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Process Intensification and Integration for Sustainable Design

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Dominic C. Y. Foo would like to dedicate this book to his wife Cecilia and kids Irene, Jessica, and Helena. Mahmoud M. El-Halwagi would like to dedicate this book to his parents, his wife Amal, and sons Omar and Ali.

Preface

The chemical process industry involves a broad spectrum of manufacturing sectors and facilities around the world. With increased global competition, escalating environmental concerns, dwindling energy, and material resources, it is imperative for industry to seek continuous process improvement. Process intensification and integration are among the most effective strategies leading to improved process designs and operations with enhancement in cost effectiveness, resource conservation, efficiency, safety, and sustainability. Process integration is a holistic framework for designing and operating industrial facilities with an overarching focus on the interconnected nature of the various pieces of equipment, mass, energy, and functionalities. On the other hand, process intensification involves efficiency improvement through effective strategies such as increasing throughput for the same physical size or decreasing the physical size for the same throughput, coupling units and phenomena, enhancing mass and energy utilization, and mitigating environmental impact. There is a natural synergism between process integration and intensification. For instance, mass and energy integration (two key pillars of process integration) are ideal approaches for enhancing mass and energy intensities.

This book is intended to provide a compilation of the various recent developments in the fields of *process intensification* and *process integration* with focus on enhancing sustainability of the chemical processes and products. It includes state-of-the-art contributions by world-renowned leaders in process intensification and integration. It strikes a balance between fundamental techniques and industrial applications. Both academic researchers and industrial practitioners will be able to use this book as a guide to optimize their respective plants and processes.

The 14 chapters in the book are classified into two broad areas: process intensification and process integration. As expected, several intensification chapters include integration and vice versa. These chapters may be read independently of each other, or with no particular sequence. Synopses of all chapters are given as follows.