Process Control, Fisher

Simulated Controller Tuning

Course 1705BL NEW CEUs: 1.2

This course is designed for those who have the job responsibility of tuning or monitoring industrial process control loops. Students will learn to tune controllers to meet the needs of each loop.

Overview
During this blended learning students will be introduced to the basic fundamentals of PID control. The control and response characteristic of each PID component will be explained and students will have the opportunity to see their effect using simulated loop software. Using the software the class will also work through and discuss different strategies for tuning various process loops. These strategies include non-calculation based methods like non-calculation based like trail and error, as well as, calculation based methods such as Zigler-Nichols and lambda tuning.

Prerequisites
None, however some basic understanding of process measurement and control is recommended.

Topics
- Elements of PID Control
- Load upsets; Process Noise
- Self Regulating Process
- Integrating Process
- Valve Dead Band and Stick/Slip
- Limit Cycling
- Trial and Error Tuning
- Ultimate Gain Tuning
- Lambda Tuning

Introduction to Process Control

Course 9000 CEUs: 3.2

This Fisher course is for students that have little or no process experience.

Overview
This 4-1/2 day course provides those new to the field with the basic, overall fluid process controls knowledge they need to better understand the function of automated control loops. Aspects of process control (measurement devices, controllers, final control elements, and fundamental control methods) are covered by classroom presentations and laboratory exercises that are intended to familiarize students with the function and application of the wide variety of equipment commonly found in process plants.

Prerequisites None. This is an introductory course.

Topics
- Process Control Terminology and Symbols
- Process Loop Introduction
- Measurement Instrumentation for:
  - Flow;- Level;- Temp;- Pressure
- Instrument Calibration Concepts
- Final Control Elements
  - Control Valves; - Actuators;
  - Control Valve Instrumentation
- Introduction to Loop Dynamics, Tuning and Control

Loop Tuning Short Course

Course 9006 CEUs: 1.4

This Fisher course is designed for those who have the job responsibility of tuning or monitoring industrial process control loops. Students will learn to tune controllers to meet the needs of each loop.

Overview
During this 2-day course, students will practice tuning on process simulation software using tuning methods that do not require calculations. The baseline method requires knowledge of the type of process, and the trial and error method requires making small setpoint bumps and changing controller gain and reset to meet the desired loop performance. Students will also learn open loop response testing and Lambda tuning to obtain greater loop accuracy, stability, and predictability.

Prerequisites None.

Topics
- Load Upsets
- Process Noise
- Self Regulating Process
- Integrating Process (Level)
- Valve Deadband and Stick/Slip
- Limit Cycling
- Baseline Controller Tuning
- Trial and Error Tuning
- Lambda Tuning
- Process Time Constant, Deadtime, and Gain
- Positioner Application Guidelines

Control Loop Foundation

Course 9025 CEUs: 3.2

This course is for engineers, managers, technicians, and others that are new to process control. This course includes the practical aspects of control design and process applications that course developers personally learned through years of hands on experience while designing and commissioning process control applications.

Overview

This 4-1/2 day course for personnel new to automation and covers process control fundamentals as well as the practical aspects of control system design and applications. Upon completion of this course the student will be able to effectively work with and commission single and multi-loop control strategies. Interactive workshops allow the student to apply what they learn in the class

Prerequisites Windows experience.

Topics

- Background – Historic Perspective
- Measurements – Basic Transmitter Types, Limitations
- Analyzers – Examples of On-Line Analyzers
- Final Elements - Valves and Variable Speed Drives
- Field Wiring and Communications – Traditional, HART, Foundation fieldbus, WirelessHART
- Control Strategy Documentation – Plot Plan, Flow Sheet, P&ID, Loop Sheet
- Operator Graphics and Metrics – Considerations in Display Design
- Process Characterization – Identifying Process Dynamics and Gain
- Control Objectives
- Single Loop Control – Basis for PID, Guideline in Selecting PID Structure, Action
- Tuning and Loop Performance - Manual and Automated Tuning Techniques
- Multi-loop Control – Feedforward, Cascade, Override, Split-range, Valve Position Control
- Model Predictive Control – Addressing Difficult Dynamics, Interactive Processes
- Process Modeling – Development of Process Simulation for Control System Checkout
- Application Examples – Batch, Continuous, Combustion, Distillation, Unit Coordination

