

**CAMBRIDGE SERIES IN CHEMICAL ENGINEERING**

# **Parametric Sensitivity in Chemical Systems**



**A. Varma, M. Morbidelli, and H. Wu**

# Parametric Sensitivity In Chemical Systems Cambridge Series In Chemical Engineering

**Alan L Buchman**



### **Parametric Sensitivity In Chemical Systems Cambridge Series In Chemical Engineering:**

Parametric Sensitivity in Chemical Systems Arvind Varma, Massimo Morbidelli, Hua Wu, 2005-09-15 The behavior of a chemical system is affected by many physicochemical parameters The sensitivity of the system's behavior to changes in parameters is known as parametric sensitivity When a system operates in a parametrically sensitive region its performance becomes unreliable and changes sharply with small variations in parameters Thus it is of great value to those who design and operate chemical systems to be able to analyze and predict their sensitivity behavior This book is the first to provide a thorough treatment of the concept of parametric sensitivity and the mathematical tool it generated sensitivity analysis The emphasis is on applications to real situations The book begins with definitions of various sensitivity indices and describes the numerical techniques most commonly used for their evaluation Extensively illustrated chapters discuss sensitivity analysis in a variety of chemical reactors batch tubular continuous flow fixed bed and in combustion systems mechanistic studies air pollution and metabolic processes Seniors and graduate students in various fields of science and engineering researchers and practicing engineers will welcome this valuable resource

### **Numerical Methods with Chemical Engineering**

**Applications** Kevin D. Dorfman, Prodromos Daoutidis, 2017-01-11 Designed primarily for undergraduates but also graduates and practitioners this textbook integrates numerical methods and programming with applications from chemical engineering Combining mathematical rigor with an informal writing style it thoroughly introduces the theory underlying numerical methods its translation into MATLAB programs and its use for solving realistic problems Specific topics covered include accuracy convergence and numerical stability as well as stiffness and ill conditioning MATLAB codes are developed from scratch and their implementation is explained in detail all while assuming limited programming knowledge All scripts employed are downloadable and built in MATLAB functions are discussed and contextualised Numerous examples and homework problems from simple questions to extended case studies accompany the text allowing students to develop a deep appreciation for the range of real chemical engineering problems that can be solved using numerical methods This is the ideal resource for a single semester course on numerical methods as well as other chemical engineering courses taught over multiple semesters

Chemical Engineering Morton Denn, 2011-09-30 Chemical engineering is the field of applied science that employs physical chemical and biological rate processes for the betterment of humanity This opening sentence of Chapter 1 has been the underlying paradigm of chemical engineering Chemical Engineering An Introduction is designed to enable the student to explore the activities in which a modern chemical engineer is involved by focusing on mass and energy balances in liquid phase processes Problems explored include the design of a feedback level controller membrane separation hemodialysis optimal design of a process with chemical reaction and separation washout in a bioreactor kinetic and mass transfer limits in a two phase reactor and the use of the membrane reactor to overcome equilibrium limits on conversion Mathematics is employed as a language at the most elementary level Professor Morton M Denn incorporates design

meaningfully the design and analysis problems are realistic in format and scope      *Mathematical Modelling and Simulation in Chemical Engineering* M. Chidambaram, 2018-03-09 An easy to understand guide covering key principles of mathematical modelling and simulation in chemical engineering      *Thermal Safety of Chemical Processes* Francis Stoessel, 2008-06-25

Based on the author's many years of experience in practicing safety assessment in industry and teaching students or professionals in this area the topic of this book is seldom found on university curricula and many professionals do not have the knowledge required to interpret thermal data in terms of risks For this reason Francis Stoessel adopts a unique systematic how to do approach Each chapter begins with a case history illustrating the topic and presenting the lessons learned from the incident In so doing he analyzes a goldmine of numerous examples stemming from industrial practice additionally providing a series of problems or case studies at the end of each chapter Divided into three distinct sections part one looks at the general aspects of thermal process safety while Part 2 deals with mastering exothermal reactions The final section discusses the avoidance of secondary reactions including heat accumulation and thermal confinement

