

Chapter 2

Short Answer Problems

- The LMTD factor is required for heat exchangers when the two streams do not exhibit pure counter-current flow. Most exchangers such as S&T and other arrangements fall into this category.
- This statement is not generally true. In fact, condensers often have high heat transfer coefficients on the condensing side. One exception is for partial condensers where the majority of the condenser-side of the exchanger comprises of non-condensing gas – in this case the heat transfer coefficient on the condensing side may be limiting.
- Turbulent flow on both sides of the heat exchanger – see Table 2.9

a.	Shell-side	$h \propto Re_{0.6}$	$\frac{h}{h_{\text{base case}}} = \frac{1.5^{0.6}}{1}$	1.275 or and increase of 27.5%
b.	Tube-side	$h \propto Re_{0.8}$	$\frac{h}{h_{\text{base case}}} = \frac{1.5^{0.8}}{1}$	1.383 or and increase of 38.3%
- Laminar flow on both sides of the heat exchanger – see Table 2.9

a.	Shell-side	$h \propto Re_{0.45}$	$\frac{h}{h_{\text{base case}}} = \frac{1.5^{0.45}}{1}$	1.20 or and increase of 20%
b.	Tube-side	$h \propto Re_{0.3}$	$\frac{h}{h_{\text{base case}}} = \frac{1.5^{0.3}}{1}$	1.145 or and increase of 14.5%
- All else considered, the heat transfer coefficient for turbulent flow will be (much) higher than for laminar flow. For this reason when possible flow should be in the turbulent regime.
- Refer to Section 2.2.1.7 – three reasons for placing a fluid on the tube side of a S&T exchanger
 - 2-If the fluid is corrosive
 - 2-If the fluid causes severe fouling or scaling
 - 2-If the fluid is at a much higher pressure than the other fluid
 - 2-If the fluid has a much higher film coefficient
 - 2-If the material in contact with the fluid must be an expensive alloy

Solution Manual Chemical Process Design Integration

WJ Hussar



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Chemical Process Design and Integration Robin Smith, 2016-08-08 Written by a highly regarded author with industrial and academic experience this new edition of an established bestselling book provides practical guidance for students researchers and those in chemical engineering The book includes a new section on sustainable energy with sections on carbon capture and sequestration as a result of increasing environmental awareness and a companion website that includes problems worked solutions and Excel spreadsheets to enable students to carry out complex calculations

Integration of Process Design and Control E. Zafiriou, 2014-05-23 The existence of interactions between the design of a process and that of its control system have been known to industrial practitioners for a long time In the past decade academic research has produced methodologies and tools that begin to address the issue of designing processes that are flexible can be controlled reliably and are inherently safe This publication unites the work of academics and practitioners with interests in the integration of process design and control in order to examine the state of the art in methodologies and applications The scope covers the design of chemical plants at different stages of detail It also examines control issues from the plantwide level where for example recycles between units can be important to the specific unit level where the availability or selection of measurements might be the most important factor

Collaborative and Distributed Chemical Engineering. From Understanding to Substantial Design Process Support Manfred Nagl, Wolfgang Marquardt, 2008-07-23 IMPROVE stands for Information Technology Support for Collaborative and Distributed Design Processes in Chemical Engineering and is a large joint project of research institutions at RWTH Aachen University This volume summarizes the results after 9 years of cooperative research work The focus of IMPROVE is on understanding formalizing evaluating and consequently improving design processes in chemical engineering In particular IMPROVE focuses on conceptual design and basic engineering where the fundamental decisions concerning the design or redesign of a chemical plant are undertaken Design processes are analyzed and evaluated in collaboration with industrial partners

Integrated Design and Simulation of Chemical Processes Alexandre C. Dimian, Costin Sorin Bildea, Anton A. Kiss, 2014-09-18 This comprehensive work shows how to design and develop innovative optimal and sustainable chemical processes by applying the principles of process systems engineering leading to integrated sustainable processes with green attributes Generic systematic methods are employed supported by intensive use of computer simulation as a powerful tool for mastering the complexity of physical models New to the second edition are chapters on product design and batch processes with applications in specialty chemicals process intensification methods for designing compact equipment with high energetic efficiency plantwide control for managing the key factors affecting the plant dynamics and operation health safety and environment issues as well as sustainability analysis for achieving high environmental performance All chapters are completely rewritten or have been revised This new edition is suitable as teaching material for Chemical Process and Product Design courses for graduate MSc students being compatible

with academic requirements world wide The inclusion of the newest design methods will be of great value to professional chemical engineers Systematic approach to developing innovative and sustainable chemical processes Presents generic principles of process simulation for analysis creation and assessment Emphasis on sustainable development for the future of process industries , **Analysis, Synthesis and Design of Chemical Processes** Richard Turton, Richard C.

