Multivariable Control

PART V

In this part we continue the trend of addressing increasingly more complex process control systems. Although some of the control systems in Part IV involved more than one measured variable, we considered these to be single-variable control because they had the ultimate objective of maintaining only one variable near its set point. By contrast, *multivariable control* involves the objective of maintaining several controlled variables at independent set points.

The simple chemical reactor process shown in Figure V.1 is considered first to introduce the concept of a multivariable process. The control objectives depend on the goals of the entire plant and of the design of associated equipment, but typical objectives would be to control the level, temperature, and outlet concentration at independent set points, which would be achieved by adjusting selected manipulated variables in the process. Again, the variability of the controlled variables is reduced through actions that increase the variability of the manipulated variables. In Part V the complexity of multivariable systems is reduced by assuming (for the most part) that the process design, measurements, and final elements cannot be changed; thus, the process dynamics and control calculations are addressed. These restrictions will be relieved in Part VI, when process control design is addressed.

Control of multivariable systems requires more complex analysis than that of single-variable systems, as summarized in Table V.1. Fortunately, essentially all methods and results learned for single-variable systems are applicable to multivariable systems. Thus, aspects of a single-variable system that make it easy or difficult to control have generally the same effect for multivariable systems. However, in multivariable systems new characteristics due to *interaction* must be