*Thermodynamics with Chemical Engineering Applications* Elias I. Franses, 2014-08-25 Master the principles of thermodynamics and understand their practical real world applications with this deep and intuitive undergraduate textbook

**Control and Monitoring of Chemical Batch Reactors** Fabrizio Caccavale, Mario Iamarino, Francesco Pierri, Vincenzo Tufano, 2010-12-07 The Chemical Batch Reactor is aimed at tackling the above problems from a blending of academic and industrial perspectives Advanced solutions i.e. those based on recent research results to the four fundamental problems of modeling identification control and fault diagnosis for batch processes are developed in detail in four distinct chapters In each chapter a general overview of foundational concepts is also given together with a review of recent and classical literature on the various subjects To provide a unitary treatment of the different topics and give a firm link to the underlying practical applications a single case study is developed as the book progresses a batch process of industrial interest i.e. the phenol formaldehyde reaction for the production of phenolic resins is adopted to test the various techniques developed In this way a roadmap of the solutions to fundamental problems ranging from the early stages of the production process to the complete design of control and diagnosis systems is provided for both industrial practitioners and academic researchers

**Chemical Reaction Engineering** L.K. Doraiswamy, Deniz Uner, 2013-07-15 Filling a longstanding gap for graduate courses in the field Chemical Reaction Engineering Beyond the Fundamentals covers basic concepts as well as complexities of chemical reaction engineering including novel techniques for process intensification The book is divided into three parts Fundamentals Revisited Building on Fundamentals and Beyond the Fundamentals Part I Fundamentals Revisited reviews the salient features of an undergraduate course introducing concepts essential to reactor design such as mixing unsteady state operations multiple steady states and complex reactions Part II Building on Fundamentals is devoted to skill building particularly in the area of catalysis and catalytic reactions It covers chemical thermodynamics emphasizing the

thermodynamics of adsorption and complex reactions the fundamentals of chemical kinetics with special emphasis on microkinetic analysis and heat and mass transfer effects in catalysis including transport between phases transfer across interfaces and effects of external heat and mass transfer It also contains a chapter that provides readers with tools for making accurate kinetic measurements and analyzing the data obtained Part III Beyond the Fundamentals presents material not commonly covered in textbooks addressing aspects of reactors involving more than one phase It discusses solid catalyzed fluid phase reactions in fixed bed and fluidized bed reactors gas solid noncatalytic reactions reactions involving at least one liquid phase gas liquid and liquid liquid and multiphase reactions This section also describes membrane assisted reactor engineering combo reactors homogeneous catalysis and phase transfer catalysis The final chapter provides a perspective on future trends in reaction engineering

**Proceedings of IDEAS 2019** Luciana Pereira, José Reginaldo Hughes Carvalho, Petter Krus, Magnus Klostén, Victor Juliano De Negri, 2020-08-11 This book presents the proceedings of the IDEAS Conference which is intended as a forum for a new generation of researchers IDEAS is an arena that encourages researchers to defy their field's boundaries leveraging disciplinary mindset into contributions to broad domains within the Science Technology Engineering Entrepreneurship and Management Further IDEAS explores novel questions and challenges existing policies and practices on how to apply science and technology as an input to design more innovative and sustainable systems that promote human well being

**Colloidal Suspension Rheology** Jan Mewis, Norman J. Wagner, 2012 Presented in an accessible and introductory manner this is the first book devoted to the comprehensive study of colloidal suspensions

Distillation Theory and its Application to Optimal Design of Separation Units F. B. Petlyuk, 2004-10-18 Originally published in 2004 Distillation Theory and Its Application to Optimal Design of Separation Units presents a clear multidimensional geometric representation of distillation theory that is valid for all distillation column types splits and mixtures This representation answers such fundamental questions as what are the feasible separation products for a given mixture What minimum power is required to separate a given mixture What minimum number of trays is necessary to separate a given mixture at a fixed power input This book is intended for students and specialists in the design and operation of separation units in the chemical pharmaceutical food wood petrochemical oil refining and natural gas industries and for software designers

