

# Level and Inventory Control

## CHAPTER

# 18

### 18.1 ■ INTRODUCTION

Level control is extremely important for the successful operation of most chemical plants, because it is through the proper control of flows and levels that the desired production rates and inventories are achieved. Since some level processes are non-self-regulatory (i.e., unstable), automatic control is required to prevent the levels from overflowing or emptying completely when flow disturbances occur. Furthermore, the performance of some processes, such as chemical reactors, depends critically on the residence time in the vessel, which in turn depends on the level. In addition, the study of level control is helpful at this point because it emphasizes the importance of *control objectives* in controller design and tuning. Contrary to the situation with most control loops, the behavior of the manipulated variable—a flow in or out of the vessel—often is of as much importance as is the controlled variable itself! Thus, we have to modify some of the approaches developed in previous chapters to achieve the desired dynamic performance. As should be expected, these modifications are based on the principles of dynamic modelling and control system stability and performance.

In this chapter we will first review the types of inventory processes and their process dynamics. Liquid levels are used throughout this chapter, but the results are also applicable to the control of inventories of solids and gases, although the process equipment and sensors must be modified. As we will see, level is one of the few industrially important processes for which the closed-loop dynamic response can be determined analytically. Based on this analysis, the dynamic performances