

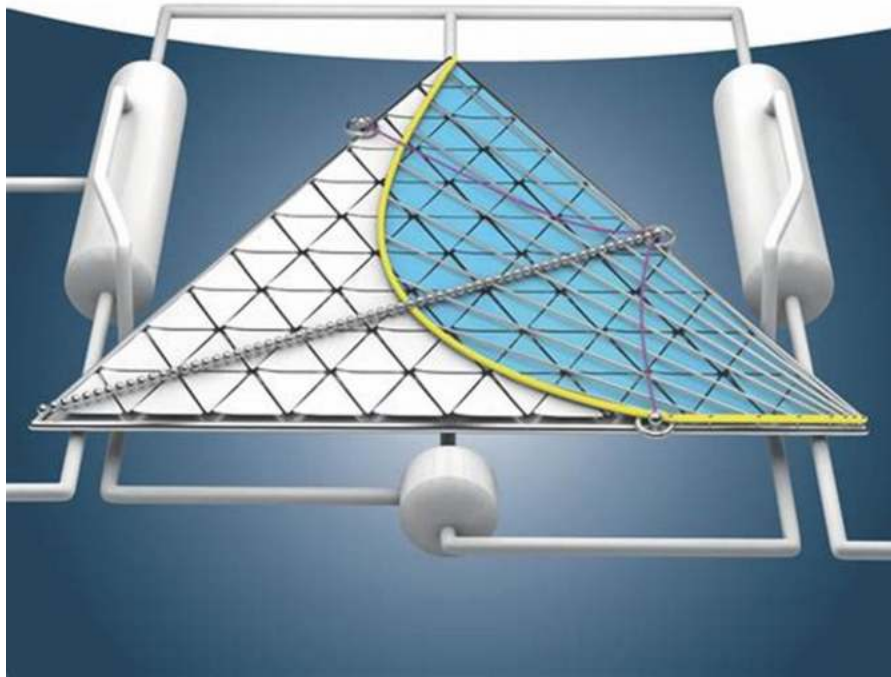
Chemical Thermodynamics for Process Simulation: Unleashing the Power of Energy

WILEY-VCH

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Chemical Thermodynamics for Process Simulation

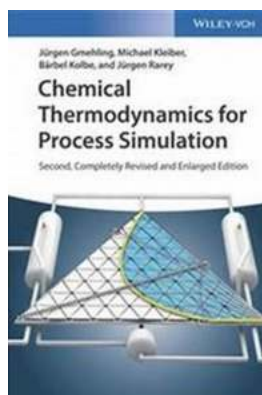
Second, Completely Revised and Enlarged Edition



Chemical thermodynamics is a fascinating discipline that plays a crucial role in understanding the behavior of chemical systems, especially in process simulation. By harnessing the power of energy and exploring complex reactions, this field lays the foundation for designing efficient industrial processes.

The Basics of Chemical Thermodynamics

Chemical thermodynamics is the study of the interplay between energy and chemical reactions. It deals with the energy changes associated with chemical processes, helping us understand how a system reaches equilibrium and predicting the conditions under which reactions occur.



Chemical Thermodynamics for Process

Simulation by Michael Kleiber (2nd Edition, Kindle Edition)

★★★★☆ 4.7 out of 5

Language	: English
File size	: 47114 KB
Text-to-Speech	: Enabled
Enhanced typesetting	: Enabled
Word Wise	: Enabled
Print length	: 1292 pages
Lending	: Enabled



At the heart of chemical thermodynamics lies the laws of thermodynamics, which govern the behavior of energy in an isolated system. These fundamental principles guide us in understanding and predicting the behavior of chemicals at different temperatures, pressures, and concentrations.

The Role of Chemical Thermodynamics in Process Simulation

Process simulation involves modeling and simulating chemical processes to optimize their design, operation, and control. It allows engineers and scientists to analyze and predict the behavior of industrial systems, helping in the development of efficient and sustainable processes.

Chemical thermodynamics provides the necessary tools and concepts to simulate and understand these complex processes. By incorporating the laws of thermodynamics into process models, engineers can accurately predict how a process will behave under different operating conditions.

Thermodynamic data, such as heat capacities, enthalpies, and Gibbs free energies, are essential inputs for process simulations. These data, often gathered through experiments or calculated using computational methods, enable engineers to evaluate the feasibility and efficiency of a process.

Making Sense of Equilibrium: Reaction Affinities

Chemical reactions tend to proceed in a particular direction until they reach a state of equilibrium. Understanding the concept of reaction affinities is crucial for predicting the equilibrium composition of a system and optimizing the conditions for desired reactions.

Reaction affinities, commonly represented by equilibrium constants, describe the extent to which a chemical reaction occurs. By analyzing these constants at different temperatures and pressures, engineers can determine the conditions that favor the formation or consumption of specific products.

Process simulations utilize reaction affinities to model the kinetics and thermodynamics of reactions. Engineers can evaluate various scenarios to maximize yield, minimize waste, and achieve desired product specifications.

Unleashing the Power of Energy: Entropy and Entropy Balances

Entropy, often referred to as the measure of disorder, is another crucial concept in chemical thermodynamics. It allows us to quantify and predict the spontaneous direction of reactions and the availability of energy within a system.