Computational Models for Polydisperse Particulate and Multiphase Systems Daniele L. Marchisio, Rodney O. Fox, 2013-03-28 All inclusive introduction to polydisperse multiphase flows linking theory to practice through numerous real world examples and MATLAB scripts for key algorithms

**Nutritional Care of the Patient with Gastrointestinal Disease** Alan L Buchman, 2015-08-06 This evidence based book serves as a clinical manual as well as a reference guide for the diagnosis and management of common nutritional issues in relation to gastrointestinal disease Chapters cover nutrition assessment macro and micronutrient absorption malabsorption food allergies prebiotics and dietary fiber probiotics and intestinal microflora nutrition and GI cancer nutritional management of reflux nutrition in IBS and IBD

nutrition in acute and chronic pancreatitis enteral nutrition parenteral nutrition medical and endoscopic therapy of obesity  
 surgical therapy of obesity pharmacologic nutrition and nutritional counseling      **Process Control** Pao C. Chau,2002-08-26  
 An introductory 2002 textbook Process Control covers the most essential aspects of process control suitable for a two  
 semester course While classical techniques are discussed also included is a discussion of state space modeling and control a  
 modern control topic lacking in most introductory texts MATLAB a popular engineering software package is employed as a  
 powerful yet approachable computational tool Text examples demonstrate how root locus Bode plots and time domain  
 simulations can be integrated to tackle a control problem Classical control and state space designs are compared Despite the  
 reliance on MATLAB theory and analysis of process control are well presented creating a well rounded pedagogical text Each  
 chapter concludes with problem sets to which hints or solutions are provided A web site provides excellent support in the  
 way of MATLAB outputs of text examples and MATLAB sessions references and supplementary notes Students and  
 professionals will find it a useful text and reference      Mass and Heat Transfer T. W. Fraser Russell, Anne Skaja  
 Robinson, Norman J. Wagner, 2008-02-11 This text allows instructors to teach a course on heat and mass transfer that will  
 equip students with the pragmatic applied skills required by the modern chemical industry This new approach is a combined  
 presentation of heat and mass transfer maintaining mathematical rigor while keeping mathematical analysis to a minimum  
 This allows students to develop a strong conceptual understanding and teaches them how to become proficient in  
 engineering analysis of mass contactors and heat exchangers and the transport theory used as a basis for determining how  
 critical coefficients depend upon physical properties and fluid motions Students will first study the engineering analysis and  
 design of equipment important in experiments and for the processing of material at the commercial scale The second part of  
 the book presents the fundamentals of transport phenomena relevant to these applications A complete teaching package  
 includes a comprehensive instructor's guide exercises case studies and project assignments      **Polymer Melt Processing**  
 Morton M. Denn, 2008-08-04 Most of the shaping in the manufacture of polymeric objects is carried out in the melt state as it  
 is a substantial part of the physical property development Melt processing involves an interplay between fluid mechanics and  
 heat transfer in rheologically complex liquids and taken as a whole it is a nice example of the importance of coupled  
 transport processes This book is on the underlying foundations of polymer melt processing which can be derived from  
 relatively straightforward ideas in fluid mechanics and heat transfer the level is that of an advanced undergraduate or  
 beginning graduate course and the material can serve as the text for a course in polymer processing or for a second course in  
 transport processes      **Design and Processing of Particulate Products** Jim Litster, 2016-10-20 With this unique and  
 comprehensive text readers will gain the quantitative tools needed to engineer the particulate processes and products that  
 are ubiquitous in modern life Covering a series of particle and particulate delivery form design processes with emphasis on  
 design and operation to control particle attributes and supported by many worked examples it is essential reading for

students and practitioners Topics covered include a range of particle design processes such as crystallization and precipitation granulation grinding aerosol processes and spray drying as well as forms of delivery such as granules tablets dry powders and aerosols Readers will learn from real world examples how the primary particle properties and the structure and properties of the delivery form can lead to high performance products ranging from pharmaceuticals consumer goods and foods to specialty chemicals paints agricultural chemicals and minerals

