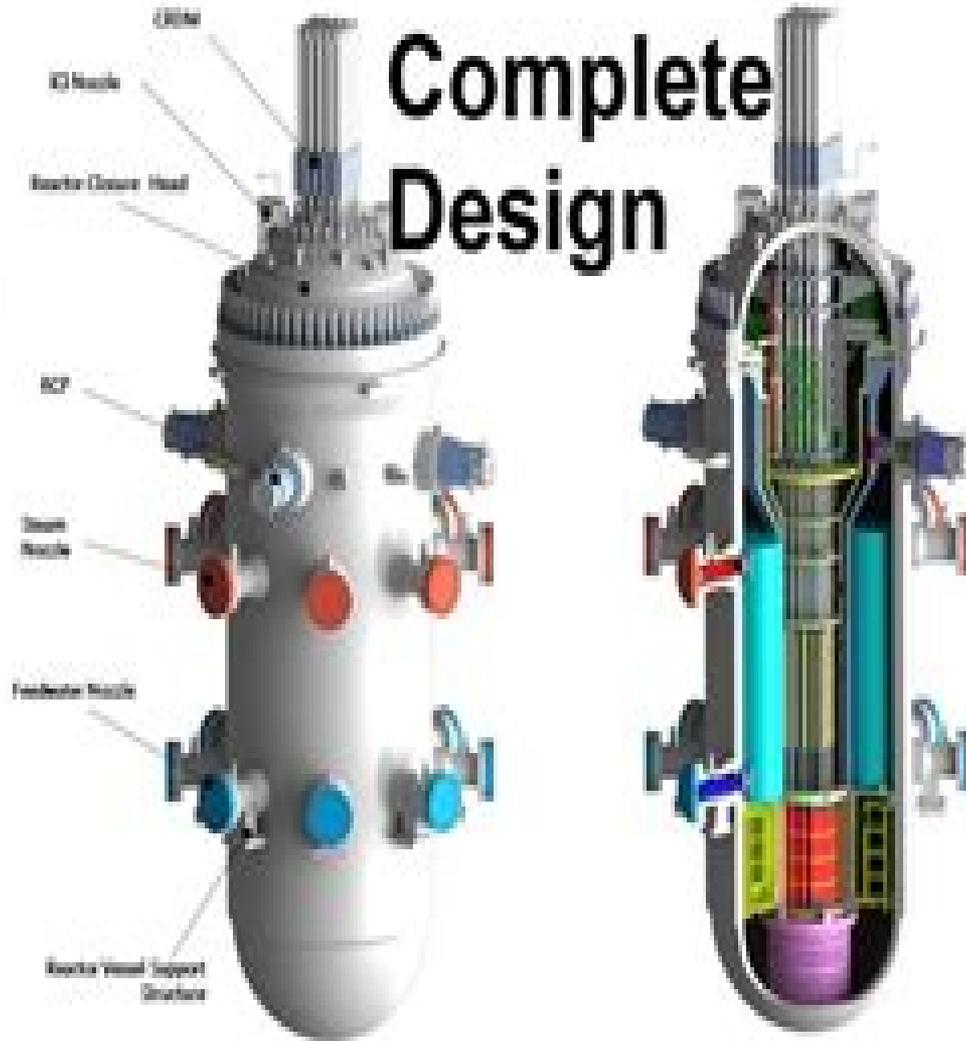


Chemical Reactors Design



Chemical Reactor Design

Charles G. Hill, Thatcher W. Root



Chemical Reactor Design:

Chemical Reactor Design and Operation K. Roel Westerterp, W. P. M. Van Swaaij, A. A. C. M. Beenackers, 1991-01-08
Chemical Reactor Design and Operation K R Westerterp W P M van Swaaij and A A C M Beenackers Chemical Reaction Engineering Laboratories Twente University of Technology Enschede The Netherlands This is a comprehensive handbook on the design and operation of chemical reactors which are vital elements in every manufacturing process The book offers an introduction to the modern literature and covers in depth the relevant theory of chemical reactors The theory is illustrated by numerous worked examples typical to chemical reaction engineering practice in research development design and operation The examples range from fine chemicals to large scale production and from water purification to metallurgical processes commencing with simple homogenous model reactors and then moving to the complicated multi phase heterogeneous reactors met with in reality All the examples are based on the industrial experience of the authors Much effort is dedicated to the behaviour of reactors in practice and to the capacity yield and selectivity of the reactor The book is thoroughly indexed and cross referenced This edition will be particularly useful to undergraduate and graduate students studying chemical reactors

