Journal of Sound and Vibration (2002) **250**(5), 965–968
doi:10.1006/jsvi.2001.4031, available online at http://www.idealibrary.com on IDEAL®

BOOK REVIEWS

ROTATING MACHINERY VIBRATION, 2000, by M. L. Adams. New York: Marcel Dekker, xxii + 354 pp. Price US $150.00. ISBN 0-8247-0258-1

This book contains 12 chapters and covers most of the aspects of rotordynamics: equations and analyses, monitoring and diagnostics, and troubleshooting.

Chapter 1 deals with basic vibration: one-degree-of-freedom and multi-degree-of-freedom systems, modal decomposition, modal damping, harmonic excitation response, instability and complex eigenvalue problems.

Chapter 2 concerns lateral rotor analysis. Basic equations are presented using Newton's law and Lagrange's equations. The latter method is used for obtaining the matrices used in the rotor dynamic analysis (RDA) finite element software: mass, stiffness and gyroscopic matrices. The models for a radial bearing and support are also outlined. The author first focuses on linear behavior: a system with non-symmetric matrices, an isotropic model, and bearing and seal models. He then deals with non-linear behavior:sources yielding non-linear effects, and non-linear journal bearing and seal models. He also gives information concerning two catastrophic failures of large 600 MW steam turbine-generator sets.

Chapter 3 is on torsion. As Dr Adams says, this effect is often of little importance for machines, especially for machines with single uncoupled rotors. Indeed, of the eight rotordynamics textbooks listed in the bibliography of the preceding chapter, only two cover torsion. Basic matrices are given and coupled parallel rotors are shown. The examples presented briefly deal with steady-state motion or transient problems caused by electric motors and generators: a high-capacity fan for a large-altitude wind tunnel, a four-square gear tester and large steam turbogenerator sets.

In Chapter 4 the RDA software is described. Its introduction contains the main menu of the program, then the unbalance steady-state response is presented. Lastly, explanations concerning elliptical orbits and stability computations are given. Data and results for several examples are presented, including a three-mass rotor with two bearings and one disk and a nine-stage, two-bearing centrifugal pump.

Chapter 5 is on bearing and seal characteristics. First, fluid–film journal bearings are presented: Reynolds equation, stiffness and damping characteristics, resources from the literature, journal-bearing softwares and uncertainties in modelling bearings. Experiments for obtaining dynamic characteristics are presented, including impedance and instability threshold approaches. Lastly, annular seals, rolling contact bearings and squeeze film dampers are presented.

Chapter 6 presents turbomachinery impeller and blade effects, static and dynamic radial forces in centrifugal pumps, centrifugal compressors, high-pressure steam turbines and gas turbines (steam whirl, blade tip clearance, blade shroud annular seal, partial admission in impulse stages) and axial flow compressors.

Chapter 7 deals with measurement and data acquisition. After an introduction to monitoring and diagnostics, signal measurements and associated sensors (accelerometers, velocity and displacement transducers), data acquisition and signal conditioning are presented.

Chapter 8 gives information on casing and bearing cap vibration guidelines, ISO and API standards, guidelines and acceptance criteria and shaft displacement criteria.

0022-460X/02/100965 + 04 $35.00/0

Chapter 9 covers signal analysis and identification of vibration causes: vibration trends and baselines, FFT spectrum, rotor orbit trajectories, cascade plots, wavelets, chaos, symptoms and identification of vibration causes: rotor mass unbalance, self-excited instability, rotor-stator rub, misalignment, resonance, mechanically loose connections, cracked shaft, rolling element bearing, gears and vane/blade passing effects.

The last part of the book contains three chapters mostly devoted to case studies. In chapter 10, problems on site due to rotor unbalance and critical speeds are presented with the solutions applied. They concern a high-pressure turbine passing through a critical speed and two boiler feed pumps with a critical speed in the operating speed range.

In chapter 11, the author presents three case studies concerning self-excited vibration: use of swirl brakes for stabilizing a 1300 MW unit, steam whirl due to bearings unloaded by nozzle forces in a 650 MW unit and oil-whip/steam-whirl "duet" created by misalignment in a 430 MW unit.

In the last chapter, the author presents additional vibration cases and some special topics: vertical-rotors, impact tests for diagnoses, bearing looseness effects, tilting-pad versus fixed-surface journal bearing, base motion excitation from earthquake and shock, parametric excitation for non-symmetric shaft stiffness, magnetic bearings and rotor balancing with the influence coefficient method.

A floppy disk for PC's is given with the book. It contains three programs. BearCoef is a library of tables for dimensionless hydrodynamic bearing stiffness and damping coefficients. A spreadsheet allows an easy use of these tables. The RDA and Balance directories contain DOS programs and examples (data and results).

One slight criticism by this reviewer is that he would have liked some information on the Campbell (interference) diagram which is useful when damping is low.

Whatever the case, it is clear that this book benefits from Dr Adams' very long experience (14 years in industry) prior to becoming a professor and more than 20 years as consultant and professor. In particular, he has been involved in all the cases studies presented.

In conclusion, this clearly written book will be useful for graduate students, professors and engineers and the reviewer highly recommends it for those concerned with rotordynamics.

M. LALANNE

HANDBOOK OF VISCOELASTIC VIBRATION DAMPING, 2001, by D. I. G. Jones. Chichester: John Wiley & Sons, Ltd. xi + 391pp. Price £75.00. ISBN 0-471-49248-5

The author's Preface states: " … Attempts are often made to apply viscoelastic materials for the solution of practical engineering vibration and noise control problems … It is essential to have an adequate understanding of viscoelastic materials in order to achieve success … It is the purpose of this handbook to introduce readers to the fundamentals of damping by means of polymeric viscoelastic materials, including means for characterising material behaviour under dynamic strain, means for obtaining usable mathematical models for application in finite element or other computational processes, means for measuring the relevant parameters for any specific polymer, and means for selecting and designing effective treatments".

From the Preface, as well as from the text, it is clear that this is not what one would typically consider a handbook that provides terse information one can readily access without reading several of the book's sections. Rather, this book is more nearly an instructional text that begins with basics and progresses to more complex topics. It is in