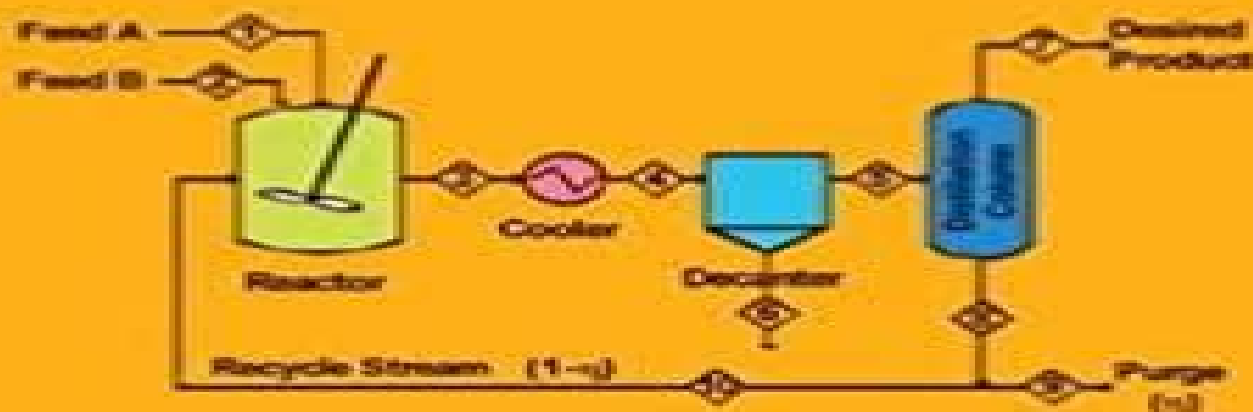


Advances in Process Systems Engineering – Vol. 1

MULTI-OBJECTIVE OPTIMIZATION

Techniques and Applications in
Chemical Engineering



Gade Pandu Rangaiah

editor

Multi Objective Optimization In Chemical Engineering Developments And Applications

Ashish M. Gujarathi, B. V. Babu



Multi Objective Optimization In Chemical Engineering Developments And Applications:

Multi-Objective Optimization in Chemical Engineering Gade Pandu Rangaiah, Adrian Bonilla-Petriciolet, 2013-03-20
For reasons both financial and environmental there is a perpetual need to optimize the design and operating conditions of industrial process systems in order to improve their performance energy efficiency profitability safety and reliability However with most chemical engineering application problems having many variables with complex inter relationships meeting these optimization objectives can be challenging This is where Multi Objective Optimization MOO is useful to find the optimal trade offs among two or more conflicting objectives This book provides an overview of the recent developments and applications of MOO for modeling design and operation of chemical petrochemical pharmaceutical energy and related processes It then covers important theoretical and computational developments as well as specific applications such as metabolic reaction networks chromatographic systems CO₂ emissions targeting for petroleum refining units ecodesign of chemical processes ethanol purification and cumene process design Multi Objective Optimization in Chemical Engineering Developments and Applications is an invaluable resource for researchers and graduate students in chemical engineering as well as industrial practitioners and engineers involved in process design modeling and optimization

Multi-objective Optimization: Techniques And Applications In Chemical Engineering (With Cd-rom) Gade Pandu Rangaiah, 2008-12-22 Optimization has been playing a key role in the design planning and operation of chemical and related processes for nearly half a century Although process optimization for multiple objectives was studied by several researchers back in the 1970s and 1980s it has attracted active research in the last 10 years spurred by the new and effective techniques for multi objective optimization In order to capture this renewed interest this monograph presents the recent and ongoing research in multi optimization techniques and their applications in chemical engineering Following a brief introduction and general review on the development of multi objective optimization applications in chemical engineering since 2000 the book gives a description of selected multi objective techniques and then goes on to discuss chemical engineering applications These applications are from diverse areas within chemical engineering and are presented in detail All chapters will be of interest to researchers in multi objective optimization and or chemical engineering they can be read individually and used in one s learning and research Several exercises are included at the end of many chapters for use by both practicing engineers and students

