

Elmar Heinzle, Irving J. Dunn,  
John Ingham, and Jiří E. Přenosil

# Biological Reaction Engineering

Dynamic Modeling Fundamentals  
With 80 Interactive Simulation Examples

Third, Completely Revised and Enlarged Edition



# Biological Reaction Engineering Dynamic Modelling

## Fundamentals With Simulation Examples

**John Ingham**

## **Biological Reaction Engineering Dynamic Modelling Fundamentals With Simulation Examples:**

**Biological Reaction Engineering** Elmar Heinze,Irving J. Dunn,John Ingham,Jiří E. Přenosil,2021-04-06 Die Dynamik biotechnologischer Produktionsprozesse ist u erst komplex Ziel des Buches ist es diese Vorg nge durch systematische Modellbildung und Computersimulation verst ndlich und durchschaubar zu machen Es werden ohne viel mathematisches R stzeug Grundprinzipien erkl rt und anhand von zahlreichen praxisrelevanten Beispielen alle wichtigen Aspekte der Bioverfahrenstechnik ausf hrlich beschrieben Modellierte biologische Systeme reichen vom einzelnen Enzym bis zu ganzen metabolischen Netzwerken und Multi Organismen Systemen Die kinetischen Modelle werden mit Reaktormodellen kombiniert was oft mit verschiedenen Konfigurationen von Zu und Abl ufen und Stofftransportprozessen kombiniert ist In vielen Beispielen werden Regelung und Optimierung der Prozesse behandelt Die Simulationsbeispiele reichen von theoretischen Schulbeispielen bis zu aktuellen Forschungsarbeiten Die verwendete Simulationssprache Berkeley Madonna erlaubt nach einer sehr kurzen Einarbeitung ein schnelles interaktives ben Der Leser kann die vorgegebenen Beispiele beliebig ver ndern um sie seinem Problemfall anzupassen Die langj hrige Lehrerfahrung der Autoren an Hochschulen und Weiterbildungskursen spiegelt sich in dem Buch wider und macht es geeignet f r alle Biochemiker Biotechnologen Bioingenieure und Verfahrenstechniker die an Modellierung und Simulation interessiert sind Die eingesetzte Software Berkeley Madonna f r Mac und PC kann direkt von der Berkeley Madonna Webseite bezogen werden [www.berkeleymadonna.com](http://www.berkeleymadonna.com) Zus tzliches Online Material d h Programme f r alle Simulationsbeispiele eine kurze Beschreibung der Verwendung der eingesetzten Simulationssoftware Berkeley Madonna und L sungen von bungsaufgaben kann als Zusatzmaterial Zip Datei direkt von dieser Webseite heruntergeladen werden Alle Beispiele k nnen auch mit der kostenlosen Demo Version von Berkeley Madonna ben tzt werden F r K ufer des Buches ist Berkeley Madonna zu einem reduzierten Preis erh ltlich Hinweise dazu gibt es im Anhang des Buches     **Biological Reaction Engineering** Irving J. Dunn,2003 Table of contents

**Comprehensive Biotechnology** ,2019-07-17 Comprehensive Biotechnology Third Edition Six Volume Set unifies in a single source a huge amount of information in this growing field The book covers scientific fundamentals along with engineering considerations and applications in industry agriculture medicine the environment and socio economics including the related government regulatory overviews This new edition builds on the solid basis provided by previous editions incorporating all recent advances in the field since the second edition was published in 2011 Offers researchers a one stop shop for information on the subject of biotechnology Provides in depth treatment of relevant topics from recognized authorities including the contributions of a Nobel laureate Presents the perspective of researchers in different fields such as biochemistry agriculture engineering biomedicine and environmental science     **Bioprocess Engineering and Technology** Biswanath Bhunia,Navneet Joshi,Muthusivaramapandian Muhuraja,2025-11-26 This book discusses the various cellular interventions that are required for the upstream processes in bioprocess engineering such as growth requirement of

different cell types their maintenance and various recombinant strategies tools available to identify and develop a cellular factory for high level synthesis of a desired product Bioprocess Engineering and Technology Upstream Process also deals with the various types of reactors process design and development media conditions mode of operation sterilisation selectivity reactor design and construction scale up process analytical technologies and process control The book examines upstream processes which include the selection of cell factories and strain engineering approaches enzyme kinetics growth kinetics fermentation downstream processing process design reactor design and scale up It also includes case studies that will assist readers to develop the upstream processes involved in an industrial scale bioprocess This book is intended for students and researchers looking to develop the upstream processes involved in an industrial scale bioprocessing operation