Contents Fundamentals of chemical reactor calculations Model reactors single reactions isothermal single phase reactor calculations Model reactors multiple reactions isothermal single phase reactors Residence time distribution and mixing in continuous flow reactors Influence of micromixing on chemical reactions The role of the heat effect in model reactors Multi phase reactors single reactions Multi phase reactors multiple reactions Heat effects in multi phase reactors

The authors The authors have accumulated a long experience both in fine chemicals and in the petrochemicals industry in Europe as well as abroad Currently they are jointly responsible for the research work in chemical reaction engineering and process development at Twente University Several new reactor types and new processes have been developed at their institute and present research interests include gasification fluidization and gas liquid reactors three phase reactors high pressure technology in chemical reaction engineering thermal behaviour of heterogeneous reactors and computer design and economic evaluation of reaction units and chemical plants

Chemical Reactor Design and Technology Hugo de Lasa, 2012-12-06 Today's frustrations and anxieties resulting from two energy crises in only one decade show us the problems and fragility of a world built on high energy consumption accustomed to the use of cheap non renewable energy and to the acceptance of existing imbalances between the resources and demands of countries Despite all these stressing factors our world is still hesitating about the urgency of undertaking new and decisive research that could stabilize our future Could this trend change in the near future In our view two different scenarios are possible A renewed energy tension could take place with an unpredictable timing mostly related to political and economic factors This could bring again scientists and technologists to a new state of shock and awaken our talents A second interesting and beneficial scenario could result from the positive influence of a new generation of researchers that with or without immediate crisis acting both in industry and

academia will face the challenge of developing technologies and processes to pave the way to a less vulnerable society Because Chemical Reactor Design and Technology activities are at the heart of these required new technologies the timeliness of the NATO Advanced Study Institute at the University of Western Ontario London was very appropriate

Handbook of Chemical Reactor Design, Optimization, and Scaleup Bruce Nauman, 2001-10-21 THE MODERN GUIDE TO CHEMICAL REACTORS In the best professional sourcebook on chemical reactors ever written world class expert Bruce Nauman provides too information and hands on expertise to make important engineering tasks and decisions easier Clearly and in depth CHEMICAL REACTOR DESIGN OPTIMIZATION AND SCALEUP provides Up to date information to help chemical and process engineers save time money and materials Decision aiding coverage of every aspect of selection design factors and parameters optimization and scaleup A convenient source of explained formulas principles and data Numerous detailed examples Worked mathematical solutions The latest information on reactor design for biochemicals and polymers as well as other newer and standard substances DESIGN AND SPECIFY CHEMICAL REACTORS CONFIDENTLY WITH STATE OF THE ART SKILLS Reactor Design for Chemical Engineers J. M. Winterbottom, Michael King, 1999-02-05 Intended primarily for undergraduate chemical engineering students this book also includes material which bridges the gap between undergraduate and graduate requirements The introduction contains a listing of the principal types of reactors employed in the chemical industry with diagrams and examples of their use There is then a brief exploration of the concepts employed in later sections for modelling and sizing reactors followed by basic information on stoichiometry and thermodynamics and the kinetics of homogeneous and catalyzed reactions Subsequent chapters are devoted to reactor sizing and modelling in some simple situations and more detailed coverage of the design and operation of the principal reactor types **An Introduction to Chemical Engineering Kinetics & Reactor Design** Charles G. Hill, *Chemical Reactor Design* Juan A. Conesa, 2019-12-04 A guide to the technical and calculation problems of chemical reactor analysis scale up catalytic and biochemical reactor design Chemical Reactor Design offers a guide to the myriad aspects of reactor design including the use of numerical methods for solving engineering problems The author a noted expert on the topic explores the use of transfer functions to study residence time distributions convolution and deconvolution curves for reactor characterization forced unsteady state operation scale up of chemical reactors industrial catalysis design of multiphase reactors biochemical reactors design as well as the design of multiphase gas liquid solid reactors Chemical Reactor Design contains several examples of calculations and it gives special emphasis on the numerical solutions of differential equations by using the finite differences approximation which offers the background information for understanding other more complex methods The book is designed for the chemical engineering academic community and includes case studies on mathematical modeling by using of MatLab software This important book Offers an up to date insight into the most important developments in the field of chemical catalytic and biochemical reactor engineering Contains new aspects such as the use of numerical methods for

