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Spur Gear Teeth Contact Analysis on Power-train Transmission Noise, Vibration and Harshness Zheng Li 2009

Vibration Fundamentals R. Keith Mobley 1999-04-23 In a single useful volume, Vibration Fundamentals explains the basic theory, applications, and benefits of vibration analysis, which is the dominant predictive maintenance technique used with maintenance management programs. All mechanical equipment in motion generates a vibration profile, or signature, that reflects its operating condition. This is true regardless of speed or whether the mode of operation is rotation, reciprocation, or linear motion. There are several predictive maintenance techniques used to monitor and analyze critical machines, equipment, and systems in a typical plant. These include vibration analysis, ultrasonics, thermography, tribology, process monitoring, visual inspection, and other nondestructive analysis techniques. Of these techniques, vibration analysis is the dominant predictive maintenance technique used with maintenance management programs, and this book explains the basic theory, applications, and benefits in one easy-to-absorb volume that plant staff will find invaluable. This is the second book in a new series published by Butterworth-Heinemann in association with PLANT ENGINEERING magazine. PLANT ENGINEERING fills a unique information need for the men and women who operate and maintain industrial plants. It bridges the information gap between engineering education and practical application. As technology advances at increasingly faster rates, this information service is becoming more and more important. Since its first issue in 1947, PLANT ENGINEERING has stood as the leading problem-solving information source for America's industrial plant engineers, and this book series will effectively contribute to that resource and reputation. Provides information essential to industrial troubleshooting investigations Describes root-cause failure analysis Incorporates detailed equipment-design guidelines

Structural Vibration C. F. Beards 1996 This work examines a range of methods for controlling structural vibrations, both by damping and by excitation control. It describes the techniques for modelling structures in a way suitable for mathematical analysis, and includes worked examples which rei

Fundamentals of Structural Dynamics Zhihui Zhou 2021-06-08 Dynamics of Structural Dynamics explains foundational concepts and principles surrounding the theory of vibrations and gives equations of motion for complex systems. The book presents classical vibration theory in a clear and systematic way, detailing original work on vehicle-bridge interactions and wind effects on bridges. Chapters give an overview of structural vibrations, including how to formulate equations of motion, vibration analysis of a single-degree-of-freedom system, a multi-degree-of-freedom system, and a continuous system, the approximate calculation of natural frequencies and modal shapes, and step-by-step integration methods. Each chapter includes extensive practical examples and problems. This volume presents the foundational knowledge engineers need to understand and work with structural vibrations, also including the latest contributions of a globally leading research group on vehicle-bridge interactions and wind effects on bridges. Explains the foundational concepts needed to understand structural vibrations in high-speed railways Gives the latest research from a leading group working on vehicle-bridge interactions and wind effects on bridges Lays out routine procedures for generating dynamic property matrices in MATLAB© Presents a novel principle and rule to help researchers model time-varying systems Offers an efficient solution for readers looking to understand basic concepts and methods in vibration analysis

An Investigation of Off-Road Vehicle Power Train Diagnostics Utilizing High Frequency Vibration Analysis John L. Frarey 1974 The report covers a short three-month program to investigate the feasibility of using high-frequency vibration analysis to diagnose power train condition in off-highway vehicles. The program was conducted on Caterpillar D8H crawler-type tractors. It was found that the use of vibration generated during shift transients to identify spectral regions of interest and to serve as a guide in establishing limits for steady-state vibration analysis appears to be a valid method for diagnosing power train component degradation. Examples of data characteristics considered normal and abnormal for the three major power train components are included in the report. In this respect the program was very fortunate because data from different tractors were recorded and analyzed that varied in age from a new tractor to one that had been used for over 12,000 hours. (Modified author abstract).

