



Instrumentation & Controls

Advanced Process Control Strategies

Course Introduction

This 5-Day Advanced Process Control Strategies training program is designed for engineers, process control specialists, and operations managers who want to enhance their skills in managing and optimizing process systems. Through a blend of theoretical learning and hands-on applications, participants will explore advanced control methodologies such as Model Predictive Control (MPC), multivariable control, adaptive control, and real-time optimization. The training will also address industry-specific challenges, offering practical insights that can be directly applied to participants' work environments. By the end of this program, attendees will possess the knowledge and tools to implement and manage advanced process control systems, significantly improving the reliability, efficiency, and performance of their industrial processes.

Target Audience

- Process Control Engineers
- Instrument Engineers
- Automation Engineers
- Chemical Engineers
- Control and Instrumentation Technicians
- DCS/PLC Technicians
- Managers and Supervisors overseeing process operations

Learning Objectives

- Gain a deep understanding of the core concepts and principles of process control. Recognize the importance of APC strategies in enhancing industrial process performance.
- Learn how to implement Model Predictive Control (MPC) and other advanced control strategies.
- Apply techniques such as cascade control, multivariable control, and adaptive control in real-world scenarios. Understand how to build and utilize both empirical and first-principles models for process control.
- Use advanced modeling techniques to predict and optimize process behavior. Learn how to implement real-time optimization strategies to minimize costs, energy usage, and process inefficiencies.
- Integrate RTO with existing control systems like Distributed Control Systems (DCS) and SCADA. Integrate APC strategies seamlessly into existing industrial control systems.
- Understand how to optimize the performance of existing processes with advanced tools and technologies.
- Develop the ability to evaluate APC system performance and identify potential issues. Gain troubleshooting skills to diagnose and resolve issues within complex control systems. Learn how to tailor APC techniques to industries such as chemicals, oil & gas, pharmaceuticals, and manufacturing. Analyze case studies to understand how APC strategies have been successfully implemented across various sectors.
- Stay up to date with the latest trends in APC, including the role of machine learning, digital twins, and IoT in modern process optimization. Understand the future of APC and how it can be leveraged for enhanced decision-making in real-time operations.

Course Outline

- **01 Day One**
 - **Introduction to Process Control**
 - Overview of process control principles.
 - Basics of process dynamics, control loops, and feedback control systems.

- Types of controllers: P, PI, PID.
- Control systems architecture and strategies.
- **Advanced Process Control Fundamentals**
- Introduction to APC: definition and scope.
- Importance of APC in modern industrial systems.
- Key benefits of APC strategies (e.g., cost reduction, quality improvement).
- Real-world applications of APC in industries like chemical, oil & gas, and manufacturing. Process Dynamics and Modeling
- **Process modeling techniques: First-principles, empirical models, and hybrid models.**
- Linear vs. nonlinear models.
- Process dynamics: time delays, lags, and dead times.
- **Model Predictive Control (MPC)**
- Fundamentals of MPC: control objectives and design.
- MPC vs traditional PID control.
- Case studies on the implementation of MPC in various industries.

• 02 Day Two

- **Multivariable Control Systems**
- Introduction to multivariable control systems.
- Decoupling, interaction analysis, and advanced control strategies.
- Design and implementation of decouplers in multivariable systems.
- **Cascade Control and Feedforward Control**
- Principles of cascade control: benefits and applications.
- Feedforward control: when and how to implement.
- Case studies and practical applications.
- **Adaptive Control Systems**

- Basics of adaptive control and its applications.
- Model Reference Adaptive Control (MRAC) and Self-Tuning Regulators (STR).
- Applications in industries requiring frequent adjustments to varying conditions.
- **Neural Networks and Fuzzy Logic in Process Control**
- Introduction to artificial intelligence in process control.
- Neural networks: training, structure, and applications in control.
- Fuzzy logic: fundamentals and implementation in process systems.

• 03 Day Three

- **Real-Time Optimization (RTO)**
- Principles of real-time optimization in process systems.
- Techniques and algorithms for implementing RTO.
- Integration of RTO with process control systems.
- **APC Integration with Distributed Control Systems (DCS)**
- Understanding DCS architecture and its role in APC.
- Integration of advanced control strategies with DCS and SCADA systems.
- Practical considerations for integration and troubleshooting.
- **Performance Monitoring and Benchmarking**
- Key performance indicators (KPIs) in process control.
- Techniques for measuring the effectiveness of APC systems.
- Benchmarking APC performance across industries.
- **Troubleshooting and Diagnostics**
- Common challenges in APC systems and troubleshooting techniques.
- Identifying faults, diagnosing issues, and rectifying performance problems.
- Case studies of successful troubleshooting in APC applications.

• 04 Day Four

◦ **Case Study 1: Chemical Industry Applications**

- APC strategies used in chemical manufacturing processes.
- Detailed analysis of a case study and lessons learned.

◦ **Case Study 2: Oil and Gas Applications**

- Optimizing oil & gas operations with APC.
- Real-world case study and challenges faced during implementation.

◦ **Simulation Tools for APC Design**

- Introduction to software tools for APC system design (e.g., MATLAB, Aspen Plus).
- Simulation of control strategies in a virtual environment.
- Hands-on session on building and testing models using simulation tools.

◦ **Control Software for MPC Implementation**

- Overview of control software used in MPC (e.g., Emerson DeltaV, Honeywell Experion).
- Configuring and deploying advanced control strategies using control software.
- Practical exercises on software configuration.

• 05 Day Five

◦ **APC in Batch Processes**

- Unique challenges in controlling batch processes.
- Implementing advanced control strategies in batch production.
- Case studies of successful batch process APC applications.

◦ **APC for Energy Management**

- The role of APC in energy optimization.
- Techniques for reducing energy consumption using advanced control.
- Industry case studies on energy management and APC.

- **Implementing APC Strategies**
 - Steps to implement APC strategies in an industrial environment.
 - Change management and process optimization considerations.
 - Overcoming resistance to APC implementation.
- **Future Trends in Process Control**
 - Emerging technologies in APC (e.g., machine learning, digital twins).
 - The future of automation and smart manufacturing.
 - Trends in integrating IoT and APC for real-time decision-making.

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
April 14, 2025	April 18, 2025	5 days	4250.00 \$	UAE - Dubai
Aug. 11, 2025	Aug. 15, 2025	5 days	2150.00 \$	Virtual - Online
Oct. 20, 2025	Oct. 24, 2025	5 days	5950.00 \$	USA - Los Angeles
Feb. 3, 2025	Feb. 7, 2025	5 days	4250.00 \$	UAE - Dubai