Training Course Data Sheet

Introduction to Multivariable Predictive Control with Aspen DMCplus®

Course Number:	**MA300**
Duration:	**5 days**
CEUs Awarded:	**3.5**
Level:	**Introductory**

Objective

- Learn fundamental concepts used in Aspen DMCplus: variable types, including settling times, step response curves, open-loop prediction, steady state optimization, and dynamic control calculation
- Learn to use the Aspen DMCplus Desktop software to develop control models, build control applications, and perform off-line tuning and simulation of control applications
- To design a typical Aspen DMCplus application on a process unit

Course Benefits

- Develop skills required to assist with the execution of Aspen DMCplus control projects
- Increased effectiveness in troubleshooting and maintenance of Aspen DMCplus controllers
- Increased awareness of the operating characteristics and capabilities of Aspen DMCplus controllers

Who Should Attend

- Engineers who are designing or implementing new Aspen DMCplus controllers
- Engineers who are maintaining existing Aspen DMCplus controllers
- Operating supervisors and console operators who are involved in Aspen DMCplus control projects
- Engineers who are involved in real-time optimization projects

Approach

- Introduction to basic concepts behind multivariable control
- Description of the theoretical concepts that form the basis of the Aspen DMCplus family of products
- Demonstrations of the ways in which the off-line and on-line tools are used
- Hands-on exercises that allow controller development concepts to be applied to typical plant processes
- Course notes, updated for v 2006, are provided
- Concept review quizzes reinforce learning

Prerequisites

- A background in chemical process engineering and/or process operations
- Some familiarity with Microsoft® Windows operating systems. The course is presented in a Windows 2000 Professional environment

Subsequent Courses

- Aspen DMCplus Online Tools: to perform typical plant testing, configuration, commissioning, and maintenance activities using the Aspen DMCplus Online software
  - Can be taken as soon as 1-2 months after completion of the introductory course
- Aspen DMCplus Advanced Concepts: to learn advanced Aspen DMCplus controller topics. Should be taken only after completing 1-2 Aspen DMCplus control implementations. Aspen DMCplus Online Tools course helpful but not required.

Introduction to Multivariable Predictive Control with Aspen DMCplus Course Agenda

Day 1

- Introductory Topics
  - Positioning within aspentech's advanced control product family
  - Basic terminology
  - Aspen DMCplus overview
  - Processes that are good candidates for Aspen DMCplus
  - Sample problem: hydrocracker control
  - Aspen DMCplus Architecture
- Model identification
  - Step response models
  - Linearity and superposition
  - General form of linear dynamic model
  - Finite Impulse Response (FIR) modeling technology
  - Addressing real-world issues in FIR modeling technology
  - Using Aspen DMCplus Model
  - Tools for tracking model convergence
- Lab exercise: Model development on fractionator 5x3 exercise

Day 2

- Basics of the open loop prediction
  - Prediction
  - Prediction error
  - Updating the prediction vector
  - Special consideration for ramp variables
- Steady state optimization
  - Definitions of LP and QP
  - Solving a basic feasible problem
  - Infeasibilities: constraint rankings
  - Infeasibilities: equal concern errors
  - Cost optimization
  - Min cost and min move MVs
  - Computing LP costs
  - Special consideration for ramps
  - Introduction to external targets
- Lab exercise: LP cost calculation

Day 3

- Dynamic Error Minimization
  - Computing the setpoint error
  - Fundamental dynamic control move equation
  - Effects of single vs. multiple future moves
  - Dynamic tuning handles: move suppression factors and equal concern errors
  - Managing dynamic tradeoffs
  - Special considerations for ramp variables
  - Enforcing the steady state solution in the dynamic control move calculation
  - SSSTEP relationship to MAXMOV
- Transformations and Calculations
  - Why transforms are needed
  - Standard transform types and examples
  - Detailed list of transformed parameters
  - Using input/output calculations
- Lab exercise: Aspen DMCplus Dynamic Tuning

Day 4

- Aspen DMCplus Project Methodology
  - Project phases
  - Pretest and plant test recommendations
  - Modeling and dynamic simulation guidelines
- Lab exercise: GRU Controller Design
- Lab exercise: Polymer Controller Design and Simulation

Day 5

- Overview of Aspen DMCplus Online Tools
  - Aspen DMCplus Build
  - Aspen DMCplus Manage
  - Production Control Web Interface
- Variable Validation

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