

Single-Variable Model Predictive Control

CHAPTER

19

19.1 ■ INTRODUCTION

Most modifications to single-loop feedback control presented in this part of the book have used additional measurements to improve control performance. In contrast, the emphasis in this chapter will be on an alternative to the proportional-integral-derivative (PID) feedback algorithm. The PID controller was introduced in Chapter 8 by explaining the features associated with each mode and by demonstrating that the combined modes could provide reasonable control performance. In subsequent chapters the applications of PID in feedback, cascade, and combined feedforward/feedback have indicated that the adoption of PID as the standard algorithm in the 1940s was an appropriate choice. Perhaps the most remarkable feature of the PID is the success of this single algorithm in so many different applications.

However, the development of the PID lacked a fundamental structure from which the algorithm could be derived, limitations could be identified, and enhancements could be developed. In this chapter a general development is presented that gives great insight into the roles of both the control algorithm and the process in the behavior of feedback systems. This development also provides a method for tailoring the feedback control algorithm to each specific application. Because a model of the process is an integral part of the control algorithm, the controller equation structure depends on the process model, in contrast to the PID controller, which has only one equation structure.

Although the control algorithm is different, the feedback concept is unchanged, and the selection criteria for manipulated and controlled variables are the same as explained in Chapters 1 and 7. In fact, the algorithms presented in this chapter