Bailie, Wallace B. Whiting, Joseph A. Shaeiwitz, 2008-12-24 The Leading Integrated Chemical Process Design Guide Now with New Problems New Projects and More More than ever effective design is the focal point of sound chemical engineering Analysis Synthesis and Design of Chemical Processes Third Edition presents design as a creative process that integrates both the big picture and the small details and knows which to stress when and why Realistic from start to finish this book moves readers beyond classroom exercises into open ended real world process problem solving The authors introduce integrated techniques for every facet of the discipline from finance to operations new plant design to existing process optimization This fully updated Third Edition presents entirely new problems at the end of every chapter It also adds extensive coverage of batch process design including realistic examples of equipment sizing for batch sequencing batch scheduling for multi product plants improving production via intermediate storage and parallel equipment and new optimization techniques specifically for batch processes Coverage includes Conceptualizing and analyzing chemical processes flow diagrams tracing process conditions and more Chemical process economics analyzing capital and manufacturing costs and predicting or assessing profitability Synthesizing and optimizing chemical processing experience based principles BFD PFD simulations and more Analyzing process performance via I O models performance curves and other tools Process troubleshooting and debottlenecking Chemical engineering design and society ethics professionalism health safety and new green engineering techniques Participating successfully in chemical engineering design teams Analysis Synthesis and Design of Chemical Processes Third Edition draws on nearly 35 years of innovative chemical engineering instruction at West Virginia University It includes suggested curricula for both single semester and year long design courses case studies and design projects with practical applications and appendixes with current equipment cost data and preliminary design information for eleven chemical processes including seven brand new to this edition **Sugarcane** Alexandre De Oliveira, 2018-05-16 Sugarcane *Saccharum officinarum* L is considered one of the major bioenergy crops grown globally Thus sugarcane research to improve sustainable production worldwide is a vital task of the scientific community to address the increasing demands and needs for their products especially biofuels In this context this book covers the most recent research areas related to sugarcane production and its applications It is composed of 14 chapters divided into 5 sections that highlight fundamental insights into the current research and technology on this crop Sugarcane Technology and Research intends to provide the reader with a comprehensive overview in technology production and applied and basic research of this bioenergy species approaching the latest developments on varied topics related to this crop **Advanced Control of Chemical Processes** 1994 D.

Bonvin,2014-05-23 This publication brings together the latest research findings in the key area of chemical process control including dynamic modelling and simulation modelling and model validation for application in linear and nonlinear model based control nonlinear model based predictive control and optimization to facilitate constrained real time optimization of chemical processes statistical control techniques major developments in the statistical interpretation of measured data to guide future research knowledge based v model based control the integration of theoretical aspects of control and optimization theory with more recent developments in artificial intelligence and computer science *Ludwig's Applied Process Design for Chemical and Petrochemical Plants Incorporating Process Safety Incidents* A. Kayode Coker,2024-07-10 Ludwig s Applied Process Design for Chemical and Petrochemical Plants Incorporating Process Safety Incidents is ever evolving starting with the first edition some 60 years ago The volumes in this fifth edition provide improved techniques and fundamental design methodologies to guide the practicing engineer in designing process equipment and applying chemical processes to the properly detailed hardware As indicative of the new title process safety incidents are incorporated in many of the chapters reviewing the root causes and how these could be mitigated in future Like its predecessor this new edition continues to present updated information for achieving optimum operational and process conditions and to avoid problems caused by inadequate sizing and lack of internally detailed hardware The volumes provide both fundamental theories where applicable and direct application of these theories to applied equations essential in the design effort This approach in presenting design information is essential for troubleshooting process equipment and in executing system performance analysis Volume 1B continues to cover mixing of liquids process safety and pressure 1 relieving devices metallurgy and corrosion and process optimization It builds upon Ernest E Ludwig s classic text to further enhance its use as a chemical engineering process design manual of methods and proven fundamentals This new edition includes new content on three phase separation mixing of liquids ejectors and mechanical vacuum systems process safety and pressure relieving devices metallurgy and corrosion and optimization of chemical process blending Some chapters review pressure relieving devices and provide case studies for process safety incidents which are well illustrated from US Chemical Safety Hazard Investigation Board www.csb.gov Finally this book contains a glossary of Petroleum and Petrochemical Terminologies and Physical and Chemical Characteristics of Major Hydrocarbons Provides improved design manual for methods and proven fundamentals of process design with related data and charts Covers complete range of basic day to day petrochemical operation topics Extensively revised with new material added on three phase separation metallurgy and corrosion Process safety management HAZOP and hazard analyses and optimization of chemical process blending Presents many examples using Honeywell UniSim Design software developed and executable computer programs and Excel spreadsheet programs Includes case studies of process safety incidents guidance for troubleshooting and checklists Includes Software of Conversion Table and 30 process data sheets in excel format The Art of Chemical Process Design G. L. Wells,L. M. Rose,1986

