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## Chapter 1 : Chemstations | Offering CHEMCAD Chemical Process Simulation Software

*Separation Process Principles with Applications Using Process Simulator, 4th Edition is the most comprehensive and up-to-date treatment of the major separation operations in the chemical industry. The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice.*

Keith Roper Ralph E. Vice President and Executive Publisher: Don Fowley Acquisitions Editor: Jennifer Welter Developmental Editor: Debra Matteson Editorial Assistant: Alexandra Spicehandler Marketing Manager: Christopher Ruel Senior Production Manager: Janis Soo Assistant Production Editor: The cover was printed by Courier Westford. This book is printed on acid free paper. Our company is built on a foundation of principles that include responsibility to the communities we serve and where we live and work. In , we launched a Corporate Citizenship Initiative, a global effort to address the environmental, social, economic, and ethical challenges we face in our business. Among the issues we are addressing are carbon impact, paper specifications and procurement, ethical conduct within our business and among our vendors, and community and charitable support. For more information, please visit our website: No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections or of the United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc. These copies are licensed and may not be sold or transferred to a third party. Upon completion of the review period, please return the evaluation copy to Wiley. Return instructions and a free of charge return shipping label are available at w. Outside of the United States, please contact your local representative. Includes bibliographical references and index. ISBN hardback 1. From to , he worked for Chevron Research, where he designed petroleum and petrochemical processes, and supervised engineering research, including the development of one of the first process simulation programs and the first widely used vaporliquid equilibrium correlation. From to , he supervised rocket engine research for the Rocketdyne Division of North American Aviation on all of the engines that took man to the moon. Seider, of the Warren K. In , as part of the AIChE Centennial Celebration, he was named one of 30 authors of groundbreaking chemical engineering books. He received his B. He has authored or coauthored 72 technical articles and 12 books, the most recent one being Probabilistic Risk Management for Scientists and Engineers. An active consultant, he holds nine patents, and served on the Board of Directors of Maxxim Medical, Inc. Keith Roper is the Charles W. H er received aB. He has authored or coauthored more than 30 technical articles, one U. He was instrumental in developing one viral and three bacterial vaccine products, six process documents, and multiple bioprocess equipment designs. His current area of interest is interactions between electromagnetism and matter that produce surface waves for sensing, spectroscopy, microscopy, and imaging of chemical, biological, and physical systems at nano scales. These surface waves generate important resonant phenomena in biosensing, diagnostics and therapeutics, as well as in designs for alternative energy, optoelectronics, and micro-electromechanical systems. This page intentionally left blank This page intentionally left blank Preface to the Third Edition Separation Process Principles was first published in to provide a comprehensive treatment of the major separation operations in the chemical industry. Both equilibrium-stage and mass-transfer models were covered. Included also were chapters on thermodynamic and mass-transfer theory for separation operations. In the second edition, published in , the separation operations of ultrafiltration, microfiltration, leaching, crystallization, desublimation, evaporation, drying of solids, and simulated moving beds for adsorption were added. This third edition recognizes the growing interest of chemical engineers in the biochemical industry, and is renamed Separation Process Principlesâ€™Chemical and Biochemical Operations. In , the National Research Council NRC , at the request of the National Institutes of Health NIH , National Science Foundation NSF , and the Department of Energy DOE , released a report calling on the United States to launch a new multiagency, multiyear, multidisciplinary

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initiative to capitalize on the extraordinary advances being made in the biological fields that could significantly help solve world problems in the energy, environmental, and health areas. To help provide instruction in the important bioseparations area, we have added a third author, D. Keith Roper, who has extensive industrial and academic experience in this area. Bioseparations are corollaries to many chemical engineering separations. Accordingly, the material on bioseparations has been added as new sections or chapters as follows: An introduction to bioseparations, including a description of a typical bioseparation process to illustrate its unique features. Thermodynamic activity of biological species in aqueous solutions, including discussions of pH, ionization, ionic strength, buffers, biocolloids, hydrophobic interactions, and biomolecular reactions. Molecular mass transfer in terms of driving forces in addition to concentration that are important in bioseparations, particularly for charged biological components. These driving forces are based on the Maxwell-Stefan equations. Extraction of bioproducts, including solvent selection for organic-aqueous extraction, aqueous twophase extraction, and bioextractions, particularly in Karr columns and Podbielniak centrifuges. Microfiltration is now included in Section 3 on transport, while ultrafiltration is covered in a new section on membranes in bioprocessing. A revision of previous Sections A new section on electrophoresis for separating charged particles such as nucleic acids and proteins is added. Because of the importance of phase separations in chemical and biochemical processes, we have also added this new chapter on mechanical phase separations covering settling, filtration, and centrifugation, including mechanical separations in biotechnology and cell lysis. Other features new to this edition are: Study questions at the end of each chapter to help the reader determine if important points of the chapter are understood. Boxes around important fundamental equations. Shading of examples so they can be easily found. Answers to selected exercises at the back of the book. Increased clarity of exposition: This third edition has been completely rewritten to enhance clarity. Sixty pages were eliminated from the second edition to make room for biomaterial and updates. More examples, exercises, and references: The second edition contained examples, homework exercises, and references. This third edition contains examples, homework exercises, and more than 1, references. Throughout the book, reference is made to a number of software products. The solution to many of the examples is facilitated by the use of spreadsheets with a Solver tool, Mathematica, MathCad, or Polymath. It is particularly important that students be able to use such programs for solving nonlinear equations. They are all described at websites on the Internet. Not only are these simulators useful for designing separation equipment, but they also provide extensive physical property databases, with methods for computing thermodynamic properties of mixtures. Hopefully, those studying separations have access to such programs. This edition is divided into five parts. Part 1 consists of five chapters that present fundamental concepts applicable to all subsequent chapters. Chapter 1 introduces operations used to separate chemical and biochemical mixtures in industrial applications. Chapter 2 reviews organic and aqueous solution thermodynamics as applied to separation problems. Chapter 3 covers basic principles of diffusion and mass transfer for rate-based models. Use of phase equilibrium and mass-balance equations for single equilibrium-stage models is presented in Chapter 4, while Chapter 5 treats cascades of equilibrium stages and hybrid separation systems. The next three parts of the book are organized according to separation method. Part 2, consisting of Chapters 6 to 13, describes separations achieved by phase addition or creation. Chapters 6 through 8 cover absorption and stripping of dilute solutions, binary distillation, and ternary liquid-liquid extraction, with emphasis on graphical methods. Chapters 9 to 11 present computer-based methods widely used in process simulation programs for multicomponent, equilibrium-based models of vapor-liquid and liquid-liquid separations. Chapter 12 treats multicomponent, rate-based models, while Chapter 13 focuses on binary and multicomponent batch distillation. Part 3, consisting of Chapters 14 and 15, treats separations using barriers and solid agents. These have found increasing applications in industrial and laboratory operations, and are particularly important in bioseparations. Chapter 14 covers rate-based models for membrane separations, while Chapter 15 describes equilibrium-based and rate-based models of adsorption, ion exchange, and chromatography, which use solid or solid-like sorbents, and electrophoresis. Parte 1 de

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### Chapter 2 : Chemical Sciences E-books: Separation Process Principles 2nd Edition, Seader & Henley

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