Dynamics and Vibration Analyses of Gearbox in Wind Turbine Qingkai Han 2016-09-27 This book explores the dynamics and vibration properties of gearboxes, with a focus on geared rotor systems. It discusses mechanical theories, finite-element based simulations, experimental measurements and vibration signal processing techniques. It introduces the vibration-resonance calculation method for the geared rotor system in wind turbines and load sharing of the planetary gear train, and offers a method for calculating the vibrations of geared rotor systems under either internal excitations from gear sets or external loads transferred from wind loads. It also defines and elaborates on parameter optimization for planetary gear systems based on the torsional dynamics of wind-turbine geared rotor systems. Moreover, it describes experimental measurements of vibrations on the wind-turbine gearbox performed on the test rig and on site, and analyzes the vibration signals of different testing points, showing them in both time and frequency domains. Lastly, it lists the gear coupling frequencies and fault characteristic frequencies from the vibrations of the gearbox housing. The technologies and results presented are valuable resources for use in dynamic design, vibration prediction and analysis of gearboxes and geared rotor systems in wind turbines as well as many other machines.

Study of Dominant Frequencies of Train-Induced Vibration and Analysis Method for Train Braking Effect ??? 2007

Applied Theory of Vibration Isolation Systems K. V. Frolov 1990 A monograph based on years of study in the field of vibration isolation. This volume addresses the analysis and synthesis of vibration isolation systems as well as experimental methods.

Virtual Security Envelope for Vibration Analysis of a Motorcycle Power Train Eduardo F. Piatti 2007

Measurement and Analysis of Truck Power Train Vibration Randall L. Fox 1976

VIBRATION AND NOISE REDUCTION IN PLANETARY GEAR TRAIN BY PHASING Ashutosh Mokate 2016-03-10 Gears are essential parts of many precision power transmitting machines such as automobiles. The major functions of a gearbox are to transform speed and torque in a given ratio and to change the axis of rotation.

Planetary gears yield several advantages over conventional parallel shaft gear systems: They produce high speed reductions in compact spaces, a greater load sharing, a higher torque to weight ratio, diminished bearing loads, and reduced noise and vibration. They are used in automobiles, helicopters, aircraft engines, heavy machinery, and a variety of other applications. Despite their advantages, the noise induced by the vibration of planetary gear systems remains a key concern. Planetary gears have received considerably less research attention than single mesh gear pairs. There is a particular scarcity of analysis of two planetary gear systems and their dynamic response. Hence, this book focuses on the study of two PGTs with different phasing (angular positions) while every individual set remains unchanged.

Wave Propagation for Train-Induced Vibrations

Correlation and Contribution Analysis of Vibration Phenomenon's Affecting Ride Comfort Considering Power-train and Chassis Targets Jagannatha Chary Senapathy 2011

Advanced Vibration Analysis S. Graham Kelly 2006-12-19 Delineating a comprehensive theory, Advanced Vibration Analysis provides the bedrock for building a general mathematical framework for the analysis of a model of a physical system undergoing vibration. The book illustrates how the physics of a problem is used to develop a more specific framework for the analysis of that problem. The author elucidates a general theory applicable to both discrete and continuous systems and includes proofs of important results, especially proofs that are themselves instructive for a thorough understanding of the result. The book begins with a discussion of the physics of dynamic systems comprised of particles, rigid bodies, and deformable bodies and the physics and mathematics for the analysis of a system with a single-degree-of-freedom. It develops mathematical models using energy methods and presents the mathematical foundation for the framework. The author illustrates the development and analysis of linear operators used in various problems and the formulation of the differential equations governing the response of a conservative linear system in terms of self-adjoint linear operators, the inertia operator, and the stiffness operator. The author focuses on the free response of linear conservative systems and the free response of non-self-adjoint systems. He explores three method for determining the forced response and approximate methods of solution for continuous systems. The use of the mathematical foundation and the application of the physics to build a framework for the modeling and development of the response is emphasized throughout the book. The presence of the framework becomes more important as the complexity of the system increases. The text builds the foundation, formalizes it, and uses it in a consistent fashion including application to contemporary research using linear vibrations.

