices and applications The book includes analysis mathematical modeling numerical simulation and experimental study of processes for prediction design and optimization It discusses the link between the characteristics of the final product and the basic transport mechanisms and provides a foundation for the study of a wide range of manufacturing processes Focuses on new and advanced methods of manufacturing and materials processing with traditional methods described in light of the new approaches Maximizes reader understanding of the fundamentals of how materials change what transport processes are involved and how these can be simulated and optimized concepts not covered elsewhere Introduces new materials and applications in manufacturing and summarizes traditional processing methods such as heat treatment extrusion casting injection molding and bonding to show how they have evolved and how they could be used for meeting the challenges that we face today

Modeling of Steelmaking Processes Dipak Mazumdar, James W. Evans, 2009-08-11 From the prediction of complex weather patterns to the design of swimsuits modeling has over the years quietly but steadily become an essential part of almost every field and industry and steelmaking is no exception Factors such as visual opacity high operating temperature and the relatively large size of industrial reactors often preclude direct experimental observation in steel manufacturing Therefore the industry is overwhelmingly dependent on modeling to quickly and cost effectively provide insight into analysis design optimization and control of processing However few if any books offer the adequate coverage of modeling Addresses Fundamental Principles of Physical and Mathematical Modeling in Steelmaking Processes Modeling of Steelmaking Processes meets that ever present demand and provides a solid knowledge base on which to build With content designed to serve professionals and students this book starts with an overview of steelmaking and develops into a focused description of underlying scientific fundamentals and applications This powerful learning tool Presents an overview of steelmaking the relevance of modeling and measurements the evolution of steelmaking and modern technology Discusses emerging issues such as environmental emissions recycling and product development and quality Reviews computational fluid dynamics CFD software Analyzes mechanistic AI based and macroscopic models to provide a holistic view of

steelmaking process modeling Provides useful questions and problems as well as a practice session on modeling to reinforce understanding Developed as a self tutorial this text explores thermodynamic principles analysis of metallurgical kinetics and transport phenomena and key numerical methods helping readers easily navigate a generally complex subject **National Research Program of the Water Resources Division, U.S. Geological Survey, Fiscal Year 1991** ,1991 *Process Modeling in Pyrometallurgical Engineering* Henrik Saxén,Marco A. Ramírez-Argáez,Alberto N. Conejo,Abhishek Dutta,2021-09-01 The Special Issue presents almost 40 papers on recent research in modeling of pyrometallurgical systems including physical models first principles models detailed CFD and DEM models as well as statistical models or models based on machine learning The models cover the whole production chain from raw materials processing through the reduction and conversion unit processes to ladle treatment casting and rolling The papers illustrate how models can be used for shedding light on complex and inaccessible processes characterized by high temperatures and hostile environment in order to improve process performance product quality or yield and to reduce the requirements of virgin raw materials and to suppress harmful emissions Computational Fluid Dynamics in Food Processing Da-Wen Sun,2018-10-26 Since many processes in the food industry involve fluid flow and heat and mass transfer Computational Fluid Dynamics CFD provides a powerful early stage simulation tool for gaining a qualitative and quantitative assessment of the performance of food processing allowing engineers to test concepts all the way through the development of a process or system Published in 2007 the first edition was the first book to address the use of CFD in food processing applications and its aims were to present a comprehensive review of CFD applications for the food industry and pinpoint the research and development trends in the development of the technology to provide the engineer and technologist working in research development and operations in the food industry with critical comprehensive and readily accessible information on the art and science of CFD and to serve as an essential reference source to undergraduate and postgraduate students and researchers in universities and research institutions This will continue to be the purpose of this second edition In the second edition in order to reflect the most recent research and development trends in the technology only a few original chapters are updated with the latest developments Therefore this new edition mostly contains new chapters covering the analysis and optimization of cold chain facilities simulation of thermal processing and modeling of heat exchangers and CFD applications in other food processes *Scaling Analysis in Modeling Transport and Reaction Processes* William B. Krantz,2007-06-30 This book is unique as the first effort to expound on the subject of systematic scaling analysis Not written for a specific discipline the book targets any reader interested in transport phenomena and reaction processes The book is logically divided into chapters on the use of systematic scaling analysis in fluid dynamics heat transfer mass transfer and reaction processes An integrating chapter is included that considers more complex problems involving combined transport phenomena Each chapter includes several problems that are explained in considerable detail These are followed by several worked examples for which the general outline for the scaling is given Each

chapter also includes many practice problems This book is based on recognizing the value of systematic scaling analysis as a pedagogical method for teaching transport and reaction processes and as a research tool for developing and solving models and in designing experiments Thus the book can serve as both a textbook and a reference book Numerical Simulations of Physical and Engineering Processes Jan Awrejcewicz, 2011-09-26 Numerical Simulations of Physical and Engineering Process is an edited book divided into two parts Part I devoted to Physical Processes contains 14 chapters whereas Part II titled Engineering Processes has 13 contributions The book handles the recent research devoted to numerical simulations of physical and engineering systems It can be treated as a bridge linking various numerical approaches of two closely inter related branches of science i e physics and engineering Since the numerical simulations play a key role in both theoretical and application oriented research professional reference books are highly needed by pure research scientists applied mathematicians engineers as well post graduate students In other words it is expected that the book will serve as an effective tool in training the mentioned groups of researchers and beyond **10th International Symposium on Process Systems Engineering** Rita Maria de Brito Alves, Cláudio Augusto Oller do Nascimento, Evaristo Chalbaud Biscaia (Jr), 2009 The 10th International Symposium on Process Systems Engineering PSE 09 will be held in Salvador Bahia Brazil on August 16 20 2009 The special focus of PSE 2009 is Sustainability Energy and Engineering PSE 2009 is the tenth in the triennial series of international symposia on process systems engineering initiated in 1982 The meeting is brings together the worldwide PSE community of researchers and practitioners who are involved in the creation and application of computing based methodologies for planning design operation control and maintenance of chemical and petrochemical process industries PSE 09 will look at how the PSE methods and tools can support sustainable resource systems and emerging technologies in the areas of green engineering environmentally conscious design of industrial processes PSE methods and tools support sustainable resource systems emerging technologies in the areas of green engineering environmentally conscious design of industrial processes *10th International Symposium on Process Systems Engineering - PSE2009* Rita Maria de Brito Alves, Claudio Augusto Oller do Nascimento, Evaristo Chalbaud Biscaia, 2009-08-05 This book contains the proceedings of the 10e of a series of international symposia on process systems engineering PSE initiated in 1982 The special focus of PSE09 is how PSE methods can support sustainable resource systems and emerging technologies in the areas of green engineering Contains fully searchable CD of all printed contributions Focus on sustainable green engineering 9 Plenary papers 21 Keynote lectures by leading experts in the field

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