Process Systems and Solutions LEARNINGPATH

To enroll in EnTech Process Control courses or for more information, please call:
800-338-8158 or 641-754-3771

EnTech Applied Modern LoopTuning 9032

EnTech Applied Modern Loop Tuning and Advanced Regulatory Controls 9035

EnTech Process Dynamics and Tuning Fundamentals (PCE I) 9030

EnTech Process Analysis and Minimizing Variability (PCE II) 9031

EnTech Applied Modern Loop Tuning

Course 9032 CEUs: 2.1

This course is for engineers and technicians responsible for maintaining process control performance using instrumentation and control loop tuning

Overview

Applied Modern Loop Tuning (9032) is a 3-day registration or on-site course that introduces participants to effective methods for determining optimal tuning parameters for regulation of processes. The non-oscillatory EnTech tuning techniques, based on Lambda tuning concepts, are taught with a focus on minimizing process variability. Effectiveness is gained by the implementation of a tuning strategy that matches control loop dynamics to process operating requirements. It contains formal lectures that are amply populated with process examples and supported with hands-on lab exercises using high-fidelity process simulator software. Participants learn how to recognize acceptable versus unacceptable control loop performance and to identify the most common source of problems. Fundamental tuning concepts, including the PID controller, process dynamics, valve motion characteristics deadband (backlash) and resolution (stick/slip), setpoint tracking and regulatory control, integrating processes, and level control are reviewed and demonstrated using case study examples

Prerequisites Some experience with process instrumentation and control is helpful.

Topics

- Process Dynamics and Process Model Identification
- Open loop and Closed Loop Bump Tests Process Response – 1st and 2nd Oorder Self-Regulating Process and Integrating Process
- Process Model – Process Gain, Process Deadtime and Process Time Constant
- Control Resolution and Valve Non-Linearity
- PID Forms and Structures
- Tuning Methods – Ziegler Nichols (QAD) and Model Based Lambda Tuning
- Self-Regulating process - Closed Loop Setpoint and Load Response Tuning
- Process variable Signal Filtering Integrating Process – Closed Loop Setpoint and Load Response Tuning
- Cascade Control Tuning
- Interactive Control Loops – Decoupling Control
- High-Fidelity Process Simulator Software - Engage Students in Hands-On Learning

For Process Control training info please refer to the appropriate contact on page 118.
For regional training center contacts refer to pages 116-117.
Visit: www.emersonprocess.com/education for current dates, locations and enrollments.

Process Control, EnTech

EnTech Applied Modern Loop Tuning and Advanced Regulatory Controls

Course 9035 CEUs: 2.8

This course is for engineers and technicians responsible for process control design, implementation, and control performance.

Overview
This is a 4-day course combining the 9032 - Applied Modern Loop Tuning course with an 4th day devoted to Applied Advanced Regulatory Controls. The 9035 course teaches the practical principals of Lambda Tuning techniques and advanced regulatory controls to achieve improvements that can exceed that of basic PID controls. The course will examine many advanced regulatory control technologies commonly available today and help participants understand which technologies are best suited and how to appropriately apply them given specific process dynamics and conditions.

Formal lectures are amply populated with process examples and supported with hands-on lab exercises. Approximately 40% of the course is hands-on lab based workshops where students develop practical skills required to apply and tune advanced regulatory controls. A dynamic process simulator is used to simulate a variety of process unit dynamics and evaluate the benefits of different advanced regulatory control strategies.

Prerequisites Participants should possess basic process control knowledge and experience with DCS control strategy configuration.