Vibrations of Elasto-Plastic Bodies Vladimir Palmov 1998-04-08 Undeservedly little attention is paid in the vast literature on the theories of vibration and plasticity to the problem of steady-state vibrations in elastoplastic bodies. This problem, however, is of considerable interest and has many important applications. The problem of low-cyclic fatigue of metals, which is now in a well de veloped state is one such application. The investigations within this area are actually directed to collecting experimental facts about repeated cyclic loadings, cf. [47J. Theoretical investigations within this area usually con sider the hysteretic loops and the construction of models of plasticity theory which are applicable to the analysis of repeated loadings and the study of the simplest dynamic problems. Another area of application of the theory of the vibration of elastoplas tic bodies is the applied theory of amplitude-dependent internal damping. Another name for this theory is the theory of energy dissipation in vibrat ing bodies. In accordance with the point of view of Davidenkov "internal damping" in many metals, alloys and structural materials under consider able stress presents exactly the effect of micro plastic deformations. There fore, it may be described by the methods of plasticity theory. This point of view is no doubt fruitful for the theory of energy dissipation in vibrating bodies, as it allows one to write down the constitutive equations appropri ate both for vibrational analysis of three-dimensional stress states and an investigation of nonharmonic deformation. These problems are known to be important for the theory of internal damping.

Group Theory and G-vector Spaces in Engineering Structures ?or?e Zlokovi? 1989

Vibration Analysis of Rotors Chong-Won Lee 1993-06-30 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-f-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.

Mechanical Vibrations and Condition Monitoring J C Jauregui 2020-03-01 Mechanical Vibrations and Condition Monitoring presents a collection of data and insights on the study of mechanical vibrations for the predictive maintenance of machinery. Seven chapters cover the foundations of mechanical vibrations, spectrum analysis, instruments, causes and effects of vibration, alignment and balancing methods, practical cases, and guidelines for the implementation of a predictive maintenance program. Readers will be able to use the book to make predictive maintenance decisions based on vibration analysis. This title will be useful to senior engineers and technicians looking for practical solutions to predictive maintenance problems. However, the book will also be useful to technicians looking to ground maintenance observations and decisions in the vibratory behavior of machine components. Presents data and insights into mechanical vibrations in condition monitoring and the predictive maintenance of industrial machinery Defines the key concepts related to mechanical vibration and its application for predicting mechanical failure Describes the dynamic behavior of most important mechanical components found in industrial machinery Explains fundamental concepts such as signal analysis and the Fourier transform necessary to understand mechanical vibration Provides analysis of most sources of failure in mechanical systems, affording an introduction to more complex signal analysis

Vehicle Gearbox Noise and Vibration Jiri Tuma 2014-02-20 Advances in methods of gear design and the possibility ofpredicting the sound pressure level and life time of gearboxes andperfect instrumentation of test stands allows for the production ofa new generation of quiet transmission units. Current literature ongearbox noise and vibration is usually focused on a particularproblem such as gearbox design without a detailed description ofmeasurement methods for noise and vibration testing. Vehicle Gearbox Noise and Vibration: Measurement, SignalAnalysis, Signal Processing and Noise Reduction Measuresaddresses this need and comprehensively covers the sources of noiseand vibration in gearboxes and describes various methods of signalprocessing. It also covers gearing design, precision manufacturing,measuring the gear train transmission error, noise test on testingstands and also during vehicle pass-by tests. The analysis tools for gearbox inspection are based on thefrequency and time domain methods, including envelope and averagetoothmesh analysis. To keep the radiated noise under control, theeffect of load, the gear contact ratio and the tooth surfacemodification on noise and vibration are illustrated by measurementexamples giving an idea how to reduce transmission noise. Key features: Covers methods of processing noise and vibration signals Takes a practical approach to the subject and includes a casestudy covering how to successfully reduce transmission noise Describes the procedure for the measurement and calculation ofthe angular vibrations of gears during rotation Considers various signal processing methods including order analysis, synchronous averaging, Vold-Kalman order trackingfiltration and measuring the angular vibration Vehicle Gearbox Noise and Vibration: Measurement, SignalAnalysis, Signal Processing and Noise Reduction Measures is acomprehensive reference for designers of gearing systems and testengineers in the automotive industry and is also a useful source ofinformation for graduate students in automotive and noiseengineering.