solving engineering problems transfer functions to study residence time distributions and more Includes illustrative case studies on MatLab approach with emphasis on numerical solution of differential equations using the finite differences approximation Written for chemical engineers mechanical engineers chemists in industry complex chemists bioengineers and process engineers Chemical Reactor Design addresses the technical and calculation problems of chemical reactor analysis scale up as well as catalytic and biochemical reactor design

Problem Solving in Chemical Reactor Design Juan A. Conesa, 2024-12-23 Extensive workbook with more than 200 up to date solved problems on advanced chemical reactors for deeper understanding of chemical reactor design Problem Solving in Chemical Reactor Design provides in depth coverage of more than 200 solved complex reactor design problems extracted from core chemical engineering subject areas The problems in this book cover the design of non ideal catalytic multiphase heterogeneous and biochemical reactors rather than focusing on basic Chemical Reactor Engineering concepts Each complex problem is solved using simple procedures and mathematical tools enabling readers to better understand the correct procedure for solving problems and solve them faster more conveniently and more accurately This book is inspired by more than two decades of the author s teaching experience in chemical reactor engineering Accompanying electronic materials include spreadsheets and easily understandable Matlab programs which can both be downloaded from the Wiley website Some of the topics covered in Problem Solving in Chemical Reactor Design include Optimization operation and complexities of reactor design in the face of non idealities such as mixing issues and residence time distributions Utilization of the tanks in series model dispersion model and intricate combinations of ideal reactors to elucidate the impact on conversion rates Signal processing within the domain of chemical reactor engineering specifically focusing on convolution and deconvolution methodologies Reaction kinetics diffusion dynamics and catalyst efficiency in catalytic reactor design and design of gas catalytic and gas liquid solid catalyst systems in multiphase reactors Problem Solving in Chemical Reactor Design is an excellent learning resource for students and professionals in the fields of chemical engineering pharmaceuticals biotechnology and fine chemistry

Introduction to Chemical Engineering Kinetics and Reactor Design Charles G. Hill, Thatcher W. Root, 2014-05-27 The Second Edition features new problems that engage readers in contemporary reactor design Highly praised by instructors students and chemical engineers Introduction to Chemical Engineering Kinetics Reactor Design has been extensively revised and updated in this Second Edition The text continues to offer a solid background in chemical reaction kinetics as well as in material and energy balances preparing readers with the foundation necessary for success in the design of chemical reactors Moreover it reflects not only the basic engineering science but also the mathematical tools used by today s engineers to solve problems associated with the design of chemical reactors Introduction to Chemical Engineering Kinetics Reactor Design enables readers to progressively build their knowledge and skills by applying the laws of conservation of mass and energy to increasingly more difficult challenges in reactor design The first one third of the text emphasizes general principles of

chemical reaction kinetics setting the stage for the subsequent treatment of reactors intended to carry out homogeneous reactions heterogeneous catalytic reactions and biochemical transformations Topics include Thermodynamics of chemical reactions Determination of reaction rate expressions Elements of heterogeneous catalysis Basic concepts in reactor design and ideal reactor models Temperature and energy effects in chemical reactors Basic and applied aspects of biochemical transformations and bioreactors About 70% of the problems in this Second Edition are new These problems frequently based on articles culled from the research literature help readers develop a solid understanding of the material Many of these new problems also offer readers opportunities to use current software applications such as Mathcad and MATLAB By enabling readers to progressively build and apply their knowledge the Second Edition of Introduction to Chemical Engineering Kinetics Reactor Design remains a premier text for students in chemical engineering and a valuable resource for practicing engineers

