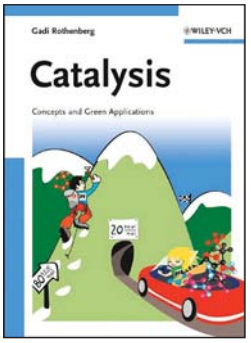
Books

Catalysis: Concepts and Green Applications

Gadi Rothenberg, Wiley-VCH, Weinheim, Germany, 296 pages, $80, 2008, ISBN: 978-3-527-31824-7

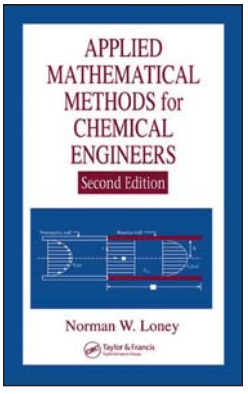


Covering the basics of catalysis from a "green chemistry" perspective, this book's main message is that heterogeneous catalysis, homogeneous catalysis, and biocatalysis are all one discipline, so the engineer needs to understand only once how catalysis works. The book begins with an introduction that explains the fundamentals of sustainable chemistry, catalysis and reaction kinetics. It then shows how these principles are applied in homogeneous, heterogeneous, and biocatalysis. The final chapter gives an overview of the exciting and fast-growing field of computer applications in catalysis research. Each chapter includes detailed literature references and practical exercises. To help readers master the jargon of catalysis, key terms appear in bold and are defined the first time they appear in the text, and are also included in the index.

For instructors using this as a textbook, an accompanying website (www.catalysisbook.org) provides additional teaching materials, such as lecture slides, exercises and answers. It also includes a searchable list of all the references with their corresponding digital object identifier (DOI) hyperlinks. The website is accessible free of charge.

Applied Mathematical Methods for Chemical Engineers, Second Edition

Norman W. Loney, CRC Press, Taylor & Francis Group, Boca Raton, FL, 464 pages, $99.95, 2007, ISBN: 978-0-8493-9778-3



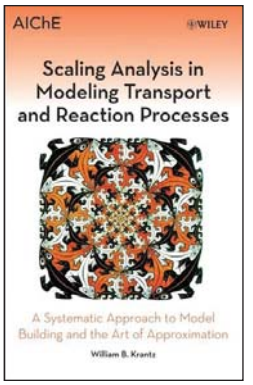
This book addresses the setup and verification of mathematical models using experimental or other independently derived data. An expanded and updated version of its well-respected predecessor, it uses worked examples to illustrate several mathematical methods that are essential in solving process engineering problems.

The book first provides an introduction to differential equations that are common to chemical engineering, followed by examples of first-order and linear second-order ordinary differential equations (ODEs). Later chapters examine Sturm-Liouville problems, Fourier series, integrals, linear partial differential equations (PDEs), and regular perturbation. The author also focuses on examples of PDE applications as they relate to the various conservation laws practiced in chemical engineering. The book concludes with discussions of dimensional analysis and the scaling of boundary value problems, and presents selected numerical methods and available software packages.

Worked examples cover heat transer, mass transfer, simultaneous diffusion, convection, chemical reaction, and viscous flow applications. In addition, the book integrates cutting-edge topics from current research, such as the modeling of membrane separation in hemodialysis.

Scaling Analysis in Modeling Transport and Reaction Processes: A Systematic Approach to Model Building and the Art of Approximation

William B. Krantz, John Wiley & Sons, Inc., Hoboken, NJ, 529 pages, $115, 2007, ISBN: 978-0-471-77261-3-3

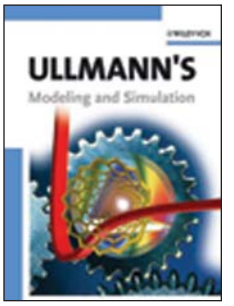


Scaling analysis facilitates assessing the viability of a process or technology without the need for prior bench- or pilot-scale data. It also provides a template for the design of experiments used to explore a new process or to validate a mathematical model. This is the first comprehensive book to focus on systematic scaling analysis while spanning various disciplines and applications.

The book provides an overview of the systematic approach to scaling analysis, including the mathematical basis. Detailed chapters cover specific applications in fluid dynamics, heat transfer, mass transfer, mass transfer with chemical reaction, and process design. Scaling analysis across scientific disciplines is addressed, enabling communication across different research areas of applied science, including biology, chemistry and physics. Sixty-two detailed examples illustrate the scaling method in various applications, and 165 end-of-chapter problems can be used for independent study or as class assignments.

