

# Computational Techniques of Rotor Dynamics with the Finite Element Method

Second Edition



 **CRC Press**  
Taylor & Francis Group

**Arne Vollan and  
Louis Komzsik**

# Computational Techniques Of Rotor Dynamics With The Finite Element Method

**Shiyu Zhou**



## **Computational Techniques Of Rotor Dynamics With The Finite Element Method:**

*Computational Techniques of Rotor Dynamics with the Finite Element Method* Arne Vollan, Louis Komzsik, 2012-03-13 For more than a century we have had a firm grasp on rotor dynamics involving rigid bodies with regular shapes such as cylinders and shafts. However, to achieve an equally solid understanding of the rotational behavior of flexible bodies, especially those with irregular shapes such as propeller and turbine blades, we require more modern tools and methods. *Computational Techniques of Rotor Dynamics with the Finite Element Method* explores the application of practical finite element method (FEM) based computational techniques and state-of-the-art engineering software. These are used to simulate behavior of rotational structures that enable the function of various types of machinery, from generators and wind turbines to airplane engines and propellers. The book's first section focuses on the theoretical foundation of rotor dynamics, and the second concentrates on the engineering analysis of rotating structures. The authors explain techniques used in the modeling and computation of the forces involved in the rotational phenomenon. They then demonstrate how to interpret and apply the results to improve fidelity and performance. Coverage includes: Use of FEM to achieve the most accurate computational simulation of all gyroscopic forces occurring in rotational structures; Details of highly efficient and accurate computational and numerical techniques for dynamic simulations; Interpretation of computational results which is instrumental to developing stable rotating machinery; Practical application examples of rotational structures' dynamic response to external and internal excitations; An FEM case study that illustrates the computational complexities associated with modeling and computation of forces of rotor dynamics; Assessment of propellers and turbines that are critical to the transportation and energy industries. Useful to practicing engineers and graduate-level students alike, this self-contained volume also serves as an invaluable reference for researchers and instructors in this field. CRC Press. Authors Speak: Louis Komzsik introduces you to two books that share a common mathematical foundation: the finite element analysis technique. Watch the video.

*Computational Techniques of Rotor Dynamics with the Finite Element* Arne Vollan, Louis Komzsik, 2025 Rotor dynamics is both a classical and a modern branch of engineering science. The rotation of rigid bodies, mainly those with regular shapes such as cylinders and shafts, has been well understood for more than a century. However, analyzing the rotational behavior of flexible bodies, especially those with irregular shapes like propellers and blades, requires more modern tools such as finite elements, hence the title and focus of the book. In the dozen years since the original publication, the book was used in teaching engineering students at universities and in consulting in the industry. During those activities, several topics were deemed to require further explanations. Students requested a deeper finite element technology foundation in certain places to make the book self-contained in that regard also. Some desired more details about the computational and numerical solutions. These requests are answered in new sections of this edition. Practicing engineers asked for a detailed industrial application case study, and such was added in a new chapter dealing with wind turbines. The book is composed of two parts: the first focusing

on the theoretical foundation of rotor dynamics and the second on the engineering analysis of industrial structures The theoretical foundation is built on physics calculus and finite element technology chapters Computational and numerical techniques provide free vibration and response analyses solutions The industrial engineering analysis part contains chapters analyzing jet engine turbine wheels aircraft propellers and wind turbine blades The book concludes with a new industrial case study based on a recent modern wind turbine development project **The Shock and Vibration Digest** ,1993

**Vibration Analysis of Rotors** Chong-Won Lee,2012-12-06 This text is intended for use as an advanced course in either rotordynamics or vibration at the graduate level This text has mostly grown out of the research work in my laboratory and the lectures given to graduate students in the Mechanical Engineering Department KAIST The text contains a variety of topics not normally found in rotordynamics or vibration textbooks The text emphasizes the analytical aspects and is thus quite different from conventional rotordynamics texts potential readers are expected to have a firm background in elementary rotordynamics and vibration In most previously published rotordynamics texts the behavior of simple rotors has been of a primary concern while more realistic multi degree of freedom or continuous systems are seldom treated in a rigorous way mostly due to the difficulty of a mathematical treatment of such complicated systems When one wanted to gain a deep insight into dynamic phenomena of complicated rotor systems one has in the past either had to rely on computational techniques such as the transfer matrix and finite element methods or cautiously to extend ideas learned from simple rotors whose analytical solutions are readily available The former methods are limited in the interpretation of results since the calculations relate only to the simulated case not to more general system behavior Ideas learned from simple rotors can fortunately often be extended to many practical rotor systems but there is of course no guarantee of their validity ASME

Technical Papers ,1995 *Journal of Engineering for Gas Turbines and Power* , **Advances in Design Automation**,

**1989: Design optimization** Bahram Ravani,1989 *Advances in Design Automation, 1989* Bahram Ravani,1989

*Modeling, Estimation, and Active Balancing of Speed Varying Rotor System* Shiyu Zhou,2001 *Stability of Numerical Integration Techniques for Transient Rotor Dynamic* Albert F. Kascak,1977 *Third International Conference on Vibrations in Rotating Machinery, 11-13 September 1984, University of York, Heslington, Yorkshire* Institution of Mechanical Engineers (Great Britain). Engineering Sciences Division,1984 Name of previous conferences varied Rotor Dynamics by the Finite Element Method Including Dynamic Model Reduction Karen Belles Kane,1988 **Paper** ,1995 Stability of Numerical Integration Techniques for Transient Rotor Dynamics Albert F. Kascak,1977 **Vibrations in Rotating Machinery** ,1984

**Journal of Mechanical Design** ,1980 *Proceedings of the Fourth International Conference on Rotor Dynamics, September 7-9, 1994, Chicago, USA* Ronald L. Eshleman,Neville F. Rieger,1994 *Annual Report to the President* Cornell University. College of Engineering,1983 **The Directory of Graduate Studies** ,1999 Graduate Programs in Engineering and Applied Sciences 1984 ,1983

The Enigmatic Realm of **Computational Techniques Of Rotor Dynamics With The Finite Element Method**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing lacking extraordinary. Within the captivating pages of **Computational Techniques Of Rotor Dynamics With The Finite Element Method** a literary masterpiece penned by a renowned author, readers set about a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book's core themes, assess its distinct writing style, and delve into its lasting impact on the hearts and minds of those who partake in its reading experience.

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