Venturi Engineering Solutions

ProNamics Control

Pipeline Process Control Optimization Basics

Improving Pipeline Process Control Performance

Spring/Fall Edmonton, Alberta

COURSE TOPICS:

Process Control Basics
Understanding Process Dynamics
Nonlinearity
Lambda Tuning Procedures
Troubleshooting Pipeline Control Problems

Your technical resource for improving pipeline process control performance

Pipeline system pressure and flow control applications are somewhat unique. The pipeline control valves may spend much of their time wide open to minimize pumping costs but also need to respond quickly and accurately to sudden pressure excursions to prevent unscheduled line shutdowns. One key to 'good' pipeline control is careful selection and sizing of the pressure/flow control valves in order to minimize non-linear dynamics and ensure valve stability. The control valve speed and resolution are also key requirements. A structured, scientific approach to control loop tuning is needed to ensure fast, stable controller response to upsets. Finally the control strategy needs to compensate for the high non-linearity resulting from hydraulic design and the wide range of operating conditions.

COURSE DESCRIPTION

The 2 day course begins with a review of pipeline process control needs and the basic functioning of control loops. Open loop bump testing to measure process dynamics, evaluate sensor, control valve and VFD performance (resolution, speed of response) and develop Lambda tuning constants are the next core topics. The most common pipeline control strategies (override, ratio) are introduced. Analytical troubleshooting techniques to identify / correct process control problems is the final topic.
Approximately 40% of the course is devoted to a computer-based lab, where the student demonstrates that they have understood the main concepts.

INSTRUCTORS

Doug Nelson, P.Eng. has over 30 years of industrial process control experience. He has broad expertise in process control training of operators, instrumentation specialists and process control engineers.
George Jablonsky, AScT has over 25 years of industry experience in process control. He is a recognized expert in optimizing pipeline control performance and has extensive experience in troubleshooting.
Tyler Rushfeldt, P.Eng. has over 10 years' experience across various aspects of the pipeline industry, notably steady state and transient hydraulics and currently specializing in pressure control applications.

WHO SHOULD ATTEND

The two-day course is primarily intended for instrument / electrical technicians, and operations engineers who want to improve their ability to optimize/troubleshoot pipeline process controls. It is an excellent introductory course for pipeline control engineers and beneficial for maintenance and design engineers.

COURSE LOCATION

The course will be held at the Sawridge Inn Edmonton South (4235 Gateway Boulevard North, Edmonton, AB T6J 5H2). Registrants are responsible for their own hotel room reservation. For your convenience we recommend that you stay at the Sawridge Inn (780-438-1222 or toll free 800-565-1222).

REGISTRATION

Registration fee is $1750 CDN (including taxes) for the 2-day course. Please register 3 weeks in advance (at www.pronamicscontrol.com) to ensure that space and materials will be available. ProNamics / Venturi reserve the right to cancel the course based on a minimum number of registrants.

COURSE SCHEDULE

Day One

Lecture 1 — **Pipeline Process Control Overview**
08:00 - 09:00
Initiating, Mainline Station and Delivery System control description
Benefits of good process control

Lecture 2 — **Control Loop Fundamentals**
9:00 - 10:30
Loop overview - block diagram
Loop terminology
Loop components—sensors, controllers, actuators/valves, VFD's
Performance guidelines / Common problems

Lab 0 — **Simulator Introduction**
10:30 - 11:00

Lecture 3 — **Process Dynamics**
11:00 - 12:00
Open Loop Bump Description and Procedures
First Order process dynamics
Second Order process dynamics
Impact of Filtering

Lab 1 — **Measuring 1st order dynamics**
1:00-3:00
Pump station discharge and suction pressure control loops,
Holding/Manifold Pressure control loops
Impact of operating parameters on dynamics

Lecture 4 — **Process Non-Linearities**
300 - 4:30
Control Valve backlash/stiction
Valve response time
Inherent / Installed Process Gain

Lunch Breaks between 12:00 & 1:00 each day

Day Two

Lab 2 — **Non-Linear Lab**
8:00 - 9:00
Measuring Control Valve backlash/stiction
Impact of pump /;valve selection

Lecture 5 — **Lambda Tuning**
8:00 - 10:00
PID control algorithms
Lambda tuning procedures for 1st order loops
Setpoint / Load response
Examples

Lab 3 — **Lambda Tuning**
10:00 - 12:00
Pump station suction/discharge pressure
Setpoint/Load response
Impact of non-linearities on performance

Lecture 6 — **Troubleshooting Pipeline Control Problems**
1:00 - 2:00
Troubleshooting tools, Identifying the problem source, case studies

Lab 5 — **Troubleshooting Lab**
2:00-4:00
Identifying / solving control problems

Wrap-Up
4:00-4:30

ABOUT Venturi Solutions / ProNamics Control

Venturi Engineering Solutions is based in Edmonton, AB. The company provides pipeline hydraulics, leak detection, operator qualification and data analytic services to the pipeline sector. Venturi has recently allied with **ProNamics Control** to provide process control services including PCV sizing/selection, controller tuning and output linearization, field PCV and VFD tuning commissioning services, and training.

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