Introduction

PART I

There is an old adage, "If you do not know where you are going, any path will do." In other words, a good knowledge of the goal is essential before one addresses the details of a task. Engineers should keep this adage in mind when studying a new, complex topic, because they can easily become too involved in the details and lose track of the purpose of learning the topic. Process control is introduced in this first, brief part of the book so that the reader will understand the overall goal of process automation and appreciate the need for the technical rigor of the subsequent parts.

The study of process control introduces a new perspective to the mastery of process systems: *dynamic operation.* Prior engineering courses in the typical curriculum concentrate on steady-state process behavior, which simplifies early study of processes and provides a basis for establishing proper equipment sizes and determining the best constant operating conditions. However, no process operates at a steady state (with all time derivatives exactly zero), because essentially all external variables, such as feed composition or cooling medium temperature, change. Thus, the process design must consider systems that respond to external disturbances and maintain the process operation in a safe region that yields high-quality products in a profitable manner. The emphasis on good operation, achieved through proper plant design and automation, requires a thorough knowledge of the dynamic operation, which is introduced in this part and covered thoroughly in Part II.

In addition, the study of process control introduces a major new concept: *feedback control.* This concept is central to most automation systems that monitor a process and adjust some variables to maintain the system at (or near) desired conditions. Feedback is one of the topics studied and employed by engineers of most

subdisciplines, and chemical engineers apply these principles to heat exchangers, mass transfer equipment, chemical reactors, and so forth. Feedback control is introduced in this part and covered in detail in Part III.

Finally, the coverage of these topics in this part is qualitative, because it precedes the introduction of mathematical tools. This qualitative presentation is not a shortcoming; rather, the direct and uncomplicated presentation provides a clear and concise discussion of some central ideas in the book. The reader is advised to return to Part I to clarify the goals before beginning each new part of the book.