PROCESS CONTROL FOR PROCESS ENGINEERS USING DYNAMIC SIMULATION

For Process Engineers who want to understand the fundamentals of Process Control by using practical simulation cases.

INTRODUCTION

Process Engineers are heavy users of simulation tools (HYSYS, UniSim, A+, …) to design new processes or revamps. They mainly work in steady-state mode, but frequently they have to interact with the Control Engineers to discuss how the process will be controlled and operated. Then, many process dynamics and control concepts need to be clearly understood by the Process Engineers to effectively design the production process and their corresponding control philosophy.

Plant designs have become increasingly complex, integrated and interactive. Heat integration, process recycles and minimum hold-ups are typical design features. Whilst such designs optimize steady state operation, they present particular challenges to control and operations engineers. Clearly, the ideal solution is not to just develop a working control strategy, but also to design a process that is inherently easy to control.

Some questions answered during the course:

- How valve´s size affects the process behavior?, What problems are encountered for wrongly sized valve?

- How valve characteristics changes when it is installed?

- How to indentify process responses and non-linear behavior?

- What process parameter determines the ability of a process to reject, or attenuate, disturbances?

- Why process capacitance is good for disturbance rejection, but produces very slow response times?

- Why process Dead Time has no effect on the filtering capability of the process?

- When processes with Dead Time can cause problems in the control?

- What kind of processes can be covered with the Feedback control?

- What is the effect of filtering in the control response?

- What processes can benefit from the PID derivate action?

- How Buffer tanks/surge drums can help to isolate equipment from upstream disturbances?

- What are the limitations of the Feedback control, when the Feedforward control is recommended?

Remember that no fancy Laplace transforms or Nyquist plots are used. The importance of the course is that all questions are answered from the practical side, through the use of already built dynamic models, so attendees can additionally evaluate the usability of the tool for certain dynamic/control analysis. However, no previous knowledge of the tool is required.

COURSE AUDIENCE

The course is intended for process engineers who have been working in industry but are new to process control concepts and that need to develop an understanding of process dynamics and process control theory.

Important note: The dynamic simulation cases that will be used during the course will be given to attendees in a *ready-to-work* status so, no previous knowledge about dynamic simulation is required to attend this course.

COURSE OBJECTIVES

Plant designs have become increasingly complex, integrated and interactive. Heat integration, process recycles and minimum hold-ups are typical design features. Whilst such designs optimize steady state operation, they present particular challenges to control and operations engineers. Clearly, the ideal solution is not to just develop a working control strategy, but also to design a process that is inherently easy to control.

The main objectives of this course are:

- Learn the fundamental Process Dynamic concepts and practice with them.

- Learn the Basic Control theory and practice with it.

- Make use of Simulation tools (Steady-State and Dynamics) for the development of the basic control layer.

- Learn Classical Advanced Control techniques and practice with them.

- Examine the impact of equipment sizes on process behavior.

- Understand how disturbances will affect the process.

- Study various control schemes to find the best suited one for the process of interest.

TRAINING

Training is an essential element for any organization's success. **Inprocess** has a commitment to quality and a reputation of excellence making sure we offer you cost-effective complete training solutions.

Courses delivered by **inprocess** staff have helped process technicians, engineers, and scientists to understand and apply innovative simulation techniques. We are able to offer both standard and tailored training courses using real world examples.

Inprocess offers a broad variety of training services for implementation, maintenance and updating of knowledge on process simulation technology.

Inprocess courses:

- offer training in the use of Process Simulators as well as acquiring the engineering knowledge and industry best practice to obtain the largest possible benefits from these tools

- are directed at improving your ability and confidence in the use of technology, in parallel with a deeper understanding of the processes with the object of solving industry problems as efficiently as possible.

INSTRUCTORS

The training course will be lectured in English language by experienced **Inprocess** instructors - who accumulate several years of experience in the use of process simulation both at industry and research/university level.

