

# Multiloop Control: Performance Analysis

## CHAPTER

# 21

### 21.1 ■ INTRODUCTION

Multiloop process control systems were introduced in the previous chapter, where some important effects of interaction on steady-state and dynamic behavior were explained, and a quantitative measure of interaction—the relative gain—was presented. This understanding of interaction is now applied in the analysis of multiloop control performance and design. Three main facets of control performance analysis are presented and applied to the design of multiloop systems. The first is loop pairing: deciding the controlled and manipulated variables for each single-loop controller in a multiloop system. The second facet is controller tuning to achieve the desired performance, as well as to maintain stability. The third facet involves enhancements to the PID control calculations that can improve control performance while retaining the simplicity of the multiloop control strategy in selected applications.

As in the single-loop case, the first step is to define control objectives thoroughly. The main aspects of multivariable control performance are presented in the following list. Several are the same as for single-loop systems; however, items 2, 5, and 6 are new, and item 4 can assume even greater importance.

1. *Dynamic behavior of the controlled variables.* The control system should provide the desired control performance for expected disturbances and set point changes. The performance can be defined by any appropriate measures presented in Chapter 9 (e.g., IAE and decay ratio).
2. *Relative importance among controlled variables.* The multiloop control structure should be compatible with the relative importance of various controlled