Entropy balances play a vital role in analyzing the energy conversion and efficiency of chemical processes. By considering the entropy changes during reactions and across different process units, engineers can optimize energy usage and design thermodynamically efficient systems.

Advanced Techniques: Phase Equilibrium Calculations

In addition to equilibrium constants and entropy balances, chemical thermodynamics employs advanced techniques to model phase equilibria. This is particularly important in industries such as petroleum refining, where the separation and purification of different compounds rely on phase behavior.

Phase equilibrium calculations involve predicting the distribution of components between different phases (e.g., liquid-vapor, liquid-liquid). These predictions aid in the design and optimization of separation processes like distillation, absorption, and extraction.

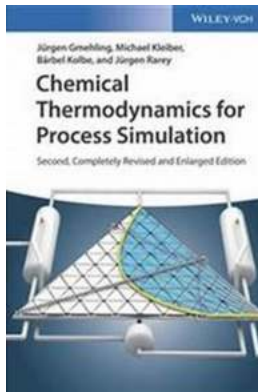
Chemical thermodynamics serves as the backbone of process simulation, unlocking the potential of energy in designing efficient industrial operations. By understanding the basics of thermodynamics, incorporating equilibrium concepts, and utilizing advanced techniques, engineers can optimize processes, minimize costs, and reduce environmental impact.

Whether it is developing sustainable energy systems, improving chemical reactions, or designing separation processes, chemical thermodynamics opens the door to a world of possibilities. So, let's embrace this fascinating field and unleash the power of energy in process simulation!

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The only textbook that applies thermodynamics to real-world process engineering problems

This must-read for advanced students and professionals alike is the first book to demonstrate how chemical thermodynamics work in the real world by applying them to actual engineering examples. It also discusses the advantages and disadvantages of the particular models and procedures, and explains the most important models that are applied in process industry. All the topics are illustrated with examples that are closely related to practical process simulation problems. At the end of each chapter, additional calculation examples are given to enable readers to extend their comprehension.

Chemical Thermodynamics for Process Simulation instructs on the behavior of fluids for pure fluids, describing the main types of equations of state and their abilities. It discusses the various quantities of interest in process simulation, their correlation, and prediction in detail. Chapters look at the important terms for the description of the thermodynamics of mixtures; the most important models and routes for phase equilibrium calculation; models which are applicable to a wide variety of non-electrolyte systems; membrane processes; polymer thermodynamics; enthalpy of reaction; chemical equilibria, and more.

- Explains thermodynamic fundamentals used in process simulation with solved examples
- Includes new chapters about modern measurement techniques, retrograde condensation, and simultaneous description of chemical equilibrium
- Comprises numerous solved examples, which simplify the understanding of the often complex calculation procedures, and discusses advantages and disadvantages of models and procedures
- Includes estimation methods for thermophysical properties and phase equilibria thermodynamics of alternative separation processes
- Supplemented with MathCAD-sheets and DDBST programs for readers to reproduce the examples

Chemical Thermodynamics for Process Simulation is an ideal resource for those working in the fields of process development, process synthesis, or process optimization, and an excellent book for students in the engineering sciences.



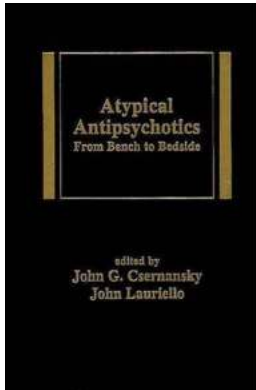
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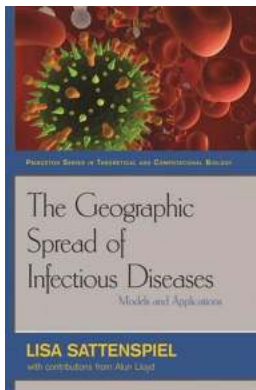
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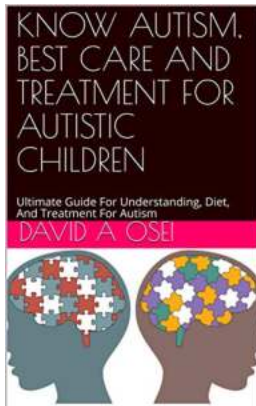
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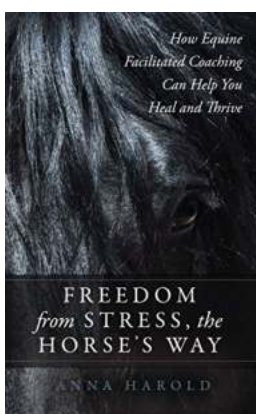
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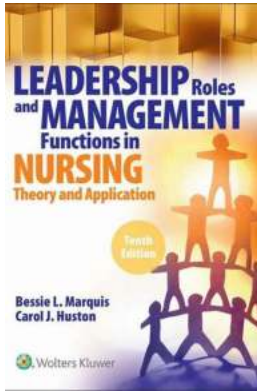
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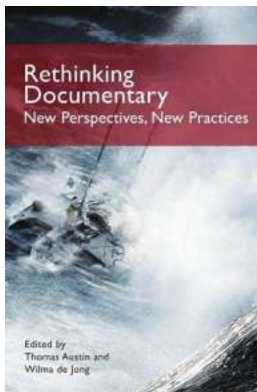
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