Topics

- Process Dynamics, Identify 1st Order, 2nd Order and Integrating Process Models
- Lambda Tune Self-Regulating Loops (Flow, Pressure, Temperature, Concentration)
- Lambda Tune Integrating Loops (Tanks Level, Header Pressure)
- Lambda Tune Loops for Setpoint Response and Load Recovery
- Cascade Control
- Dynamic Feedforward Control
- Ratio Feedforward Control
- Interactive Control Loops – Decoupling Control
- Deadtime Compensation (Smith Predictor)
- High-Fidelity Process Simulator Software - Engage Students in Hands-on Learning

EnTech Process Dynamics and Tuning Fundamentals (PCE I)

Course 9030 CEUs: 2.8

This course is for engineers, or persons with equivalent math and theoretical background, who have responsibility for process control design and implementation, process optimization,or process design and troubleshooting.

Overview
Process Dynamics and Control System Fundamentals (Process Control for Engineers I) is a 4-day course that presents the essential mathematics of classical control theory in a practical way providing a powerful and intuitive tool for analyzing most process dynamics encountered in the process industries. It enables the process control engineer to use Internal Model Control theory in an applied way. Equally important is the introduction of Lambda Tuning, which empowers the control engineer to coordinate the tuning of all of the control loops in a unit process as a unified dynamic system. This coordinated tuning allows far greater process efficiency and throughput improvements possible in contrast to the older method of tuning control loops individually which would naturally result in dynamic mismatches, interaction and higher process variability.

Course material is based on experience gained in process variability optimization work and is based on Internal Model Control engineering concepts coupled with practical process application knowledge.

Prerequisites
An engineering degree or equivalent knowledge and functionality in the mathematics required to understand the concepts listed in "topics".

Topics

- Process Dynamics - Self Regulating and Integrating
- First Order Process Model
- Second Order Process Model
- Integrating Process Model
- Process & Control Nonlinearity
- Feedback Control & PID Controllers
- QAD Tuning & Lambda Tuning
- Setpoint & Load Response
- Frequency Response - Bode Plots
- Tuning Interactive Control Loops
- Coordinated Lambda Tuning for Unit Optimization
- High-Fidelity Process Simulator Software - Engage Students in Hands-on Learning

EnTech Process Analysis and Minimizing Variability (PCE II)

Course 9031 CEUs: 2.8

This course is for engineers, or persons with equivalent math and theoretical background, who have responsibility for process control design and implementation, process optimization, instrumentation engineering, or process design and troubleshooting.

Overview
Process Analysis and Minimizing Variability (Process Controls for Engineers II) is a 4-day course that provides a knowledge of the techniques used to troubleshoot process and control problems, improve performance and reduce variability in processes. Time series analysis, including power spectrum and autocorrelation function, are presented as tools for process and control auditing. The course uses formal lectures that are highlighted with an ample repertoire of process examples and hands-on lab exercises. High-fidelity process simulator software is used as the basis for the labs and situation analysis.

Prerequisites
Participants should have taken 9030 Process Dynamics, Control and Tuning Fundamentals (Process Control for Engineers I) or have similar knowledge. The simulators used in the course are similar to those used in Process Control for Engineers I.

Topics

- Review - Topics Presented in PCE I
- Use of Software for Identification of Process Dynamics, Lambda Tuning, Time Series Analysis
- Controller Tuning Troubleshooting - Dynamic Loop Interaction Problems
- Digital Control - Digital Controllers and Digital Sensors
- Signal Quantization, Signal Aliasing and Signal Filtering
- Time Series Analysis
- Power Spectrum
- Auto/Cross Correlation Function
- Interpreting Plant Process Data
- Process and Control Auditing Techniques
- Control Loop Evaluation- Power Spectrum
- Integrated Process and Control Design
- Advanced Process Control
- Control Performance Study Exercise
- High-Fidelity Process Simulator Software - Engage Students in Hands-on Learning