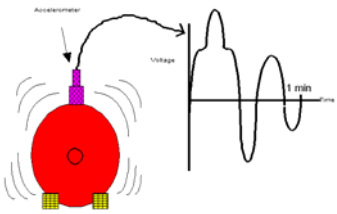
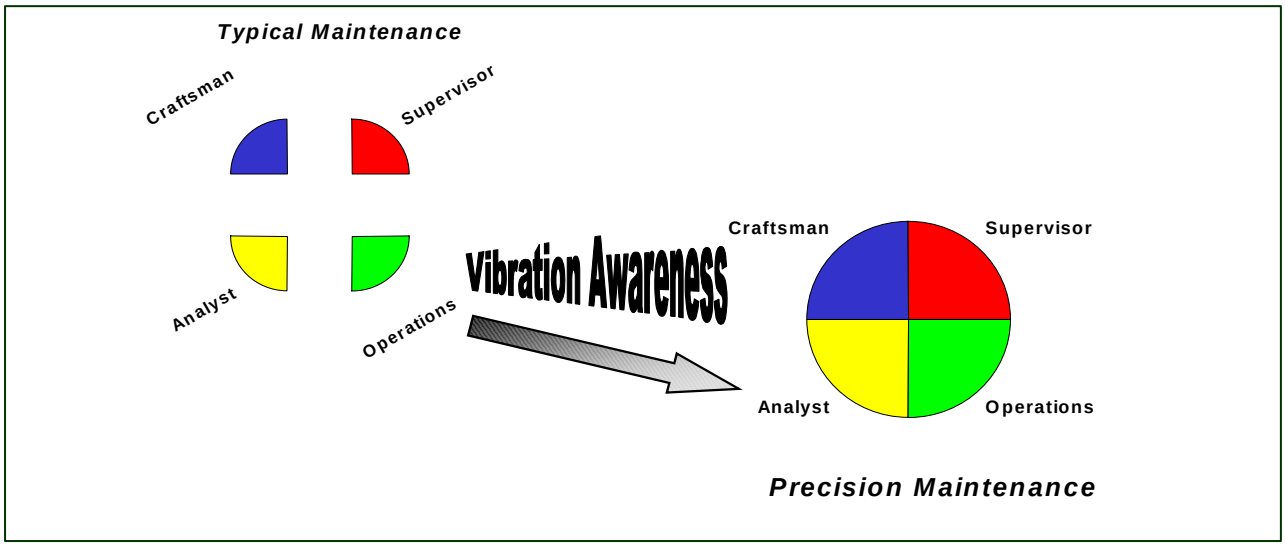


PdM-101: Introduction to Vibration and Detection Analysis

Abstract

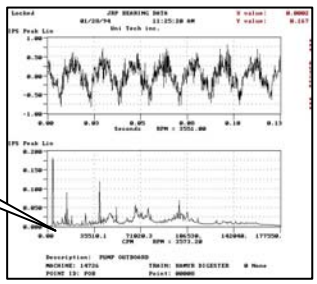
Vibration analysis is often the cornerstone of modern machinery reliability programs. In order for machinery reliability programs to be effective, it is necessary for all maintenance personnel to understand the technologies used. This seminar is designed to create an awareness of the terminology, capabilities and limitations of vibration analysis for personnel who play the vital supporting roles in effective machinery reliability programs.
The seminar focuses on the practical application of vibration, detection, analysis and correction techniques. Its goal is to equip craft personnel, managers, supervisors, and operations personnel with the tools required to understand and support condition-based maintenance processes.



Using our unique **Activity Based Training™** format, attendees do not just learn concepts, but receive detailed information on how to implement these concepts as a part of an effective machinery reliability program. The many-guided hands-on activities are designed to maximize the retention of information.

This seminar is designed for those who do not necessarily specialize in vibration analysis. Information is presented in a practical manner and using plain language. Personnel who work with and support the performance of vibration analysis processes are encouraged to attend.

Vibration Analysis Overview



Universal Technologies, Inc.