Cooperative Design, Visualization, and Engineering Yuhua Luo,2011-09-01 This book constitutes the refereed proceedings of the 8th International Conference on Cooperative Design Visualization and Engineering CDVE 2011 held in Hong Kong China in September 2011 The 33 revised full papers presented were carefully reviewed and selected from numerous submissions The papers address all aspects of distributed computing and were organized in topical sections on cooperative design cooperative applications cooperative engineering cooperative visualization and basic theory and technology

**Development of Sustainable Bioprocesses** Elmar Heinze,Arno P. Biwer,Charles L. Cooney,2007-01-11 Bioprocess technology involves the combination of living matter whole organism or enzymes with nutrients under laboratory conditions to make a desired product within the pharmaceutical food cosmetics biotechnology fine chemicals and bulk chemicals sectors Industry is under increasing pressure to develop new processes that are both environmentally friendly and cost effective and this can be achieved by taking a fresh look at process development namely by combining modern process modeling techniques with sustainability assessment methods Development of Sustainable Bioprocesses Modeling and Assessment describes methodologies and supporting case studies for the evolution and implementation of sustainable bioprocesses Practical and industry focused the book begins with an introduction to the bioprocess industries and development procedures Bioprocesses and bioproducts are then introduced together with a description of the unit operations involved Modeling procedures a key feature of the book are covered in chapter 3 prior to an overview of the key sustainability assessment methods in use environmental economic and societal The second part of the book is devoted to case studies which cover the development of bioprocesses in the pharmaceutical food fine chemicals cosmetics and bulk chemicals industries Some selected case studies include citric acid biopolymers antibiotics biopharmaceuticals Supplementary material provides hands on materials so that the techniques can be put into practice These materials include a demo version of SuperPro Designer software used in process engineering and models of all featured case studies excel sheets of assessment methods Monte Carlo simulations and exercises Previously available on CD ROM the supplementary material can now be accessed via <http://booksupport.wiley.com> by entering the author name book title or isbn and clicking on the desired entry

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**Simultaneous Sulfate Reduction and Metal Precipitation in an Inverse Fluidized Bed Reactor** Denys Kristalia Villa Gómez, 2022-01-26 Industrial activities like textile processing and mining are typical sources of heavy metal rich wastewaters The sulfate reducing process has become an attractive method for the production of sulfide to precipitate metals since most of these streams also contain sulfate which is the electron acceptor and in less common cases chemical oxygen demand which is the electron donor of sulfate reducing bacteria The inverse fluidized bed IFB reactor is a system for the production of biogenic sulfide and metal precipitation in the same unit due to its configuration the biomass floats on top of the reactor whereas metal sulfide precipitates settle and thus can be recovered at the bottom The main objective of this thesis was to elucidate the factors affecting simultaneous sulfate reduction and precipitation of heavy metals in an IFB reactor in order to optimize the metal recovery from wastewaters such as acid mine drainage Therefore this thesis focused on varying different operational conditions to study their effect on the solid liquid separation and purity of the metal sulfide precipitates as well as on their effect on the sulfate reducing process Furthermore one chapter was focused on the study of strategies for sulfide control in the IFB reactor In addition recommendations for further research to improve the recovery of the metal sulfides in bioreactors are given

**Chemical Engineering Dynamics, Includes CD-ROM** John Ingham, 2007

In this book the modelling of dynamic chemical engineering processes is presented in a highly understandable way using the unique combination of simplified fundamental theory and direct hands on computer simulation The mathematics is kept to a minimum and yet the nearly 100 examples supplied on [www.wiley-vch.de](http://www.wiley-vch.de) illustrate almost every aspect of chemical engineering science Each example is described in detail including the model equations They are written in the modern user friendly simulation language Berkeley Madonna which can be run on both Windows PC and Power Macintosh computers Madonna solves models comprising many ordinary differential equations using very simple programming including arrays It is so powerful that the model parameters may be defined as sliders which allow the effect of their change on the model behavior to be seen almost immediately Data may be included for curve fitting and sensitivity or multiple runs may be performed The results can be seen simultaneously on multiple graph windows or by using overlays The resultant learning effect of this is tremendous The examples can be varied to fit any real situation and the suggested exercises provide practical guidance The extensive experience of the authors both in university teaching and international courses is reflected in this well balanced presentation which is suitable for the teacher the student the chemist or the engineer This book provides a greater understanding of the formulation and use of mass and energy balances for chemical engineering in a most stimulating manner This book is a third edition which also includes biological environmental and food process examples

*On-line Estimation and Adaptive Control of Bioreactors* G. Bastin, Denis Dochain, 1990-07-03 This book deals with monitoring and control of biotechnological processes Different methods are proposed which are based on the nonlinear

structure of the process and do not require any a priori knowledge of the fermentation parameters The theoretical stability and convergence properties of the proposed algorithms are analysed and their performances are illustrated by simulation results and in many instances by real life experiments The concept of software sensors is introduced these are algorithms based on the nonlinear model of the process and designed for on line estimation of the biological variables and or the fermentation parameters In order to deal with process nonstationarities and parameter uncertainties reference is made to adaptive estimation and control techniques The book is the result of an intensive joint research effort by the authors during the last decade It is intended as a graduate level text for students of bioengineering as well as a reference text for scientists and engineers involved in the design and optimization of bioprocesses

