APC University Modules

Products: Aspen DMCplus® Builder, Aspen DMCplus® Composite, Aspen DMCplus® Controller, Aspen Inferential Qualities, Aspen Inferential Quality Builder, Aspen Nonlinear Controller, Aspen Nonlinear Controller Builder, Aspen PID Watch Performance Monitor, Aspen Process Controller, Aspen Process Recipe View More
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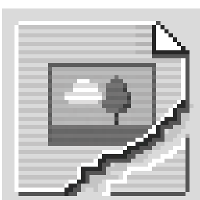

Advanced Process Control Modules

The APC Teaching Modules walk students through the configuration procedure in a step by step manner. They will use first principle equations (mass, energy, and momentum) to generate working models. The modules illustrate the advantage of MPC over PID controllers by showing that model predictive control is suitable for process with difficult dynamics, tightly constrained systems, and strongly interacting multi-variable systems. Throughout the teaching modules you will see how process outputs respond to changes in process inputs by exploring relationships by experimenting with changing set points for input and output variables. The performance of model predictive control is evaluated in the face of a strongly interacting multi-input multi output (MIMO) system as well.

AspenTech Software Used:

Aspen Process Controller Builder, Aspen State-Space Controller

Getting Started with Aspen APC Builder	This module provides an overview of the Aspen Process Controller Builder environment for the development and deployment of model-based, multivariable controller application. The concepts introduced here are used in the reaming modules. This teaching module provides an overview about the controller model, the filter and the optimizer. The case study in this teaching module is the response of an MPC applied to a system with large delay.
Disturbance Rejection with Aspen APC Builder	One of the advantages of Model Predictive Control (MPC) over traditional PID controllers is that MPC avoids the integrator (or reset) windup when facing a disturbance. The purpose of this exercise is to simulate this response of an MPC controller when facing a disturbance. Aspen APC Builder is used to create a model from a transfer function and simulate it.
	The purpose of this lesson is to evaluate the performance of an MPC in the face of a strongly interacting multi-input multi-output (MIMO) system

Setpoint Change with Aspen APC Builder	using Aspen Process Controller Builder. The traditional PID controller does not perform very well in this system. Aspen APC Builder is used to evaluate the response of an MPC controller with the same system.
Tuning & Setpoint Change with Aspen APC Builder	The purpose of this exercise is to detune the controller from the previous module so that the controller can account for sensor noise, and mismatch between the plant and the model. The controller is simulated in Aspen APC Builder with the default tuning configuration and its response is evaluated.
Input Constraints & Setpoint Change with Aspen APC Builder	In this lesson, input constraints are imposed in the controller from previous lesson. The response of a constrained MPC is examined.
Movement Constraint & Setpoint Change with Aspen APC Builder	The purpose of this lesson is to account for input movement constraint in the controller from previous lesson. The response of a constrained MPC (-1 u 0.1), and with constrained movement (u_{max} = 0.1) is shown.
Model Development of Aspen State-Space Controller with APC Builder	This teaching module demonstrates the procedure to generate the state-space model based on first principles equations (mass balances) using Aspen APC Builder. The Two Tanks system from Babatude A. Ogunnaike (Process Dynamics, Modeling and Control book) is used in this lesson. The mass balance for the system is reviewed, and then the conversion to state-space is demonstrated. Finally, the resulting model is implemented in Aspen APC Builder.
Model Identification of Aspen State-Space Controller with APC Builder	In this teaching module, the model identification tool of Aspen APC Builder is used to generate a state-space model for a fired heater example. A process step-test was conducted to determine the effect of changes to the fuel gas setpoint FGSP on the outlet temperature TO. The model identified is used to generate predictions and demonstrate the quality of the identified model.
Filter Configuration and Tuning of Aspen State-Space Controller with APC Builder	In this lesson, the MPC filter is investigated in detail for the two tanks system model. The filter in MPC is responsible for calculating prediction errors by comparing model predictions with current measurements for each measured output. Unmeasured disturbances are then estimated in order to explain the prediction errors. Future output behavior is then predicted by assuming that estimated disturbances and process inputs remain constant in the future.
Optimizer Configuration and Tuning of Aspen State-Space Controller with APC Builder	In this lesson, we show how to configure and tune the MPC Optimizer by using process knowledge (two tank system) or by using a dataset to initialize tuning (fired heater example). The Optimizer's job is to figure out where the process should go. The Optimizer computes the best steady-state operating point for the process, provided it is given targets and limits entered by the operator, and disturbance estimates from the Filter. The Optimizer can either drive towards operator-entered targets, or it can minimize a linear economic objective function (or both).
Controller Configuration and Tuning of Aspen State-Space Controller with APC Builder	In this lesson, we configure the MPC Controller block for the two tank system and the fired heater system. The Controller computes a sequence of future input adjustments, called MV moves, which will drive the process from the current position to the optimal steady-state operating point, as computed by the Optimizer. The Controller is tuned by setting the dynamic concerns, which define the sizes of violations that you are equally concerned about, and by specifying limits for upward and downward movement of the MVs. The dynamic response of the state-space controller for the two systems and fired heater example are investigated.