MODULES CONTENT

MODULE NUMBER	MODULE TITLE AND SHORT DESCRIPTION	TIME	DAY
1	**INTRODUCTION TO THE DYNAMIC PROCESS SIMULATOR** Working with an existing case. Getting used to GUI elements. Pressure Flow Solver and boundary specifications. Setting up a PID	2 hours	Day 1
2	**FINAL CONTROL ELEMENTS** Control valve sizing, Inherent valve characteristics. Valve selection based on control performance	2 hours	
3	**FUNDAMENTALS OF PROCESS CONTROL** Principles of Process Control. Single input/single output (SISO) control systems. Open and closed loops. Feedback Control. Elements of a control loop. Direct and reverse acting. Process dynamics and attributes. Capacitance and Dead time. Process responses.	4 hours	
4	**PROCESS DYNAMIC GAIN, DEAD TIME AND CAPACITANCE** System Identification: The Process Reaction Curve. Effects that dead time and capacitance have on system behavior, and controllability. System attenuation capability. Use of filters and their effect in control performance.	2 hours	Day 2
5	**FEEDBACK CONTROL** Basic Control Modes. Setup and operation of basic single loop controllers. Choosing the right controller. PID algorithm and commercial DCS implementation forms (Honeywell, Yokogawa, Emerson, Foxboro, etc.).	2 hours	
6	**CONTROLLER TUNING AND PRACTICE** Tuning of controllers in a practical way, over a dynamic simulation of the process. Most popular tuning techniques are covered. A commercially available tuning tool is as well introduced and used in a practical exercise.	2 hours	
7	**USING CASCADE CONTROL** Learn how to build and configure a cascade controller. Students will also be able to see the benefits and limitations to this type of control scheme.	2 hours	Day 3
8	**USING FEED-FORWARD CONTROLLERS** Teaches students how to build and configure a Feed-forward controller. They will also be able to see the benefits and limitations to this type of control scheme.	2 hours	
9	**USING RATIO CONTROLLERS, SPLIT-RANGE CONTROLLERS AND OVERRIDE SELECTORS** Teaches students how to build and configure a Ratio and split-range controller. They will also build override logic structures for different operation purposes.	3 hours	

HOW TO REGISTER

To book your place at the course please, send us an email to: **training@inprocessgroup.com** detailing:

- Course name and dates
- Name
- Company/Department/Position
- Phone number
- email
- Short (less than 50 words) background description
- Need for proforma invoice?
- Attach the completed Appendix A that you will find at the end of this brochure

After receipt of the registration request, places will be reserved for 10 days. After payment of the course fee, the registration is firmly confirmed. In case you are facing issues to travel, a remote attendance through TEAMS or Webex meeting can be also explored under request. Indicate the same in your registration.

For an optimal learning experience, the number of available places is limited to 10 attendees. Please, register as soon as possible in order to ensure your participation.

COURSE VENUE

The course will be given from Inprocess' Rio de Janeiro office:

Rua do Passeio, 38 - Torre 2 - 15º andar
Rio de Janeiro, 20021-290, Brazil

Our office is located on Rua do Passeio, in the city centre of Rio de Janeiro, within walking distance of Cinelândia and close to Santos Dumont Airport, and with direct access to key business areas and public transportation connections across the city.

Depending on the number of attendees the location of the course might change to a place nearby. Inprocess will inform the attendees with enough anticipation.

COURSE PRICE

This 3-day course is priced **$ 1,500**. All prices and rates quoted in this document are exclusive of taxes and duties.

Attendees are required to bring their own laptop.

PAYMENT

All bank transfers in USD to:

CaixaBank

CCC: **2100 9617 34 7200304813**

IBAN: **ES81 2100 9617 34 7200304813**

SWIFT: **CAIXESBBXXX**

Send us an email with a copy of the bank transfer to inform us about the payment (**training@inprocessgroup.com**)

Appendix A: Workflow for Order

Please fill in and sign the information below: **Order** (page 6) and email or fax to us at least 1 month before start of the training.

Please provide complete and clearly printed contact and billing details:

	Contact Information	**Billing Information**
		o same as contact information
Name :		
Title / Department :		
Company :		
Complete Address :		
Telephone Number :		
Fax Number :		
Email Address :		
VAT # :		
Signature :		

Purchase order (number / date):

O is enclosed   O will follow by mail

O my company does not require a purchase order

Thank you for taking the time to accurately complete this offer. This will ensure that all practical details are properly covered, and will ensure a smooth and profitable workshop experience for all involved.

Please do not hesitate to contact us should you have any questions or require additional information.