

Maximizing Machinery Reliability...

the practical analyst

Seminar Synopsis

Abstract

A primary goal of modern condition-based maintenance programs is to maximize machinery reliability. The success of these efforts is often monitored by tracking mean-time-between-failures (MTBF), production uptime, product quality, maintenance costs, etc. Unfortunately, many programs fail to achieve the highest level of effectiveness because too much time is spent on the detection, rather than the analysis and prevention of problems. A key component of extending machinery life is effective analysis of the root cause of machinery failure, and using this knowledge to prevent recurrence of the failure.

This seminar focuses on use of practical vibration analysis and correction techniques. Its goal is to equip the analyst with the tools required to perform such analysis. Using our unique Activity Based Training™ format, analysts do not just learn the concepts of analysis, but receive detailed information on how to implement these concepts as a part of an effective machinery reliability program. The seminar addresses how to develop existing predictive technologies and interact with those in management, production and other departments. Analysts learn how much more value can be obtained by utilizing all resources available to obtain root cause solutions.

Whereas many training programs are available on general vibration analysis concepts, and others on specific instrument procedures, this seminar combines the two. It also addresses the subjects from the perspective of specific machine types and components which face the analyst on a daily basis. This seminar includes over thirty (30) guided hands-on activities, designed to maximize the retention of information.. This unique approach better equips the analyst to apply the seminar content and to immediately solve problems upon returning to the plant.

In order for the maximum cognitive levels to be achieved during this seminar it is important that the attendees bring their own vibration instruments. In Universal Technologies' Activity Based™ format, detailed step by step procedures specific to your instrument are presented for each analysis subject. Upon completion of the course each attendee will have a set of detailed set up procedures customized to their instrument for all the main analysis techniques.

Seminar subjects include the fundamentals and terminology of vibration, specific instrument setup procedures, detailed procedures for detecting and analyzing the most common vibration problems (misalignment, unbalance, resonance, etc.) as well as vibration analysis for specific machine types (pumps, motors, fans, etc.), More advanced subjects, including beat frequencies, low frequency applications, high frequency applications, and time waveform analysis are also introduced.

Students are also encouraged to bring practical case histories for in-class study.

Who should attend?

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This seminar is designed primarily for maintenance, engineering, technical support and management personnel whose job functions involve or relate to maximizing machinery reliability using current condition monitoring technologies. The scope of content is appropriate for those who collect vibration data, analyze machines, perform root cause failure analysis, or investigate and resolve premature machinery failure problems, as well as those who direct such activities. While the course is aimed towards participants with some vibration experience, new analysts will also find the seminar informative, eye opening and loaded with practical tips for immediate use.

Highlights

In this seminar, you will gain knowledge and experience relating to:

- Maximizing Machinery Reliability
- The Benefits of Effective Condition Monitoring
- Vibration Fundamentals and Terminology
- Detailed Procedures on Setup and Use of Your Instrument
- Detailed Detection, Analysis and Correction Procedures for the following vibration problems:
 - Resonance
 - Unbalance
 - Misalignment
 - Looseness
- Detailed Detection, Analysis and Correction Procedures for the following equipment/component types:
 - Bearings
 - Electric Motors
 - Gears
 - Pumps
 - Fans
 - Belt Drives
- Introduction of the following special vibration problems and techniques:
 - Beat Frequencies
 - Low Frequency Applications
 - High Frequency Applications
 - Time Waveform Analysis
- Hands-on Activities on all Subjects

Seminar Duration

The duration of this seminar ranges from 4 1/2 to 5 days depending on client preference, worker availability, and the attendees' backgrounds.

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Subject Outline:

1.0 Introduction

2.0 Maximizing Machinery Reliability

3.0 Vibration Fundamentals

- 3-1 Vibration Terminology
- 3-2 Vibration Severity
- 3-3 Condition Monitoring Data Requirements
- 3-4 Vibration Transducers
- 3-5 Good vs. Bad Data
- 3-6 Vibration Fundamentals Activities & Critique

4.0 Instrument Familiarization

- 4-1 FFT Introduction
- 4-2 FFT Operation and Setup Verification
- 4-3 Spectrum Acquisition
- 4-4 Phase Acquisition
- 4-5 Instrument Familiarization Activities & Critique

5.0 Common Vibration Problems

- 5-1 Resonance Overview, Analysis, and Correction
- 5-2 Analyzing Unbalance with Spectral and Phase Data
- 5-3 Unbalance Prevention Techniques
- 5-4 Analyzing Misalignment with Spectral and Phase Data
- 5-5 Misalignment Prevention Techniques
- 5-6 Looseness Overview, Detection and Analysis
- 5-7 Resonance, Unbalance, Misalignment, and Looseness Activities

6.0 Other Vibration Problems

- 6-1 Bearing Vibration
- 6-2 Electric Motor Vibration
- 6-3 Gear Vibration
- 6-4 Pump/Fan Vibration
- 6-5 Belt Drive Vibration
- 6-6 Bearings, Motors, Gears, Pumps, Fans, and Belt Drive Vibration Activities

7.0 Problems Requiring Special Techniques

- 7-1 Beat Frequencies
- 7-2 Low/High Frequency Applications
- 7-3 Time Waveform Analysis
- 7-4 Beats, Low/High Frequency and Time Waveform Activities

8.0 Putting it All Together

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NOTE: This 2-tier condensed outline highlights the major subjects and general sequence of the seminar. More detailed and day-to-day outlines are available upon request.

Associated Tasks

VIB1: Set up a vibration instrument and acquire spectral and phase data for analysis purposes for common machinery applications.

VIB2: Analyze and make suggestions for resolving the following common vibration problems:

- A. Resonance
- B. Unbalance
- C. Misalignment
- D. Looseness
- E. Bearing Defects
- F. Electrically-induced Vibration
- G. Flow-induced Vibration

Overall Seminar Goals

Upon completion of this training the student will be able to properly:

1. Explain the terminology, severity and data acquisition requirements for vibration analysis.
2. Explain how to select and correctly mount an appropriate vibration transducer for a particular application.
3. Recognize bad data and take appropriate steps to prevent it.
4. Verify the set up and operation of a vibration instrument and gather and record spectrum and phase data.
5. Explain, effectively analyze and correct /prevent the following vibration problems:
 - Resonance
 - Unbalance
 - Misalignment
 - Looseness
6. Explain the operation of, common problems with, and the effective analysis of the following machines and components:
 - Bearings
 - Motors
 - Gearboxes
 - Pumps
 - Fans
 - Belt Drives
7. Explain the phenomenon of beats and its effect on vibration data.
8. Explain and demonstrate how to perform analysis in low frequency applications.
9. Explain and demonstrate how to perform analysis in high frequency applications.

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10. Explain and demonstrate when and how to perform Time waveform analysis.

NOTE: The objectives above highlight overall seminar goals. A complete copy of the specific objectives are available upon request.