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Coulson & Richardson's Chemical Engineering -- Coulson and Richardson's Chemical Engineering: Volume 3A: Chemical and Biochemical Reactors and Reaction Engineering -- Copyright -- Contents -- List of Contributors -- About Prof. Coulson -- About Prof. Richardson -- Preface -- Introduction -- 1 - Reactor Design-General Principles -- 1.1 Basic Objectives in Design of a Reactor -- 1.1.1 By-products and Their Economic Importance -- 1.1.2 Preliminary Appraisal of a Reactor Project -- 1.2 Classification of Reactors and Choice of Reactor Type -- 1.2.1 Homogeneous and Heterogeneous Reactors -- 1.2.2 Batch Reactors and Continuous Reactors -- 1.2.3 Variations in Contacting Pattern-Semibatch Operation -- 1.2.4 Influence of Heat of Reaction on Reactor Type -- 1.2.4.1 Adiabatic Reactors -- 1.2.4.2 Reactors With Heat Transfer -- 1.2.4.3 Autothermal Reactor Operation -- 1.3 Choice of Process Conditions -- 1.3.1 Chemical Equilibria and Chemical Kinetics -- 1.3.2 Calculation of Equilibrium Conversion -- 1.3.3 Ultimate Choice of Reactor Conditions -- 1.4 Material and Energy Balances -- 1.4.1 Material Balance and the Concept of Rate of Generation of a Species -- 1.4.2 Energy Balance -- 1.5 Chemical Kinetics and Rate Equations -- 1.5.1 Definition of Order of Reaction and Rate Constant -- 1.5.2 Influence of Temperature: Activation Energy -- 1.5.3 Rate Equations and Reaction Mechanism -- 1.5.4 Reversible Reactions -- 1.5.5 Experimental Determination of Kinetic Constants -- 1.6 Batch Reactors -- 1.6.1 Calculation of Reaction Time: Basic Design Equation -- 1.6.2 Reaction Time-Isothermal Operation -- 1.6.3 Maximum Production Rate -- 1.6.4 Reaction Time-Nonisothermal Operation -- 1.6.5 Adiabatic Operation -- 1.6.6 Kinetics From Batch Reactor Data -- 1.6.6.1 Differential Method -- 1.6.6.2 Integral Method. 1.6.6.3 Differential Versus Integral Method: Comparison -- 1.6.6.4 Fractional Life Method -- 1.6.6.5 Kinetics of Gas-Phase Reactions From Pressure Measurements -- 1.7 Tubular Flow Reactors -- 1.7.1 Basic Design Equations for a Tubular Reactor -- 1.7.2 Tubular Reactors-Nonisothermal Operation -- 1.7.3 Pressure Drop in Tubular Reactors -- 1.7.4 Kinetic Data From Tubular Reactors -- 1.8 Continuous Stirred Tank Reactors -- 1.8.1 Assumption of Ideal Mixing: Residence Time -- 1.8.2 Design Equations for Continuous Stirred Tank Reactors -- 1.8.3 Graphical Methods -- 1.8.4 Autothermal Operation -- 1.8.5 Kinetic Data From Continuous Stirred Tank Reactors -- 1.9 Comparison of Batch, Tubular, and Stirred Tank Reactors for a Single Reaction: Reactor Output -- 1.9.1 Batch Reactor and Tubular Plug Flow Reactor -- 1.9.2 Continuous Stirred Tank Reactor -- 1.9.2.1 One Tank -- 1.9.2.2 Two Tanks -- 1.9.3 Comparison of Reactors -- 1.10 Comparison of Batch, Tubular, and Stirred Tank Reactors for Multiple Reactions: Reactor Yield -- 1.10.1 Types of Multiple Reactions -- 1.10.2 Yield and Selectivity -- 1.10.3 Reactor Type and Backmixing -- 1.10.4 Reactions in Parallel -- 1.10.4.1 Requirements for High Yield -- 1.10.4.1.1 Reactant Concentration and Reactor Type -- 1.10.4.1.2 Pressure in Gas-Phase Reactions -- 1.10.4.1.3 Temperature of Operation -- 1.10.4.1.4 Choice of Catalyst -- 1.10.4.2 Yield and Reactor Output -- 1.10.5 Reactions in Parallel-Two Reactants -- 1.10.6 Reactions in Series -- 1.10.6.1 Batch Reactor or Tubular Plug Flow Reactor -- 1.10.6.2 Continuous Stirred Tank Reactor-One Tank -- 1.10.6.3 Reactor Comparison and Conclusions -- 1.10.6.3.1 Reactor Type -- 1.10.6.3.2 Conversion in Reactor -- 1.10.6.3.3 Temperature -- 1.10.6.3.4 General Conclusions -- 1.10.7 Reactions in Series-Two Reactants -- 1.11 Appendix: Simplified Energy Balance Equations for Flow Reactors. Nomenclature -- References -- Further Reading -- 2 - Flow Characteristics of Reactors-Flow Modeling -- 2.1 Nonideal Flow and Residence Time Distribution -- 2.1.1 Types of Nonideal Flow Patterns

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4.1.6.3 Well-Mixed Bubble Column Reactors: Gas-Liquid Flow Patterns and Mass Transfer.

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Sommario/riassunto

Coulson and Richardson's Chemical Engineering: Volume 3A: Chemical and Biochemical Reactors and Reaction Engineering, Fourth Edition, covers reactor design, flow modelling, gas-liquid and gas-solid reactions and reactors.- Captures content converted from textbooks into fully revised reference material- Includes content ranging from foundational through technical- Features emerging applications, numerical methods and computational tools

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