Reaction Kinetics and Reactor Design, Second Edition John B. Butt, 2000-01-03 This text combines a description of the origin and use of fundamental chemical kinetics through an assessment of realistic reactor problems with an expanded discussion of kinetics and its relation to chemical thermodynamics It provides exercises open ended situations drawing on creative thinking and worked out examples A solutions manual is also available to instructors

Chemical Reactor Design E. B. Nauman, 1987-02-13 Combines the concepts of chemical kinetics as taught in physical chemistry with those of transport phenomena taught in engineering courses fluid flow heat transfer and mass transfer with heavy emphasis on numerical methods and computation The reader is taught to use and understand modern computer aided design techniques CAD with emphasis on design optimization Includes sections on biochemical engineering electronic materials processing and multiphase reactions and provides a chapter on polymer reaction engineering

Electrochemical Reactor Design David J. Pickett, 1977

The Optimal Design of Chemical Reactors Rutherford Aris, 2016-06-03 Mathematics in Science and Engineering Volume 3 The Optimal Design of Chemical Reactors A Study in Dynamic Programming covers some of the significant problems of chemical reactor engineering from a unified point of view This book discusses the principle of optimality in its general bearing on chemical processes Organized into nine chapters this volume begins with an overview of the whole range of optimal problems in chemical reactor design This text then provides the fundamental equations for reactions and reactors Other chapters consider the objective function needed to define a realistic optimal problem and explain separately the main types of chemical reactors and their associated problems This book discusses as well the three problems with a stochastic element The final chapter deals with the optimal operation of existing reactors that may be regarded as partial designs in which only some of the variables can be optimally chosen This book is a valuable resource for chemical engineers

Chemical Reactor Design and Control William L. Luyben, 2007-07-16 Chemical Reactor Design and Control uses process simulators like Matlab Aspen Plus and Aspen Dynamics to study the design of chemical reactors and their dynamic control There are numerous books that focus on steady state reactor design There are no books that

consider practical control systems for real industrial reactors This unique reference addresses the simultaneous design and control of chemical reactors After a discussion of reactor basics it Covers three types of classical reactors continuous stirred tank CSTR batch and tubular plug flow Emphasizes temperature control and the critical impact of steady state design on the dynamics and stability of reactors Covers chemical reactors and control problems in a plantwide environment Incorporates numerous tables and shows step by step calculations with equations Discusses how to use process simulators to address diverse issues and types of operations This is a practical reference for chemical engineering professionals in the process industries professionals who work with chemical reactors and students in undergraduate and graduate reactor design process control and plant design courses

Chemical Reactor Design Peter Harriott,2002-11-06 Featuring case studies and worked examples that illustrate key concepts in the text this book contains guidelines for scaleup of laboratory and pilot plant results methods to derive the correct reaction order activation energy or kinetic model from laboratory tests and theories correlations and practical examples for 2 and 3 phase reaction systems including bubble columns slurry reactions trickle bed reactors and fluidized beds A comprehensive reference the book offers strategies to analyze and interpret kinetic data for homogeneous and heterogeneous reactions practical design procedures rate equations and analytical models for improved reactor performance

Chemical Reactor Design in Practice L. M. Rose,1981-01-01 When this book first appeared in 1981 a reviewer writing in *Chemistry in Britain* commented I enjoyed reading this book and would recommend it to teachers of the subject The book is now available in paperback at less than half the price of the hardcover edition thus bringing it within the reach of students Intended as an extension to the normal introductory reactor engineering course the text is based on a lecture course in practical reactor design and aims to teach students how to design and specify reactors or to know the advanced techniques by which this is done Reactor design is concerned with many aspects Hence the text touches on a multitude of disciplines statistics economics optimization control and safety as well as those subjects traditionally thought of as reactor design The book includes a set of interactive computer based exercises which enable the student to discover for himself the major characteristics of the various reactor types

