Inprocess Technology & Consulting Group, S.L.
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TC-DS01: Process Control for Process Engineers using Dynamic Simulation

Objectives

Process Engineers are heavy users of simulation tools 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 processes and their corresponding control philosophy.

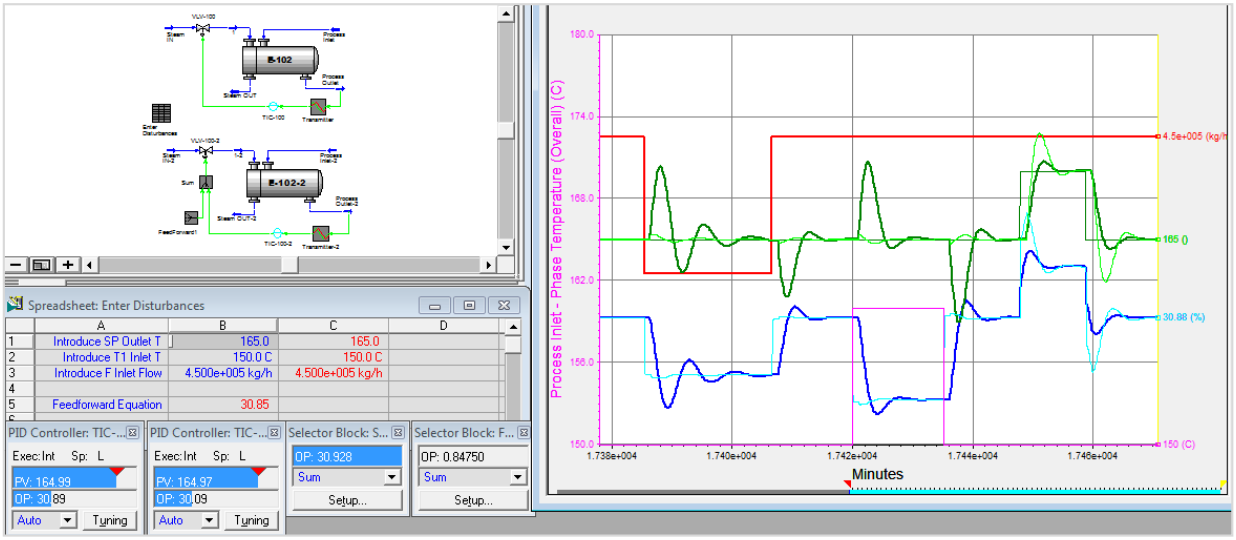
Plant designs have become increasingly complex, integrated and interactive. Heat integration, process recycles and minimum hold-ups are typical design features. Whilst such designs optimize steady state operation, they present particular challenges to control and operations engineers. Clearly, the ideal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

Participants

This course is aimed at process engineers who are involved in the design, control and operation of any processing facility. At the same time, process engineers in any engineering company, usually involved in basic or detailed engineering projects, will definitely benefit from the course content. Safety engineers, even junior control engineers might find useful the opportunity to experiment the classical control topics in a so powerful tool like a dynamic process simulator.

Contents

During the course, process engineers will learn the fundamentals of Dynamic Process Simulation concepts and will practice with them. They will as well learn the Basic Control theory and practice with it. The concepts acquired during the course will allow process engineers to make use of simulation tools (Steady State and Dynamics) for the development of the basic control layer. Thanks to this, they will be able to examine the impact of equipment sizes on process behaviour, to understand how disturbances will affect the process and to study various control schemes to find the best suited one for the process of interest.



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 identify 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?

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THREE-DAYS COURSE AGENDA

MODULE	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.	3 hours	
4	PROCESS DYNAMIC GAIN, DEAD TIME AND CAPACITANCE System Identification: The Process Reaction Curve. Effects that dead time and capacitance have on system behaviour, 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 Tune controllers in a practical way over the dynamic simulation. Most popular tuning techniques are covered.	3 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.	1 hour	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 This module teaches students on how to build and configure a Ratio and Split-range controller. They will also build override logic structures for different operation purposes.	2 hours	
10	TYPICAL CONTROL OF EQUIPMENT A revision of most common control structures for tanks, heat exchangers and furnaces.	2 hours	