Illustrating all aspects of chemical process design this book demonstrates process synthesis material and heat balancing by manual and computerised methods the use of flowsheeting programs and their construction flowsheet development plant safety process economics and project engineering The reader is introduced to each of the key areas and is given further information to follow these up The process is developed as a whole entity with appropriate partitioning of certain tasks In recent years there has been increased activity in process synthesis particularly in the development of heat exchanger networks and distillation trains Various chapters describe and develop these and other areas of interest In particular note is made of the need to select appropriate unit operations for given process tasks Traditional manual methods of material and heat balancing introduce the computerised methods used in flowsheeting programs Plant safety continues to generate professional and public interest as catastrophes continue to occur The recent developments in this area are described

Chemical Process Analysis and Design Using Computers Working Party on the Use of Computers in Chemical Engineering. Symposium, 1982 **Chemical Process Design** Robin Smith, 1995 Chemical process design involves the invention or synthesis of a process to transform raw materials into a desired product Using a minimum of mathematics this book offers chemical engineers a complete guide to selecting connecting the steps for a well designed process Flowsheet synthesis the choice of reactor separator distillation sequencing economic trade offs are explored in detail Special emphasis is placed on energy efficiency waste minimization health safety considerations with worked examples case studies presented to illustrate important points Principles and Applications of Mass Transfer Jaime Benitez, 2022-12-13 Principles and Applications of Mass Transfer Core textbook teaching mass transfer fundamentals and applications for the design of separation processes in chemical biochemical and environmental engineering Principles and Applications of Mass Transfer teaches the subject of mass transfer fundamentals and their applications to the design of separation processes with enough depth of coverage to guarantee that students using the book will at the end of the course be able to specify preliminary designs of the most common separation process equipment Reflecting the growth of biochemical applications in the field of chemical engineering the fourth edition expands biochemical coverage including transient diffusion environmental applications electrophoresis and bioseparations Also new to the fourth edition is the integration of Python programs which complement the Mathcad programs of the previous edition On the accompanying instructor's website the online appendices contain a downloadable library of Python and Mathcad programs for the example problems in each chapter A complete solution manual for all end of chapter problems both in Mathcad and Python is also provided Some of the topics covered in Principles and Applications of Mass Transfer include Molecular mass transfer covering concentrations velocities and fluxes the Maxwell Stefan relations and Fick's first law for binary mixtures The diffusion coefficient covering diffusion coefficients for binary ideal gas systems dilute liquids and concentrated liquids Convective mass transfer covering mass transfer coefficients dimensional analysis boundary layer theory and mass and heat transfer analogies Interphase mass transfer

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26th European Symposium on Computer Aided Process Engineering, 2016-06-17 26th European Symposium on Computer Aided Process Engineering contains the papers presented at the 26th European Society of Computer Aided Process Engineering ESCAPE Event held at Portoro Slovenia from June 12th to June 15th 2016 Themes discussed at the conference include Process product Synthesis Design and Integration Modelling Numerical analysis Simulation and Optimization Process Operations and Control and Education in CAPE PSE Presents findings and discussions from the 26th European Society of Computer Aided Process Engineering ESCAPE Event