25797 Conifer Road #C210 Aspen Park, CO 80433 USA Tel: 303-838-3447 Fax: 303-838-3437 www.unitechinc.com

Seminar Duration

The duration of this seminar ranges from 20-24 hours depending on client preference, worker availability, and the attendees' backgrounds. Seminar can be customized to meet specific client needs.

Who should attend?

This seminar is designed primarily for maintenance, operations, 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.

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Associated Task(s)

1. Effectively support your facility's condition-based maintenance program, including:
   A. Understanding terminology associated with predictive maintenance technologies
   B. Communication with predictive maintenance personnel
   C. Understand the benefits of condition-based maintenance
   D. Understanding vibration analysis and machinery troubleshooting processes

2. Recognize the common symptoms, major causes, and practical prevention of the following machinery problems:
   A. Resonance
   B. Unbalance
   C. Misalignment
   D. Looseness
   E. Bearing Defects
   F. Electrically-induced Vibration
   G. Flow-induced Vibration

Seminar Objectives

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

1. Explain key elements and the benefits of an effective condition-based maintenance program.

2. Explain the terminology associated with condition-based maintenance and vibration analysis.

3. Explain how to determine vibration severity and associated precautions.

4. Explain precautions associated with data collection using modern FFT instruments.

5. Understand the machinery analysis approach, including the different types of data required.

6. Explain common symptoms, major causes, general analysis of and practical prevention techniques for the following common machinery problems:
   A. Resonance
   B. Unbalance
   C. Misalignment
   D. Looseness
   E. Bearing Defects
   F. Electrically-induced Vibration
   G. Flow-induced Vibration

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Seminar Outline

1.0 Introduction
2.0 Maximizing Machinery Reliability Overview
- 2.1 Maintenance Philosophies
- 2.2 Applying RCM Principles to Select Machines for Precision Repair
- 2.3 Benefits of Precision Maintenance
- 2.4 Most Common Sources of Premature Failure

3.0 Elements of Condition- Based Maintenance
- 3.1 Detection
- 3.2 Analysis
- 3.3 Correction/Improvement
- 3.4 Verification

4.0 Vibration Terminology/Severity

5.0 Vibration Analysis Approach
- 5.1 History/Machine Details
- 5.2 Hand Feel
- 5.3 Spectrum
- 5.4 Phase/Relative Motion

6.0 Data Acquisition Precautions
- 6.1 FFT Overview and Precautions
- 6.2 Transducer Locations and Mounting Overview

7.0 Resonance Introduction

8.0 Symptoms of Resonance
- 8.1 Speed Sensitivity
- 8.2 Vibration Mode Shapes
- 8.3 Bump Tests

9.0 Resonance Correction Techniques
- 9.1 Bracing
- 9.2 Mass
- 9.3 Eliminate Source

10.0 Unbalance Overview

11.0 Symptoms of Unbalance
- 11.1 History
- 11.2 Interpreting Spectrum
- 11.3 Using Phase/Relative Motion to Confirm Results

12.0 Common Causes of Unbalance and Prevention Techniques

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12.1 Tolerance and Standards
12.2 Precision Assembly Techniques
12.3 Costs VS. Benefits

13.0 Misalignment Overview

14.0 Symptoms of Misalignment
14.1 History
14.2 Spectrum/Precautions
14.3 Phase/Relative Motion

15.0 Common Causes of Misalignment and Prevention Techniques
15.1 Alignment Methods and Precautions
15.2 Applying Alignment Tolerances
15.3 Pre-alignment Checks
15.4 Detecting and Correcting Soft Foot
15.5 Detecting and Correcting Dynamic Movement, Thermal Growth, Pipe Strain

16.0 Bearings
16.1 Common Causes of Bearing Failure
16.2 Symptoms of Bearing Failure
16.3 Pattern Recognition
16.4 Bearing Failure Prevention Overview

17.0 Electric Motors
17.1 Symptoms of Motor Problems
17.2 Common Causes and Prevention Techniques

18.0 Analysis Assistant Pattern Recognition Chart

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