Fundamentals of Vibration Analysis

Energy Milestones Corporation

Advancing Professionals to the next level

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Fundamentals of Vibration Analysis

Overview

This course provides a thorough review of the various causes of process plant piping vibration from the perspective of an engineer who must identify the cause of vibration, determine if it is excessive, and correct the problem if necessary. It provides background on the fundamental causes of piping vibration, how to identify the source of vibration, rules of thumb and simplified methods for evaluating vibration severity, and methods of treatment. A wide variety of causes of vibration are covered in order to enable the participant to properly evaluate the variety of piping vibration prob lems that can occur in piping systems

Course Objectives

At the end of this course, the participants will be able to:

- Provide an integral, analytical/test approach to solving field vibration problems with an emphasis on piping vibration issues
- Provide a common language that supports a clear understanding for both the analyst and the test engineer of what each needs to solve vibration problems

Course Content

1. Introduction
   - General vibration facts and plant vibration issues

2. Optimum Vibration Problem Resolution Strategy
   - Root cause determination approach; Integration of analysis and test

3. Signal Processing
   - FFTs, windowing, filtering, digital integration, averaging, overlap and order tracking

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Course Content

4. Basic Vibration Theory

- Terminology: sine waves, amplitude, frequency, phase.
- Single DOF Parameters: stiffness, damping, and mass, Governing EOM
- Multi-degree-of-freedom system characteristics: mode shape and frequency

5. Vibration Test Fundamentals

- Test specifications: frequency range, measured parameters, sensor locations, sensor types
- Instrumentation concerns: linearity, range, bandwidth, installation, uncertainty analysis
- Data acquisition: digital vs. analogue. Digital DAQ issues: amplitude resolution and aliasing.

6. Data Analysis Techniques

- Data analysis: time history, frequency spectrum; Data statistics: peak, peak-to-peak, RMS

7. Vibration Causes and Data Interpretation

- Imbalance: static, dynamic; Misalignment: parallel and angular; Bent or bowed shaft
- Resonance and Critical speed; Damaged bearings; Gear problems; Fluid induced vibration

8. Case Studies

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Targeted Audience

This course is directed towards engineers responsible for operating piping systems. However, designers of new piping systems will also find the broad coverage of potential vibration problems a time-saving briefing on the variety of vibration problems that can occur in piping systems.

Course Methodology

Facilitated by an experienced professional trainer, this training course will be conducted as a highly interactive workshop session. A variety of training methodologies and facilitation techniques will be used before and during the course whenever applicable. These methods are aimed at enhancing individual and group interaction while maximizing learning. Some of these methods are:

- Online Pre-post Test
- Colorful Visual Aids
- Gamification
- Self-Assessment Instruments
- Simulations
- Case Studies
- Videos
- Group Exercises & Discussions
- Role plays
- Indoor & Outdoor games