

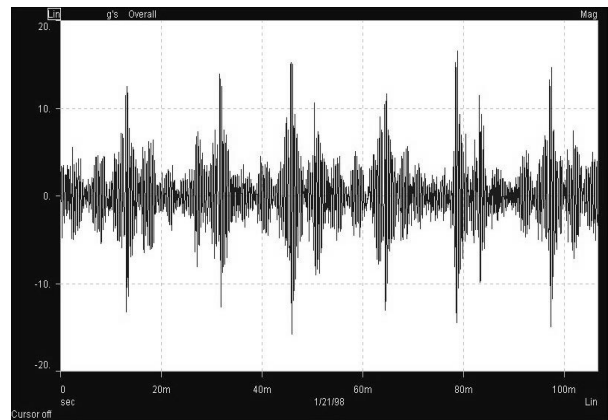
Maximizing Machinery Reliability... time waveform analysis Seminar Synopsis

Abstract

In recent years there has been a resurgence in the use of time waveform analysis techniques. Condition monitoring personnel have now come to realize some of the limitations of the FFT process. Since many find the time waveform analysis process difficult and confusing, the technique is rarely used to its full potential. This **Activity Based™** seminar examines the limitations of the FFT process, identifies specific applications where enhancing FFT information with time waveform analysis is appropriate, and discusses the interpretation of time waveform data in those applications.

The seminar details in practical terms how to set up your instrument, acquire, manipulate, and analyze time waveform data. Students are requested to bring their own instrumentation as the seminar contains extensive hands on activities. Time is also allotted in the course for discussion of student supplied case histories.

The seminar uses Universal Technologies' unique "Activity Based™" format and contains extensive hands on analysis activities using the special digital demonstrator units.



Who should attend?

This seminar is designed for those who have been active in the field of vibration analysis for at least 1 year and are looking to enhance their analysis capabilities with time waveform data.

Highlights

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

- Application of time waveform analysis in modern condition based maintenance programs
- Instrument setup for time waveform analysis
- Which measurement units to use
- Precautions when gathering waveform data
- Understanding how waves summate.
- Pattern recognition of common faults
- Understanding synchronous time averaging
- Triggers
- Rundown Tests
- Bump tests

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Seminar Synopsis

- Balancing using time waveform

Seminar Duration

The duration of this seminar is 3 days.

Associated Tasks

TW1: Given common machinery applications, set up a vibration instrument and acquire time waveform data for enhancement of certain analysis tasks.

TW2: Use time waveform data to enhance analysis of specific vibration problems, including:

- A. Unbalance
- B. Misalignment
- C. Eccentricity
- D. Looseness
- E. Bearings
- F. Rubs
- G. Gears
 - Looseness vs. eccentricity
 - Missing/cracked/broken teeth
- H. Beats

Overall Seminar Goals

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

1. Explain the advantages and disadvantages of FFT data and time waveform data for specific applications.
2. Explain the principles of the frequency and time relationship, $F=1/p$.
3. Select an appropriate measurement unit for particular applications.
4. Set up a vibration instrument to acquire appropriate time waveform data for any given application.
5. Select an appropriate transducer location and mounting method.
6. Explain setup precautions for gearboxes.
7. Identify and explain the fundamental patterns that comprise a time waveform, including:
 - Sine Waves
 - Truncation
 - Impacts
 - Rubs
 - Angel fish
 - Symmetry of amplitude and time scales

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8. Explain the effect of relative phase on the summation of waveform data.
9. Recognize typical time waveform patterns for the following common machinery problems:
 - Unbalance
 - Misalignment
 - Eccentricity
 - Looseness
 - Bearings
 - Rubs
 - Gears
 - Looseness vs. eccentricity
 - Missing/cracked/broken teeth
 - Beats
9. Set up and use triggers:
 - Internal
 - External
 - Analog
10. Utilize synchronous time averaging techniques to enhance analysis data.
11. Acquire and evaluate bump test data.
12. Acquire and evaluate coast down data.
13. Acquire and evaluate orbit data from large sleeve bearing machines.
14. Perform dynamic balancing using time waveform techniques.

Subject Outline

1.0 Introduction

- 1.1 Why time waveform?
- 1.2 When to use time waveform
- 1.3 When not to use time waveform
- 1.4 $F=1/p$ relationship
- 1.5 Instrument setups
- 1.6 Units of measurement
- 1.7 Transducer location
- 1.8 Precautions
- 1.9 Phase shift while integrating

2.0 Basic Analysis Techniques

- 2.1 Basic Patterns
 - A. Sine waves
 - B. Understanding how waves summate
 - C. Truncation
 - D. Impacts, Rubs
 - E. "Angel fish"
- 2.2 Symmetry

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- A. Amplitude
- B. Time scale

3.0 Pattern Recognition

- 3.1 Unbalance
- 3.2 Misalignment
- 3.3 Eccentricity
- 3.4 Looseness
- 3.5 Bearings
- 3.6 Rubs
- 3.7 Gears
- 3.8 Looseness vs. eccentricity
- 3.9 Missing/cracked/broken teeth
- 3.10 Beats
- 3.11 Precautions

4.0 Student Examples and Case History Discussion

5.0 Advanced Analysis Techniques

- 5.1 Orbits
- 5.2 Using Triggers
- 5.3 Synchronous time averaging
- 5.4 Bump Tests
- 5.5 Pre-triggering
- 5.6 Windows
- 5.7 Coast Downs
- 5.8 2 Channel Functions

6.0 Balancing using Time Waveform