

ABOUT THE LABORATORY EXERCISES

A set of laboratory exercises accompanies **PC-ControlLAB**. There are five exercises covering PID controller tuning, one or more exercises for each of the control strategies, plus additional exercises for selected process models and applications. In addition, there is one exercise using **MPC-ControlLAB**, a model predictive control simulation and demonstration program.

The complete set of exercises covers the full spectrum of topics presented in most process control seminars, and in general follows the order of presentation of the topics. The first exercise covers process dynamic characteristics, followed by control valve and valve actuator characteristics. Following this are characteristics of typical of typical flow, temperature, pressure and liquid level control loops.

The next set of exercises covers feedback control, including an examination of PID controller characteristics, conventional open loop and closed loop tuning, followed by a unique tuning method called “improving as found tuning”. Because of the different nature of liquid level control loops from typical temperature, pressure and flow loops, a separate exercise covers tuning of liquid level control loops,. This set of exercises is concluded with an exercise covering scheduled tuning.

The next set of exercises covers advanced regulatory control topics, including ratio, cascade, feedforward, override, decoupling and model-based control techniques. Some of these exercises are intended for instructor-led demonstration, rather than hands-on practice exercises.

The next set of exercises covers particular application topics. Currently included are an exercise applicable to batch control and an exercise demonstrating boiler drum level control. Other exercises are planned for this section, including an exercise on exothermic chemical reactor control and distillation tower control.

The last exercise uses MPC-ControlLAB to demonstrate the behavior of model-predictive control (MPC) for a process containing up to four controlled variables (CV’s), two manipulated variables (MV’s) and two load (disturbance) variables. References are given in the exercise to texts for obtaining familiarity with MPC technology.

PC-ControlLAB is intended for use in several different manners, including instructor-led demonstrations in training programs and seminars in process control, as student activities, and in support of self-study.

In a formal training program or seminar, the exercises provide an excellent basis for hands-on learning reinforcement experience. When used in this manner, we suggest that two persons be assigned per computer. With two persons per computer, there is a natural tendency to provide mutual assistance for points that may be unclear to one of the partners.

When **PC-ControlLAB** is used in a program of self-study, a text is recommended to accompany the material. One suggested text is “Wade, H. L.; *Basic and Advanced Regulatory Control: System Design and Application*. Published by ISA. 2004.

Permission is granted to licensed users of PC-ControlLAB to reproduce, modify or to excerpt material from these laboratory exercises for use in support of an educational course, training
