MERCURY

Industrial Instrumentation and Modern Control Systems Conference

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Introduction:

In an industrial setting where the precise measurement and control of various process parameters are essential, the expertise of Engineers and Technicians is crucial. A fundamental grasp of the operation of various sensors/transducers and instrumentation techniques, along with a working knowledge of Process Control methods and tuning procedures, makes professionals invaluable to their organizations.

This industrial instrumentation and control systems conference will allow participants to delve into instrumentation and measurement, gaining insights into variables' characteristics and properties. Delegates will also learn about the process control systems and methods utilized in contemporary industrial systems.

This hands-on industrial instrumentation and control systems training will be supplemented with practical activities wherever possible, ensuring the delegates can design, develop, construct, test, and evaluate their instrumentation systems according to theoretical studies.

Understanding Industrial Instrumentation and Control

Understanding and mastering industrial instruments and controls, as well as industrial instrumentation and control systems, is vital in today's dynamic industrial environments. This industrial instrumentation and control systems conference encompasses the comprehension of industrial instrumentation and control and the fundamentals of industrial instrumentation and process control.

Industrial instrumentation technicians play a critical role in maintaining, operating, and improving these systems. To enhance their skills, they often participate in an industrial instrumentation training program. Using the latest industrial instrumentation and control techniques, engineers, plant management, and technicians collaborate to ensure seamless process control and measurement accuracy.

Targeted Groups:

- Plant Management Personnel
- Engineers from all disciplines
- Processing Control Technicians
- Instrumentation Artisans
- Supervisors
- Individuals engaged in Projects.
- Those involved with Instrumentation Equipment Selection
- Safety Department Representatives
- Purchasing Department Representatives
- Anyone with more than a passing interest in instrumentation

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Conference Objectives:

By the end of this industrial instrumentation and control systems conference, the participants will:

- Understand the operating principles of a variety of sensors and transducers.
- Through hands-on exercises, investigate the functioning of an instrumentation system by designing, building, and testing sensor systems with appropriate signal conditioning.
- Become comfortable with various measurement techniques.
- Comprehend Process Control concepts and become acquainted with the properties of process variables.
- Share and disseminate experience and knowledge in open session discussions, enhancing the collective knowledge base.
- Gain familiarity with PID control and develop proficiency in tuning a process control system using PID techniques.
- Apply the learned techniques and principles to address unique measurement challenges in the workplace.
- Assess and choose the most appropriate sensor technology for an instrumentation system.
- Design, build, and test instrumentation systems to meet specific requirements
- Identify components and characteristics of a Process Control system.
- Calibrate and condition signals and take precise measurements from the system.

Targeted Competencies:

Upon the end of this industrial instrumentation and control systems conference, the participants will:

- Introduction to Instrumentation systems and Process variables. Symbols, units, and sample calculations.
- Temperature Measurement Techniques.
- Strain measurement.
- Exploration of Pressure and Flow Measurement.
- Understand ultrasonic techniques for non-invasive process measurement.
- Design, build, calibrate, and signal condition various sensor applications through practical activities.

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Conference Content:

Unit 1: Introduction to Sensors, Transducers, and Instrumentation Systems:

- Overview of Sensors, Transducers, and Instrumentation Systems.
- Provide examples.
- Terms and definitions linked to Instrumentation systems, including:
    - Maximum error.
    - Hysteresis.
    - Repeatability.
    - Sensitivity.
    - Resolution.
    - Span.
    - Response time.
- Discussion of Process Variables such as:
    - Mass flow.
    - Volumetric flow rate.
    - Pressure.
    - Viscosity.
    - Turbidity.

Unit 2: Strain, Pressure, and Flow Measurement:

- Fundamental principles of strain measurement are tension, compression, stress, strain, and young modulus.
- Operate principles, applications, and installation considerations of different gauge types.
- Basics of Pressure measurement.
- Operating principles, applications, and installation considerations for:
    - Diaphragms.
    - Bellows.
    - Capacitive devices.
    - Fiber Optic pressure measurement techniques.
- Fundamentals of flow measurement.
- Concepts such as Reynolds number.
- The principle of operation, application, and installation considerations of Invasive types like:
    - Coriolis Flowmeters.
    - Differential Pressure type flowmeters.
    - Orifice plate.
    - Venturi tube.
    - Flow nozzle.
    - Dall flow tube.
    - Electromagnetic flowmeters.

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Unit 3: Temperature, Level, and Non-Invasive Ultrasonic Measurement Techniques:

- Understand temperature scales.
- The operating principles, applications, and installation considerations of:
    - Resistance Temperature Detectors RTD's.
    - Thermistors.
    - Thermocouples.
    - Radiation Pyrometers.
- Principles of Single-Point and Continuous-Level Measurement Techniques.
- Direct and Indirect Level Measurement Techniques.
- The operating principles, applications, and installation considerations for:
    - Ultrasonic techniques.
    - Capacitive techniques.
    - Pressure techniques.
- Principles and Applications of Ultrasonic Techniques for Non-Invasive Measurement.
- Explanation of Doppler Shift and Transit Techniques and Ultrasonic Flowmeters.

Unit 4: Introduction to Process Control Engineering:

- Overview of Control Strategies.
- Representation using block diagrams.
- Explore control components.
- Understanding Servomechanisms and Regulators.
- Differentiate between Open and closed-loop systems.
- Discussion on Negative Feedback NFB.
- Explain Transfer Functions for 1st and 2nd order systems.
- Connection Between Transfer Functions and Closed-Loop Systems.
- Examination of ON/OFF control, Two-step control action, Proportional control, including aspects like:
    - Proportional band vs. proportional gain.
    - Proportional offset.
- Understand Reset Integral action and challenges like Integral windup.
- Explore Derivative action and PID control.

Unit 5: Tuning PID Controllers:

- Evaluating Stability and System Response.
- Use the Bode plot and Nyquist plot for analysis.
- Investigate Load disturbances and offset.
- Learning Empirical methods of setting Controllers, including:
    - Open-Loop Reaction Curve Method Ziegler-Nichols.
    - Default and Typical Settings.
- Explore the Closed-Loop continuous cycling method Ziegler-Nichols.
- Techniques for Fine-tuning controllers.