Training Course Data Sheet

Aspen DMCplus® Advanced Concepts

Course Number:	**MA305**
Duration:	**5 days**
CEUs Awarded:	**3.5**
Level:	**Advanced**

Objective

- To learn about the benefits and potential pitfalls in using prediction error feedforward techniques to improve model accuracy
- To learn about the details of controlling ramp (integrating) variables
- To understand the techniques required to obtain model consistency and close material balances in the Aspen DMCplus steady state optimization
- To understand the techniques involved in characterizing non-linear transformations.
- To learn the details of designing and implementing an Aspen DMCplus Composite suite
- To learn the fundamentals of parametric identification using subspace identification technology

Course Benefits

- Develop skills required to design, implement, and troubleshoot complex Aspen DMCplus controllers to generate increased APC benefits at your facility

Who Should Attend

- Engineers who are designing or implementing Aspen DMCplus controllers
- Engineers who are responsible for maintaining Aspen DMCplus controllers

Approach

- Descriptions of advanced design concepts
- Demonstrations of the offline and online tools that illustrate the advanced concepts
- Hands-on exercises that illustrate the advanced concepts complement the theory sessions
- Course notes are provided
- Review quizzes reinforce each day’s learning

Prerequisites

- Attend Course “Introduction to Multivariable Predictive Control with Aspen DMCplus”
- Field experience with commissioning at least one project with the Aspen DMCplus controller and a familiarity with chemical process engineering and/or process operations
- Familiarity with the process control computer and distributed control system
- Some familiarity with using Microsoft operating systems. The course is presented in a Windows 2000 Professional environment

Aspen DMCplus Advanced Concepts Course Agenda

Day 1

- Review of basic Aspen DMCplus technology
- Overview of advanced controller issues and tasks
- Advanced Identification Techniques
  - Identification with valve saturation
  - Understanding partial independence
  - Using prediction error feedforward
  - Dealing with noisy regulatory controllers
- Ramp Variable Techniques
  - Advantages and drawbacks of breaking PI level loops
  - Ramp implications for prediction error updating – using the ramp rotation factor
  - Ramp handling in the steady state optimization – balancing the ramp
  - Ramp imbalance calculations – using the ramp horizon and safety zones
  - Ramp handling in the dynamic move calculation – using the ramp rate and ramp setpoint
  - Using pseudo-ramps
- Lab exercise: Modeling using the prediction error feedforward technique

Day 2

- Lab exercise: Controlling a Ramp
- Steady State Optimization Advanced Techniques
  - Closing the mass balance
  - Pivoting technique to deal with ramps in the middle of a plant; how to compute the LP costs
  - Using Singular Value Decomposition (SVD) and Relative Gain Analysis (RGA) to avoid numerical instability
  - Gain matrix analysis in Aspen DMCplus Model
  - Dealing with parallel processes
  - Comparison of LP vs. QP
- Lab exercise: Using the ramp pivoting technique to calculate LP costs

Day 3

- Special Dynamic Topics
  - Move suppression
  - Equal concern errors
  - Move compression and resolution issues
  - Prediction error filtering
- Variable Transformations
  - Why transforms are needed
  - Standard transform types and examples
  - Detailed list of transformed parameters
  - Using input/output calculations
  - Gain scheduling
- Lab exercise: Identifying and modeling valve output transforms and using Gain Matrix Analysis

Day 4

- Subcontrollers and External Targets
  - Subcontrollers: basic definition, guidelines for use, implementation guidelines, configuration parameters
  - External Targets: basic definition, implementation guidelines, configuration parameters, validation
- Aspen DMCplus Composite
  - Justification for using Composite
  - Composite tiers
  - Composite calculation steps
  - Composite participation modes and states
  - Timeout flags
  - Aliasing
  - Composite initialization file
  - Composite parameters in the CCF
  - Using and configuring the CCF Switcher
- Lab exercise: Using Aspen DMCplus Composite and the CCF Switcher

Day 5

- Introduction to Subspace Identification
  - Overview of MPC modeling technologies: FIR, ARX, state space models
  - State space model example and characteristics
  - Subspace identification technology
  - Subspace identification parameters
  - Subspace identification guidelines
  - Using multiple data sets in Aspen DMCplus Model

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