Multi-objective Optimization: Techniques And Applications In Chemical Engineering (Second Edition) Gade Pandu Rangaiah, 2016-12-22 Optimization is now essential in the design planning and operation of chemical and related processes Although process optimization for multiple objectives was studied in the 1970s and 1980s it has attracted active research in the last 15 years spurred by the new and effective techniques for multi objective optimization MOO To capture this renewed interest this monograph presents recent research in MOO techniques and applications in chemical engineering Following a brief introduction and review of MOO applications in chemical engineering since 2000 the book presents selected MOO

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Multi-objective Optimization Gade Pandu Rangaiah,2009 Following a brief introduction and general review on the development of multi objective optimization applications in chemical engineering since 2000 the book gives a description of selected multi objective techniques and then goes on to discuss chemical engineering applications These applications are from diverse areas within chemical engineering and are presented in detail Several exercises are included at the end of many chapters

Differential Evolution In Chemical Engineering: Developments And Applications Gade Pandu Rangaiah,Shivom Sharma,2017-05-29 Optimization plays a key role in the design planning and operation of chemical and related processes for several decades Techniques for solving optimization problems are of deterministic or stochastic type Of these stochastic techniques can solve any type of optimization problems and can be adapted for multiple objectives Differential evolution DE proposed about two decades ago is one of the stochastic techniques Its algorithm is simple to understand and use DE has found many applications in chemical engineering This unique compendium focuses on DE its recent developments and applications in chemical engineering It will cover both single and multi objective optimization The book contains a number of chapters from experienced editors and also several chapters from active researchers in this area

Applications of Metaheuristics in Process Engineering Jayaraman Valadi,Patrick Siarry,2014-08-07 Metaheuristics exhibit desirable properties like simplicity easy parallelizability and ready applicability to different types of optimization problems such as real parameter optimization combinatorial optimization and mixed integer optimization They are thus beginning to play a key role in different industrially important process engineering applications among them the synthesis of heat and mass exchange equipment synthesis of distillation columns and static and dynamic optimization of chemical and bioreactors This book explains cutting edge research techniques in related computational intelligence domains and their applications in real world process engineering It will be of interest to industrial practitioners and research academics

Process Intensification in Chemical Engineering Juan Gabriel Segovia-Hernández,Adrián Bonilla-Petriciolet,2016-04-02 This book will provide researchers and graduate students with an overview of the recent developments and applications of process intensification in chemical engineering It will also allow the readers to apply the available intensification techniques to their processes and specific problems The content of this book can be readily adopted as part of special courses on process control design optimization and modelling aimed at senior undergraduate and graduate students This book will be a useful resource for researchers in process system engineering as well as for practitioners interested in applying process intensification approaches to real life problems in chemical engineering and related areas

Chemical Process Retrofitting and Revamping Gade Pandu Rangaiah, 2016-01-22 The proposed book will be divided into three parts The chapters in Part I provide an overview of certain aspect of process retrofitting The focus of Part II is on computational techniques for solving process retrofit problems Finally Part III addresses retrofit applications from diverse process industries Some chapters in the book are contributed by practitioners whereas others are from academia Hence the book includes both new developments from research and also practical considerations Many chapters include examples with realistic data All these feature make the book useful to industrial engineers researchers and students **Process**

Industries 1 Jean-Pierre Dal Pont, Marie Debaq, 2020-10-08 Of crucial economic and societal importance process industries transform matter by chemical physical or biological means They cover broad fields such as chemistry oil pharmacy metallurgy and agri food to name a few As a result of knowledge exchange between the academic and industrial worlds Process Industries 1 decrypts the operations and technical management of these industries in order to formulate and manufacture products with use value in a sustainable way Using concrete examples this book presents the fundamentals for defining the reaction and purification conditions that form the basis of chemical engineering The unit operations the technological building blocks of the production units are the subject of scientific and technical descriptions supplemented by numerous videos Frameworks written by well known specialists provide a deep understanding of topics related to these themes Process Industries 1 is intended for students teachers professionals and decision makers interested in learning more about these industries

