

Vibration Analysis, Instruments, and Signal Processing

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This book was written to help the reader develop an understanding of common methods of vibration analysis and measurements. Starting with the requisite chapter on the single degree of freedom system, it jumps right into finite element analysis (FEA) in the next chapter, using simple dynamic systems for ease of illustrating the theory. The FEA chapter discusses modal analysis using a cantilever beam example and ends with a discussion on damping which I found rather short, considering the importance of damping upon analysis results.

Force response analysis, using FEA, is given an entire chapter on its own, including separate discussions of the direct integration and modal superposition solution methods with discussion of the merits of each approach. The next chapter, "Introduction to Vibration Instruments," provides a good description of the dynamics of displacement, velocity, and acceleration transducers, followed by a discussion on vibration excitation instruments, i.e., instrumented hammers and shakers. The chapter ends with data collection and storage.

The next chapter is dedicated to signal processing. Basic topics are discussed, including time domain signals, filtering, quantification of time domain data (e.g., RMS,

crest factor, etc.), calculation of the Fourier transform, Nyquist frequency, and window functions. Data sampling was included in the discussion on data collection and storage in the previous chapter. The next two chapters provide concise descriptions of experimental modal analysis and FEA model updating with examples provided.

Next is a chapter on vibration-based condition monitoring of rotating machines. This reviewer has limited experience in this particular field, but the chapter appears to encompass the necessary topics of measurement and fault detection techniques.

The final chapter provides a variety of case studies that appear to come directly from the author's experience as a vibration analyst. They were chosen to illustrate many of the concepts discussed in the previous chapters.

A strong background in linear algebra and differential equations is necessary in order fully understand many of the concepts discussed in the book. However, the content should be accessible to most advanced undergraduates and graduates pursuing degrees in engineering, physics, or mathematics. The book is not intended to be an encompassing reference. Rather, it provides a good starting point for anyone engaging in research or in a career related to vibration measurement and analysis.

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