### **Molecular Engineering Thermodynamics**

Juan J. de Pablo, Jay D. Schieber, 2014-07-10 Building up gradually from first principles this unique introduction to modern thermodynamics integrates classical statistical and molecular approaches and is especially designed to support students studying chemical and biochemical engineering In addition to covering traditional problems in engineering thermodynamics in the context of biology and materials chemistry students are also introduced to the thermodynamics of DNA proteins polymers and surfaces It includes over 80 detailed worked examples covering a broad range of scenarios such as fuel cell efficiency DNA protein binding semiconductor manufacturing and polymer foaming emphasizing the practical real world applications of thermodynamic principles more than 300 carefully tailored homework problems designed to stretch and extend students understanding of key topics accompanied by an online solution manual for instructors and all the necessary mathematical background plus resources summarizing commonly used symbols useful equations of state microscopic balances for open systems and links to useful online tools and datasets

Albright's Chemical Engineering Handbook Lyle Albright, 2008-11-20 Taking greater advantage of powerful computing capabilities over the last several years the development of fundamental information and new models has led to major advances in nearly every aspect of chemical engineering Albright's Chemical Engineering Handbook represents a reliable source of updated methods applications and fundamental concepts that will continue to play a significant role in driving new research and improving plant design and operations Well rounded concise and practical by design this handbook collects valuable insight from an exceptional diversity of leaders in their respective specialties Each chapter provides a clear review of basic information case examples and references to additional more in depth information They explain essential principles calculations and issues relating to topics including reaction engineering process control and design waste disposal and electrochemical and biochemical engineering The final chapters cover aspects of patents and intellectual property practical communication and ethical considerations that are most relevant to engineers From fundamentals to plant operations Albright's Chemical Engineering Handbook offers a thorough yet succinct guide to day to day methods and calculations used in chemical engineering applications This handbook will serve the needs of practicing professionals as well as students preparing to enter the field

### *Global Sensitivity Analysis*

Andrea Saltelli, Marco Ratto, Terry Andres, Francesca Campolongo, Jessica Cariboni, Debora Gatelli, Michaela Saisana, Stefano Tarantola, 2008-02-28 Complex mathematical and computational models are used in all areas of society and technology and yet model based science is increasingly contested or refuted especially when models are applied to controversial themes in

domains such as health the environment or the economy More stringent standards of proofs are demanded from model based numbers especially when these numbers represent potential financial losses threats to human health or the state of the environment Quantitative sensitivity analysis is generally agreed to be one such standard Mathematical models are good at mapping assumptions into inferences A modeller makes assumptions about laws pertaining to the system about its status and a plethora of other often arcane system variables and internal model settings To what extent can we rely on the model based inference when most of these assumptions are fraught with uncertainties Global Sensitivity Analysis offers an accessible treatment of such problems via quantitative sensitivity analysis beginning with the first principles and guiding the reader through the full range of recommended practices with a rich set of solved exercises The text explains the motivation for sensitivity analysis reviews the required statistical concepts and provides a guide to potential applications The book Provides a self contained treatment of the subject allowing readers to learn and practice global sensitivity analysis without further materials Presents ways to frame the analysis interpret its results and avoid potential pitfalls Features numerous exercises and solved problems to help illustrate the applications Is authored by leading sensitivity analysis practitioners combining a range of disciplinary backgrounds Postgraduate students and practitioners in a wide range of subjects including statistics mathematics engineering physics chemistry environmental sciences biology toxicology actuarial sciences and econometrics will find much of use here This book will prove equally valuable to engineers working on risk analysis and to financial analysts concerned with pricing and hedging



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