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Dana Ferguson,2005-09 Book Review Index provides quick access to reviews of books periodicals books on tape and electronic media representing a wide range of popular academic and professional interests The up to date coverage wide scope and inclusion of citations for both newly published and older materials make Book Review Index an exceptionally useful reference tool More than 600 publications are indexed including journals and national general interest publications and newspapers Book Review Index is available in a three issue subscription covering the current year or as an annual cumulation covering the past year

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**Chemical Engineering Dynamics** John Ingham,1994 In this book the reader is guided through the complex study of dynamic chemical engineering systems by the unique combination of a simplified presentation of the fundamental theory Part 1 and direct hands on computer experimentation with the provision of 85 accompanying computer based simulation examples Part 2 supplied on diskette The ISIM digital simulation language is very simple to use and its powerful interactive nature enables the readers to create their own simulations based on their own specific problems This powerful dynamic ISIM software is ready to run on any DOS personal computer The treatment employed in this book is well tried and tested based on over 20 years experience in teaching an international post experience course Whether for the teacher the student the chemist or engineer this book serves as the key to a greater understanding of chemical engineering dynamics through the fun and enjoyment of active learning

**Dynamics of Environmental Bioprocesses** Jonathan B. Snape,1995-04-17

Dynamic environmental processes are complex the easiest and most effective way to understanding them lies through the disciplines of dynamic modelling and computer simulation The prerequisite modelling fundamentals are presented in the first chapter in a manner comprehensible to students as well as to practising scientists and engineers The second chapter describes the many environmental processes that lend themselves to modelling for example pollution and wastewater treatment The third part of the book provides 65 simulation examples both on the page and on an accompanying diskette in the simulation language ISIM the first time that this has been done with a teaching book in this field ready to run on any DOS personal computer Crucially the simulation runs can be interrupted to allow rapid interactive parameter changes and easy

plotting of results this enables the reader to get a feel for the model and system behaviour      **Biological Reaction Engineering** Irving J. Dunn, Elmar Heinze, Jiri E. Prenosil, John Ingham, 1992-11-13 This book is the admirable result of ten years experience in organizing and teaching courses in biological reaction engineering. It gives engineers and scientists the information they need to analyze the behavior of complex biological reactors using mathematical equations and a dynamic simulation computer language. Part I treats the fundamentals of modelling mass balance equations involving reaction kinetics and mass transfer rates making them readily understandable to those new in the field. Part II gives 45 example problems complete with models and programs. This book is the first of its kind to include a diskette with a commercial simulation language. The diskette can be run on any DOS personal computer. Users will appreciate how the simulation runs can be interrupted for interactive parameter changes and instructive plotting      *Chemical Engineering Dynamics* John Ingham, Irving J. Dunn, Elmar Heinze, Jiri E. Prenosil, Jonathan B. Snape, 2008-02-08 In this book the modelling of dynamic chemical engineering processes is presented in a highly understandable way using the unique combination of simplified fundamental theory and direct hands on computer simulation. The mathematics is kept to a minimum and yet the nearly 100 examples supplied on [www.wiley-vch.de](http://www.wiley-vch.de) illustrate almost every aspect of chemical engineering science. Each example is described in detail including the model equations. They are written in the modern user friendly simulation language Berkeley Madonna which can be run on both Windows PC and Power Macintosh computers. Madonna solves models comprising many ordinary differential equations using very simple programming including arrays. It is so powerful that the model parameters may be defined as sliders which allow the effect of their change on the model behavior to be seen almost immediately. Data may be included for curve fitting and sensitivity or multiple runs may be performed. The results can be seen simultaneously on multiple graph windows or by using overlays. The resultant learning effect of this is tremendous. The examples can be varied to fit any real situation and the suggested exercises provide practical guidance. The extensive experience of the authors both in university teaching and international courses is reflected in this well balanced presentation which is suitable for the teacher the student the chemist or the engineer. This book provides a greater understanding of the formulation and use of mass and energy balances for chemical engineering in a most stimulating manner. This book is a third edition which also includes biological, environmental and food process examples      *Chemical Engineering Progress*, 2005

**Deutsche Nationalbibliographie und Bibliographie der im Ausland erschienenen deutschsprachigen Veröffentlichungen**, 2008      *Acta Hydrochimica Et Hydrobiologica*, 1995      Nachrichten aus Chemie, Technik und Laboratorium, 1995

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