The Water-Food-Energy Nexus I. M. Mujtaba, R. Srinivasan, N. O. Elbashir, 2017-09-11 Exponential growth of the worldwide population requires increasing amounts of water food and energy However as the quantity of available fresh water and energy sources directly affecting cost of food production and transportation diminishes technological solutions are necessary to secure sustainable supplies In direct response to this reality this book focuses on the water energy food nexus and describes in depth the challenges and processes involved in efficient water and energy production and management wastewater treatment and impact upon food and essential commodities The book is organized into 4 sections on water food energy and the future of sustainability highlighting the interplay among these topics The first section emphasizes water desalination water management and wastewater treatment The second section discusses cereal processing sustainable food security bioenergy in food production water and energy consumption in food processing and mathematical modeling for food undergoing phase changes The third section discusses fossil fuels biofuels synthetic fuels renewable energy and carbon capture Finally the book concludes with a discussion of the future of sustainability including coverage of the role of molecular thermodynamics in developing processes and products green engineering in process systems petrochemical water splitting petrochemical approaches to solar hydrogen generation design and operation strategy of energy efficient processes and the sustainability of process supply chain and enterprise **Evolutionary Computation**

Ashish M. Gujarathi, B. V. Babu, 2016-12-01 Edited by professionals with years of experience this book provides an

introduction to the theory of evolutionary algorithms and single and multi objective optimization and then goes on to discuss to explore applications of evolutionary algorithms for many uses with real world applications Covering both the theory and applications of evolutionary computation the book offers exhaustive coverage of several topics on nontraditional evolutionary techniques details working principles of new and popular evolutionary algorithms and discusses case studies on both scientific and real world applications of optimization *Applied Process Control* Michael Mulholland, 2016-12-19 Bridging theory and practice this book contains over 200 practical exercises and their solutions to develop the problem solving abilities of process engineers The problems were developed by the author during his many years of teaching at university and are kept brief taken from the fields of instrumentation modelling plant control control strategy design and stability of control The algorithm flows and codes which are mostly based on MATLAB are given in many cases and allow for easy translation into applications Since the text is structured according to *Applied Process Control Essential Methods* all of the necessary background information on the underlying methods can be easily and quickly found in this accompanying book

Optimization in Chemical Engineering Fernando Israel Gómez-Castro, Vicente Rico-Ramírez, 2025-04-21 Optimization is an area in constant evolution The search for robust optimization techniques to deal with the highly non convex models that represent the systems related to Chemical Engineering has led to important advances in the area The need for developing economically feasible processes which are simultaneously environmentally friendly safe and controllable requires for adequate optimization strategies Moreover finding a global optimum is still a challenge for a diversity of cases Thus this book presents a compilation of classic and emerging optimization techniques focusing on their application to systems related to the Chemical Engineering The book shows the applications of classic mathematical programming metaheuristic optimization methods and machine learning based strategies The analysis of the described techniques allows the reader identifying the advantages and disadvantages of each approach Moreover the book will discuss the perspectives for future developments on the area *Advances in Computing* Néstor Darío Duque-Méndez, Luz Ángela Aristizábal-Quintero, Mauricio

Orozco-Alzate, Jose Aguilar, 2024-12-21 This two volume set CCIS 2208 2209 constitutes revised selected papers from the refereed proceedings of the 18th Colombian Congress on Computing CCC 2024 held in Manizales Colombia during September 4 6 2024 The 50 full papers and 5 short papers included in this book were carefully reviewed and selected from 124 submissions They were organized in topical sections as follows Artificial Intelligence Pattern recognition and computer vision Computational statistics and formal methods Cyber security and information security Data information and knowledge ICT for education and e Learning Industry 4 0 and digital transformation Software engineering and automation *Materials Physics and Chemistry* Satya Bir Singh, Alexander V. Vakhruşhev, A. K. Haghi, 2020-11-02 This volume focuses on the development and application of fundamental concepts in mechanics and physics of solids as they pertain to the solution of challenging new problems in diverse areas such as materials science and micro and nanotechnology In this volume emphasis

