Online Certificate in Advanced Process Control Strategies

This online course has three modules. You can enroll and start at any time. You work at your own pace and have up to four months to finish each module.

Module 1: Processes, Controllers, and Tuning
Module 2: Assessing Loop Performance and Diagnosing Problems
Module 3: Advanced Control Strategies and Optimization

Learning Objectives:

- Understand process dynamics and show their relevance to controller tuning.
- Describe the inner workings of PID controllers.
- Recognize different controller types, algorithms, and options, and describe when to use each.
- Apply the appropriate tuning techniques for different process types and tuning objectives.
- Employ techniques for quickly assessing the performance of control loops.
- Identify control valve and instrumentation problems.
- Find sources of process nonlinearity.
- Recognize performance issues that are not related to control loop problems.
- Identify how and when to apply cascade and feedforward controls.
- Understand the interaction of feedforward and cascade
- Understand the design, use and tuning of ratio and override controls.
- Optimize control loop performance.

Who Should Enroll

The training is suited to entry-level personnel who want to understand process control and learn controller tuning techniques, and to experienced personnel who want to further their professional development:

- Control Engineers and Technicians
- Process Engineers
- Process Control Specialists
- Instrumentation Technicians

Program Content

This online program has three modules arranged in 14 lessons.

Module 1 – Processes, Controllers, and Tuning

Lesson 0. Introductory Session

Lesson 1. Introduction to Process Control
- The control loop and feedback control
- Continuous versus discrete control
- Feedback, cascade, and feedforward control
- Process types—self-regulating, integrating, runaway

Lesson 2. Process Characteristics
- Characteristics of self-regulating processes
- Impact of dead time on loop response
- Characteristics of integrating processes
- Process variable filtering
- Practical aspects of step-testing

Lesson 3. Control Modes and Controller Settings
- Proportional control
- Integral control
- Derivative control
- When to use derivative

Lesson 4. Controller Algorithms and Options
- Direct- or reverse-acting controllers
- Controller algorithms
- Derivative filtering
- Set point filtering
- Gap control and nonlinear gains
- Controller scan interval

Lesson 5. Controller Tuning - I
- The basic tuning philosophy
- Tuning objectives
- Robustness and speed of response
- Tuning rules for self-regulating processes

Lesson 6. Controller Tuning - II

- Tuning rules for integrating processes
- Ziegler-Nichols closed loop tuning
- When to use which tuning rule
- Fine-tuning PID controllers

Module 2 – Assessing Loop Performance and Diagnosing Problems

Lesson 1. Assessing Control Loop Performance

- Detecting poor loop performance
- Statistical analyses
- The Harris index
- Oscillation detection
- Event analysis
- Key performance indicators

Lesson 2. Control Valve and Instrumentation Problems

- Valve hysteresis / dead band
- Valve stiction
- Valve sizing and instrument range
- Control valve flow characteristics
- Process nonlinearity

Lesson 3. Process Nonlinearity

- Sources of nonlinearity
- Linearization with a characterizer
- Gain scheduling
- Scheduling other controller settings

Lesson 4. Diagnosing Performance Issues

- Sources of poor control
- Disturbances and noise
- Oscillations
- Interactions
- Sluggish performance
- Intermittent problems

Module 3 – Advanced Control Strategies and Optimization

Lesson 1. Cascade Control
- What is cascade control
- Benefits of cascade control
- When to apply and not apply cascade control
- Tuning cascaded controllers
- Tracking and initialization

Lesson 2. Feedforward Control
- What is feedforward control
- Benefits of feedforward control
- Additive and multiplicative feedforward
- Tuning a feedforward controller
- Feedforward and cascade control combined

Lesson 3. Other Advanced Control Strategies
- Ratio control
- Split-range control
- Override control
- Decoupling interactive control loops

Lesson 4. Effective Control Loop Optimization
- Control objectives and loop function
- Validation of design and specifications
- Diagnostic and tuning tests
- Controller tuning and performance monitoring
- Applying advanced controls

Certificate Requirements

The certificate is awarded after the completion of the three modules, including all quizzes and final exams. The participants must attain a minimum of 65 percent for each module and an aggregate average of at least 75 percent in the program. The entire course is comparable to seven and a half days of seminar training. Therefore, the certificate will state that the recipient has earned 6 Continuing Education Units (CEUs) or 60 Professional Development Hours (PDHs). However, the course does not carry any college credits and cannot be used as part of a degree-seeking program.

Course Materials

- Textbook: *Process Control for Practitioners* by Jacques Smuts (2011), OptiControls Shipped to you at no extra cost.
- License for the process control simulation software
- Controller tuning spreadsheet

Course Delivery

This online class will be delivered using the Blackboard Learning System. Each session has related reading material followed by a quiz. It is recommended that students read the corresponding chapter in the textbook and the assigned online notes provided before viewing the lesson recording.

Instructor

Jacques Smuts is the founder and principal consultant of OptiControls Inc. Jacques is a member of ISA, a licensed professional engineer and has been a successful process control practitioner since the early 1990s. He is an expert in his field and has optimized thousands of control loops and solved control problems for many companies on a wide range of processes.

Jacques is an advocate for improving process control and has developed several process control training seminars that he has delivered to hundreds of engineers and technicians in several countries. He has developed industrial controller tuning and performance monitoring software that is being used in process plants all over the world. Jacques is a leading authority on process control, controller tuning, and control loop performance monitoring.

Refund and Cancellation Policy

No refunds will be granted for this class once the student has accessed the Blackboard class site. A full refund of registration fees, less a $30 administrative fee, will be approved if requested in writing at kupce@ku.edu prior to accessing the course. Requests must be made within 60 days of payment.