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Principles of Chemical Reactor Analysis and Design Uzi Mann,2009-03-30 An innovative approach that helps students move from the classroom to professional practice This text offers a comprehensive unified methodology to analyze and design chemical reactors using a reaction based design formulation rather than the common species based design formulation The book s acclaimed approach addresses the weaknesses of current pedagogy by giving readers the knowledge and tools needed to address the technical challenges they will face in practice *Principles of Chemical Reactor Analysis and Design* prepares readers to design and operate real chemical reactors and to troubleshoot any technical problems that may arise The text s unified methodology is applicable to

both single and multiple chemical reactions to all reactor configurations and to all forms of rate expression This text also Describes reactor operations in terms of dimensionless design equations generating dimensionless operating curves that depict the progress of individual chemical reactions the composition of species and the temperature Combines all parameters that affect heat transfer into a single dimensionless number that can be estimated a priori Accounts for all variations in the heat capacity of the reacting fluid Develops a complete framework for economic based optimization of reactor operations Problems at the end of each chapter are categorized by their level of difficulty from one to four giving readers the opportunity to test and develop their skills Graduate and advanced undergraduate chemical engineering students will find that this text s unified approach better prepares them for professional practice by teaching them the actual skills needed to design and analyze chemical reactors

Chemical Reactors Pierre Trambouze, Jean-Paul Euzen, 2004 This in depth revision provides a summary of current knowledge updated based on the most recent literature in the field The reader will find recommendations on the choice of correlations to apply depending on the case and useful references to the original documents on industrial processes This practical user s guide is designed for engineers in industries involved with the problems of chemical transformations and for professors and students of process engineering Whether the reader is working in a design department an engineering firm or an R D department or is managing production plants he will find material here that is directly applicable to the solution of his problems Contents 1 Definitions and fundamental concepts 2 Single phase reactors 3 General characteristics of reactors with two fluid phases 4 Experimental data and correlations for gas liquid reactors 5 Experimental data and correlations for liquid liquid reactors 6 General characteristics of heterogeneous catalytic reactors 7 Reactors employing a fluid phase and a catalytic solid phase fixed bed moving bed fluidized bed 8 Three phase reactors gas liquid and catalytic solid 9 Case studies 10 Multifunctional reactors and future developments General nomenclature Index

Chemical Reactor Analysis and Applications for the Practicing Engineer Louis Theodore, 2012-09-11 This books format follows an applications oriented text and serves as a training tool for individuals in education and industry involved directly or indirectly with chemical reactors It addresses both technical and calculational problems in this field While this text can be complimented with texts on chemical kinetics and or reactor design it also stands alone as a self teaching aid The first part serves as an introduction to the subject title and contains chapters dealing with history process variables basic operations kinetic principles and conversion variables The second part of the book addresses traditional reactor analysis chapter topics include batch CSTRs tubular flow reactors plus a comparison of these classes of reactors Part 3 keys on reactor applications that include non ideal reactors thermal effects interpretation of kinetic data and reactor design The book concludes with other reactor topics chapter titles include catalysis catalytic reactors other reactions and reactors and ABET related topics An extensive Appendix is also included

Chemical Reactor Analysis and Design Gilbert F. Froment, Kenneth B. Bischoff, 1979 This is the Second Edition of the standard text on chemical reaction engineering

beginning with basic definitions and fundamental principles and continuing all the way to practical applications emphasizing real world aspects of industrial practice The two main sections cover applied or engineering kinetics reactor analysis and design Includes updated coverage of computer modeling methods and many new worked examples Most of the examples use real kinetic data from processes of industrial importance Chemical Reactors Pierre Trambouze, Hugo van Landeghem, Jean-Pierre Wauquier, 1988

Whispering the Techniques of Language: An Mental Journey through **Chemical Reactor Design**

In a digitally-driven world where screens reign great and immediate connection drowns out the subtleties of language, the profound strategies and emotional nuances hidden within phrases frequently go unheard. Yet, located within the pages of **Chemical Reactor Design** a captivating fictional treasure pulsating with fresh emotions, lies an extraordinary journey waiting to be undertaken. Published by a skilled wordsmith, that charming opus encourages visitors on an introspective trip, delicately unraveling the veiled truths and profound impact resonating within the very cloth of each and every word. Within the psychological depths of this touching review, we will embark upon a sincere exploration of the book is key themes, dissect their interesting publishing fashion, and yield to the powerful resonance it evokes deep within the recesses of readers hearts.

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