is placed on the development of fundamental concepts of mechanics and novel applications of these concepts based on theoretical experimental or computational approaches drawing upon the various branches of engineering science and the allied areas within applied mathematics materials science and applied physics Materials Physics and Chemistry Applied Mathematics and Chemo Mechanical Analysis emphasizes the basics such as design equilibrium material behavior and geometry of deformation in simple structures or machines Readers will find a thorough treatment of stress strain and the stress strain relationships Meanwhile it provides a solid foundation upon which readers can begin work in composite materials science and engineering Many chapters include theory components with the equations students need to calculate different properties

Machine Learning in Chemistry Hugh M. Cartwright, 2020-07-15 Progress in the application of machine learning ML to the physical and life sciences has been rapid A decade ago the method was mainly of interest to those in computer science departments but more recently ML tools have been developed that show significant potential across wide areas of science There is a growing consensus that ML software and related areas of artificial intelligence may in due course become as fundamental to scientific research as computers themselves Yet a perception remains that ML is obscure or esoteric that only computer scientists can really understand it and that few meaningful applications in scientific research exist This book challenges that view With contributions from leading research groups it presents in depth examples to illustrate how ML can be applied to real chemical problems Through these examples the reader can both gain a feel for what ML can and cannot so far achieve and also identify characteristics that might make a problem in physical science amenable to a ML approach This text is a valuable resource for scientists who are intrigued by the power of machine learning and want to learn more about how it can be applied in their own field

Applied Chemistry and Chemical Engineering, Volume 4 A. K. Haghi, Lionello Pogliani, Eduardo A. Castro, Devrim Balköse, Omari V. Mukbaniani, Chin Hua Chia, 2017-12-22 Applied Chemistry and Chemical Engineering Volume 4 Experimental Techniques and Methodical Developments provides a detailed yet easy to follow treatment of various techniques useful for characterizing the structure and properties of engineering materials This timely volume provides an overview of new methods and presents experimental research in applied chemistry using modern approaches Each chapter describes the principle of the respective method as well as the detailed procedures of experiments with examples of actual applications and then goes on to demonstrate the advantage and disadvantages of each physical technique Thus readers will be able to apply the concepts as described in the book to their own experiments The book is broken into several subsections Polymer Chemistry and Technology Computational Approaches Clinical Chemistry and Bioinformatics Special Topics This volume presents research and reviews and information on implementing and sustaining interdisciplinary studies in science technology engineering and mathematics

Composite Materials for Industry, Electronics, and the Environment Omari V. Mukbaniani, Devrim Balköse, Heru Susanto, A. K. Haghi, 2019-06-03 This new volume focuses on different aspects of composite systems that are associated with research and

development helping to bridge the gap between classical analysis and modern real life applications The chapters look at the experimental and theoretical aspects of composite materials regarding preparation processing design properties and practical implications It also presents recent advancements research and development prospects of advanced composite materials that provide new solutions for advanced technologies

Process Systems Engineering for Biofuels

Development Adrian Bonilla-Petriciolet, Gade Pandu Rangaiah, 2020-10-05 A comprehensive overview of current developments and applications in biofuels production Process Systems Engineering for Biofuels Development brings together the latest and most cutting edge research on the production of biofuels As the first book specifically devoted to process systems engineering for the production of biofuels Process Systems Engineering for Biofuels Development covers theoretical computational and experimental issues in biofuels process engineering Written for researchers and postgraduate students working on biomass conversion and sustainable process design as well as industrial practitioners and engineers involved in process design modeling and optimization this book is an indispensable guide to the newest developments in areas including Enzyme catalyzed biodiesel production Process analysis of biodiesel production including kinetic modeling simulation and optimization The use of ultrasonification in biodiesel production Thermochemical processes for biomass transformation to biofuels Production of alternative biofuels In addition to the comprehensive overview of the subject of biofuels found in the Introduction of the book the authors of various chapters have provided extensive discussions of the production and separation of biofuels via novel applications and techniques

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