An in-depth analysis of machine vibration in rotating machinery

Whether it’s a compressor on an offshore platform, a turbocharger in a truck or automobile, or a turbine in a jet airplane, rotating machinery is the driving force behind almost anything that produces or uses energy. Counted on daily to perform any number of vital societal tasks, turbomachinery uses high rotational speeds to produce amazing amounts of power efficiently. The key to increasing its longevity, efficiency, and reliability lies in the examination of rotor vibration and bearing dynamics, a field called rotordynamics.

A valuable textbook for beginners as well as a handy reference for experts, Machinery Vibration and Rotordynamics is teeming with rich technical detail and real-world examples geared toward the study of machine vibration. A logical progression of information covers essential fundamentals, in-depth case studies, and the latest analytical tools used for predicting and preventing damage in rotating machinery. Machinery Vibration and Rotordynamics:

• Combines rotordynamics with the applications of machinery vibration in a single volume
• Includes case studies of vibration problems in several different types of machines as well as computer simulation models used in industry
• Contains fundamental physical phenomena, mathematical and computational aspects, practical hardware considerations, troubleshooting, and instrumentation and measurement techniques

For students interested in entering this highly specialized field of study, as well as professionals seeking to expand their knowledge base, Machinery Vibration and Rotordynamics will serve as the one book they will come to rely upon consistently.

Dr. JOHN M. VANCE was professor of mechanical engineering at Texas A&M University, retiring in 2007. He received his PhD (1967) degree from The University of Texas at Austin. His book Rotordynamics of Turbomachinery (Wiley) has sold more than 3,000 copies and is used by turbomachinery engineers around the world. He is an inventor on several patents relating to rotating machinery and vibration reduction. His patented TAMSEAL has been retrofitted to solve vibration problems in a number of high-pressure industrial compressors. He is an ASME Fellow and a registered professional engineer in the state of Texas.

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Cover photo courtesy of Sulzer Turbo Services showing technicians working on a compressor rotor.
MACHINERY VIBRATION AND ROTORDYNAMICS
The first author gratefully dedicates his part in this book to his loving wife Louise, who made the book possible by her unselfish support of the task and devotion to her husband while it was being written.

John M. Vance
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This book follows the first author’s book *Rotordynamics of Turbomachinery* in its practical approach and style. Much of the material in that book has been updated and extended with new information, new examples, and a few corrections that reflect what has been learned since then. Of particular interest and significance are the new chapters (4, 5, and 6) on bearings, seals, and computer modeling contributed by the co-authors Dr. Fouad Zeidan and Dr. Brian Murphy. Dr. Zeidan is the president of two companies that design and manufacture high performance bearings and seals. These products often require the design and modeling of the complete rotor-bearing system to ensure reliable operation and compatibility. Dr. Murphy is the author of XLRotor™, one of the most widely used computer programs for rotordynamic analysis. Chapters 1 and 7 are also completely new. Chapter 1 describes the classical analytical techniques used by engineers for troubleshooting vibration problems. Chapter 7 gives a history of the most important rotordynamics analysis and experiments since 1869.

The authors have noted (with some surprise) for many years that the subject material of this book is not taught in most engineering colleges, even though rotating machines are probably the most common application of mechanical engineering. The book is organized so that the first three or four chapters could be used as a text for a senior or graduate college elective course. These chapters have exercises at the end that can be assigned to the students, which will greatly enhance their understanding of the chapter material. The later chapters will serve the same students well after graduation as reference source material with examples of analysis and test results for real machines, bearings, and seals. But for the majority of engineers assigned to troubleshoot a rotating machine, or to design it for reliability, and having no relevant technical background, this entire book can be the substitute for the course they never had.

It is the author’s hope that this book will make a significant contribution to the improvement of rotating machines for the service of mankind in the years to come.

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