Computer Simulated Plant Design for Waste Minimization/Pollution Prevention Stan Bumble, 2020-02-10 Full of examples based on case studies from a variety of industries Computer Simulated Plant Design for Waste Minimization Pollution Prevention discusses preventing pollution and minimizing waste using computer simulation programs The author examines the computer technologies used in the field including the design and analysis of computer aided flow sheets With this book readers will understand how to use computer technology to design plants that generate little or no pollution and how to use information generated by computer simulations for technical data in proposals and presentations and as the basis for making policy decisions

Scientific and Technical Aerospace Reports, 1995

27th European Symposium on Computer Aided Process Engineering, 2017-09-21 27th European Symposium on Computer Aided Process Engineering Volume 40 contains the papers presented at the 27th European Society of Computer Aided Process Engineering ESCAPE event held in Barcelona October 1 5 2017 It is a valuable resource for chemical engineers chemical process engineers researchers in industry and academia students and consultants for chemical industries Presents findings and discussions from the 27th European Society of Computer Aided Process Engineering ESCAPE event

Chemical Technicians Mohamed Elzagheid, 2023-07-24 This book for chemical technicians contains a variety of skills that chemical technicians and technicians who work in chemical plants should develop as part of their successful experience Many of these competencies were unintentionally addressed in other resources in a dispersed way across chapters in various textbooks and internet resources but many others were not The book also provides a brief overview of the tasks that various chemical laboratory technicians must perform as part of their employment It also includes a thorough explanation of the sampling techniques chemical analysis and a description of the various tools and methods used in chemical labs Additionally the book covers information management systems and good practices in laboratories as well as how these have allowed and facilitated best practices in laboratories and the gathering of data that improves technicians

experience and knowledge Finally some advice on using lab glassware laboratory emergency first aid and a short description of the chemicals that chemical technicians frequently use are provided

AI and Robotic Technology in Materials and Chemistry Research Xi Zhu, 2024-11-06 A singular resource for researchers seeking to apply artificial intelligence and robotics to materials science In *AI and Robotic Technology in Materials and Chemistry Research* distinguished researcher Dr Xi Zhu delivers an incisive and practical guide to the use of artificial intelligence and robotics in materials science and chemistry Dr Zhu explains the principles of AI from the perspective of a scientific researcher including the challenges of applying the technology to chemical and biomaterials design He offers concise interviews and surveys of highly regarded industry professionals and highlights the interdisciplinary and broad applicability of widely available AI tools like ChatGPT The book covers computational methods and approaches from algorithms models and experimental data systems and includes case studies that showcase the real world applications of artificial intelligence and lab automation in a variety of scientific research settings from around the world You ll also find A thorough introduction to the challenges currently being faced by chemists and materials science researchers Comprehensive explorations of autonomous laboratories powered by artificial intelligence and robotics Practical discussions of a blockchain powered anti counterfeiting experimental data system in an autonomous laboratory In depth treatments of large language models as applied to autonomous materials research Perfect for materials scientists analytical chemists and robotics engineers *AI and Robotic Technology in Materials and Chemistry Research* will also benefit analytical and pharmaceutical chemists computer analysts and other professionals and researchers with an interest in artificial intelligence and robotics

Second International Conference on Chemical Engineering Education D.C. Freshwater, R.M. Blunden, J.R. Flower, 2013-09-11 Second International Conference on Chemical Engineering Education presents the situation in chemical engineering education in Germany Hungary Spain Japan and in the United States This book depicts an awareness of the problems of professional education together with a wide spectrum of opinions on their solution Organized into 39 chapters this book begins with an overview of the actual situation of chemical engineering education program in Spain This text then examines the detailed formalities of chemical engineering in secondary schools Other chapters consider the change in chemical engineering education in Japan due to the change of chemical industries as well as by a great change of students attitude This book discusses as well the curriculum proposal for the education of undergraduate and graduate levels as well as foreign students education The final chapter reviews the European situation of chemical engineering education system This book is a valuable resource for teachers and students of chemical engineering

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