Ullmann's Modeling and Simulation

Wiley-VCH, Weinheim, Germany, 452 pages, $215, 2007, ISBN: 978-3-527-31605-2



Computational methods and tools can save time and money in process development and optimization if they are used in conjunction with experimental methods. Based on the

latest online edition of "Ullmann's Encyclopedia of Industrial Chemistry," this reference provides a comprehensive survey of the mathematical fundamentals, complementary computational approaches, and applications of modeling and simulation in chemistry and engineering.

Since the entire 40-volume Ullmann's Encyclopedia is inaccessible to many readers, particularly individuals and smaller organzations, this handbook conveniently condenses the relevant information. The chapters were written by renowned experts from industry and academia. Deeper insights into any given area of interest are offered through referenced contributions, while rapid access to a particular subject is provided by both a keyword index and an author index.

Eight main chapters cover the following topics: mathematics in chemical engineering; model reactors and their design equations; mathematical modeling; molecular modeling; molcular dynamics simulation; computational fluid dynamics; design of experiments; and microreactors — modeling and simulation.

Process Engineering Problem Solving: Avoiding "The Problem Went Away, But It Came Back" Syndrome

Joe M. Bonem, John Wiley & Sons, Inc., Hoboken, NJ, 284 pages, $89.95, 2008, ISBN: 978-0-470-16928-5

In many chemical process industries plants, a great deal of time and money are spent addressing recurring problems. The subtitle of this book comes from the author's experience of listening to frustrated engineers describe problem-solving in modern, complex process plants. He wrote this book in response to those complaints — to present a structured, practical, and pragmatic way to solve real-world plant process problems, focusing on those that tend to be chronic or that require an engineering analysis.

The book has 14 chapters and a good index.

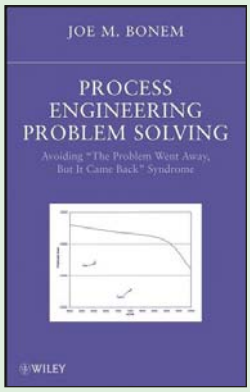
Chapter 1, on initial considerations, sets out the three components of the methodical reasoning approach:

- a systematic step-by-step procedure, which includes the three essential problem-solving skills that he calls daily monitoring system, disciplined problem-solving approach, and determining optimum technical depth
- a good understanding of how the equipment involved works
- a good understanding of the specific technology involved.

Chapter 2 briefly discusses limitations to plant problem-solving. Chapter 3 reviews the following five-step approach for successful problem-solving:

1. Verify that the problem actually occurred.
2. Write out an accurate statement of what problem you are trying to solve.
3. Develop a theoretically sound working hypothesis that explains as many specifications of the problem as possible.
4. Provide a mechanism to test the hypothesis.
5. Recommend remedial action to eliminate the problem without creating another problem.

Three actual real-life examples of problem-solving from the polymer industry are presented in Chapter 4. Chapter 5 describes an approach for the development of theoretically sound working hypotheses based on consideration of a series of questions that will require an analysis of the data in an introspective fashion.



Chapters 6, 7, 8 and 9 discuss application of the disciplined problem-solving approach to prime movers (pumps and compressors), plate processes (fractionation, extraction, and absorption towers), kinetically limited processes (heat exchange, reaction, and diffusion-limited operations), and unsteady-state operations, respectively. The chapters contain example problems with the five-step analysis approach described in Chapter 3 and a Lessons Learned section.

Chapter 10 deals with verification of process instrumentation data. The purpose of this chapter is to elucidate some of the techniques the author has developed and/or used that are beyond the conventional "check out the instrument" approach.

In Chapter 11, the author discusses steps to take in conducting successful plant tests, which are very important in solving many problems. The utilization of manual computation techniques (for phase equilibrium problems) is discussed in Chapter 12.

In order to see how material discussed in previous chapters fits together, several real-life example problems are discussed in Chapter 13. Thic chapter shows how the five-step problem-solving procedure (Chapter 3) can be used, how working hypotheses can be formulated (Chapter 5), and how various process engineering calculations (Chapters 6 through 12) can be utilized to develop and confirm these hypotheses.

In the final chapter, the author presents some of his thoughts and recommendations about problem-solving.

In my opinion, this book will be useful to many chemical engineers who have to solve problems they encounter in operating chemical process plants, both new problems as well as problems that recur after engineers thought they had been solved.

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