Training Program:

Applied Process Control Engineering for Non-Engineers

INTRODUCTION:

Efforts at improving process control are one of the best investments that an operating company in the refining and petrochemical industry can make. The capital investment for the plant has already been made, and improved process control can many times provide substantial economic benefit with little or no capital investment. Operators and technicians with the proper training can troubleshoot control loops, tune PID control loops, and identify opportunities for advanced PID applications. To effectively apply these skills, the operators and technicians must understand the hardware (control computers, control valves, and sensors) associated with control loops, have a command of the fundamentals of PID and advanced PID control, and most importantly understand the operation of their process. This course is designed to provide operators and technicians with these skill sets.

WHO SHOULD ATTEND?

Operators and technicians working in the petrochemical, oil, and gas process industries with a need to understand and use process control.

COURSE DESCRIPTION:

The course covers the key elements associated with the application of process control to the hydrocarbon and chemical processing industries. The course will begin with an introduction to process control that demonstrates the primary economic benefits associated with improved process control.

The control-relevant aspects of control computers, actuator systems, and sensor systems commonly found in the hydrocarbon and chemical processing industries will be addressed next. Then, the forms and characteristics of PID controllers are studied, as well as the proper selection of the mode of the PID controller. Industrially relevant tuning of PID controllers for fast and slow responding control loops is presented and practiced using simulation software. A systematic approach for troubleshooting a PID controller is also demonstrated.

When and how to apply advanced PID control options is considered next. Then, an overview of multivariable control is presented. Finally, the specifics of PID control applied to heat exchangers, reactors, distillation columns, and pH are covered.

METHODOLOGY:

This interactive Training will be highly interactive, with opportunities to advance your opinions and ideas and will include;

- Lectures
- Workshop & Work Presentation
- Case Studies and Practical Exercise
- Videos and General Discussions

CERTIFICATE

BTS attendance certificate will be issued to all attendees completing minimum of 80% of the total course duration.

TRAINING OBJECTIVES/KEY BENEFITS:

Upon completion of this course, participants will:

Understand the operation of control loop hardware as well as know the expected performance characteristics of the components that comprise a control loop

- Know how to specify the proper mode of a PID controller (P-only, PI, or PID)
- Know how to effectively tune fast- and slow-responding control loops in an industrial setting
- Know how to efficiently identify and troubleshoot an improperly functioning control loop
- Know when to use and how to effectively apply advanced PID control techniques for a process. These include:

  - Cascade control
  - Ratio control
  - Feed-forward control
  - Inferential control
  - Constraint and override control

- Understand the basics of heat exchanger, reactor, distillation and pH control

COURSE OUTLINE:

Day 1

Introduction

- Importance of process control
- Economic benefit of improved process control
- Terminology of process control: an everyday example of process control
- Typical process control loops
- Control and optimization

Control Loop Hardware

- Controllers (pneumatic, electronic, DCS, and fieldbus)
- Control valves
- Sensors

Day 2

- Forms of the PID controller
- Fundamental characteristics of P, I and D action
- Selecting the mode of a PID controller
- Analysis of commonly encountered control loops (flow, level, pressure, temperature, and composition loops)

PID controller tuning

- Conventional tuning methods and their limitations
- Recommended tuning approach

Day 3

Simulation In-Class Exercises

- Visual basic controller tuning exercises

Controller Troubleshooting

- General approach and expected performance specifications
- Actuator system
- Sensor system
- Controller

Advanced PID Control

- Cascade control
- Ratio control
- Feed-forward control

Day 4

Advanced PID Control

- Inferential control
- Scheduling of controller tuning parameters
- Computed manipulated variable control
- Constraint control

Multivariable Control

- Configuration selection
- Tuning multivariable PID controllers
- Model predictive control

Day 5

Case Studies

- Control of heat exchangers
- Control of exothermic and endothermic reactors
- Distillation control
- pH control

Overview Wrap-up of Course

Exercises

- Exercise 1 - Evaluation of installed valve characteristic
- Exercise 2 - Selection of reverse- or direct-acting PID controller
- Exercise 3 - Selection of PID mode for a particular process
- Exercise 4 - Field tuning exercise for level process
- Exercise 5 - Field tuning exercise for temperature mixing process
- Exercise 6 - Auto-tune exercise for heat exchanger
- Exercise 7 - Auto-tune exercise for CSTR control
- Exercise 8 - Troubleshooting exercise