PREFACE

Chemical and biological engineers create and develop processes to change raw materials into the products that society depends on, such as food, chemicals, pharmaceuticals, paper, plastics, and personal care products. Chemical and process engineers help to manage natural resources, protect the environment, control health and safety procedures, and recycle materials while developing and managing the processes, which make the products we use. Knowledge in the fields of chemistry, physics, biology, mathematics, and engineering sciences is necessary in order to apply processes developed on a laboratory scale and to adapt them for production on an industrial scale.

Biological and chemical engineering is a multidisciplinary research area in the cross field between biology, chemistry, physics, and engineering. It encompasses major cross-disciplinary areas such as disease and health, materials, environmental technologies, and food technology. Biological engineering is an interdisciplinary application of engineering principles to analyze biological systems and to expand the knowledge of chemical engineering into the biochemical realm.

Chemical engineering is an optimal combination of the molecular sciences (chemistry and biology), the physical sciences (physical chemistry and physics), the analytical sciences (math and computer programming), and engineering. Moreover, chemical engineering provides students with real-world experience through laboratory classes, hands-on operation of pilot-scale equipment, and research projects that result in clean energy production and medical applications.

Chemical and biological engineering integrates chemistry and biology and uses this broad foundation along with engineering fundamentals to study the synthesis of new processes and products.

Chemical and biological engineering uses process engineering, transforms chemical and biological materials into high-value products and services, in a safe and cost-effective way. Chemical and biological engineers bring about the large-scale benefits of advances in chemistry, biotechnology, materials, and environmental sustainability to the real world.

Chemical or biological engineers could play a vital role in the creation and production of new medicines, nutritious foods, novel materials, better waste treatment methods, and a sustainable global future.

Research into bioprocess engineering is a major part of the wider chemical and biological engineering program and includes fermentation of functional foods, production of high-value pharmaceuticals, and bioconversion of waste into value-added chemicals.

This book is designed for exploring interdisciplinary research progress in life sciences, agriculture, food processing, and environment. It is also designed to accommodate students and researchers with broad interests within the field of chemical and biological engineering.

This research-oriented book is based on experimental methods and is aimed at the design, development, operation, monitoring, control, and optimization of chemical, physical, and biological processes.

This new research-oriented book provides innovative chapters covering the growth of educational, scientific, and industrial research activities among chemical and biological engineers and provides a medium for mutual communication between international academia and the industry. This book publishes significant research reporting new methodologies and important applications and latest coverage of physical chemistry and the development of new experimental methods. This collection presents to the reader a broad spectrum of chapters in the various branches of chemical and biological engineering, which demonstrate important developments in these rapidly changing fields. Case studies are included in some chapters, building a real-world connection. These case studies form a common thread throughout the book, motivating the reader and offering enhanced understanding.