Vibrations and Stability Jon Juel Thomsen 2003-11-05 Lucidly uniting classical and modern topics of advanced vibration analysis, this text provides students with a background in elementary vibrations, especially with tools necessary for understanding and analyzing more complex dynamical phenomena that can be encountered in engineering and scientific practice. It progresses steadily from linear vibration theory over levels of nonlinearity to bifurcation analysis, global dynamics and chaotic vibrations. Readers gain analytical skills with simple models, learn to recognize nonlinear phenomena, and employ advanced tools such as perturbation analysis and bifurcation analysis. Enriching theory with relevant examples from real systems, this book meets the increasing interest in non-linear dynamics in engineering, applied mathematics, and physics. This edition includes a new chapter on the useful effects of fast vibrations and many new exercise problems.

Railway Vibration Analysis on Light Rapit Transit Train 2004

Noise and Torsional Vibration Analysis of Hybrid Vehicles Xiaolin Tang 2022-06-01 Thanks to the potential of reducing fuel consumption and emissions, hybrid electric vehicles (HEVs) have been attracting more and more attention from car manufacturers and researchers. Due to involving two energy sources, i.e., engine and battery, the powertrain in HEVs is a complicated electromechanical coupling system that generates noise and vibration different from that of a traditional vehicle. Accordingly, it is very important to explore the noise and vibration characteristics of HEVs. In this book, a hybrid vehicle with two motors is taken as an example, consisting of a compound planetary gear set (CPGS) as the power-split device, to analyze the noise and vibration characteristics. It is specifically intended for graduates and anyone with an interest in the electrification of full hybrid vehicles. The book begins with the research background and significance of the HEV. The second chapter presents the structural description and working principal of the target hybrid vehicle. Chapter 3 highlights the noise, vibration, and harshness (NVH) tests and corresponding analysis of the hybrid powertrain. Chapter 4 provides transmission system parameters and meshing stiffness calculation. Chapter 5 discusses the mathematical modeling and analyzes torsional vibration (TV) of HEVs. Finally, modeling of the hybrid powertrain with ADAMS is given in Chapter 6.

Perform Vibration Analysis

HDC Human Development Consultants 2000

An Introduction to Mechanical Vibrations Robert F. Steidel 1989-01-17 This Third Edition of the well-received engineering text retains the clarity of exposition that made the previous editions so popular, and contains the most widely-used problem sets in the business. Approach to vibration analysis is clear, concise, and simple, backed up by a wealth of problems and examples. Multi-degree-of-freedom problems are well-prefaced with two-degree-of-freedom cases. There is a special treatment of damping, including non-viscous problems (standard texts make much use of viscous damping, but most practical examples are not viscous). Now includes an excellent development of Rayleigh's principle and an introduction to finite element vibration analysis. Contains 100 new problems.

Foundation Vibration Analysis Using Simple Physical Models John P. Wolf 1994 This book provides simple physical models to represent the unbounded soil in time and frequency domain analysis. They do not supplant the more generally applicable rigorous methods, but rather supplement them. The physical models used consists of the following representations: cones based one-dimensional rod theory; lumped-parameter models with frequency-independent springs, dashpots, and masses; and prescribed wave patterns in the horizontal plane. The physical models thus offer a strength-of-materials approach to foundation dynamics.

Assessment of the Impact of Camshaft Machining Inputs on Valve Train Sound Quality Using Vibration Analysis Matthew C. Daws 2002

Vibration measurement Gh. Buzdugan 1986-08-31 Nowadays, the engineering practice raises far more vibration problems than can be theoretically explained or modelled. Because of this, measurements are used in almost all fields of industry, transportation and civil engineering in studies of mechanical and structural vibration. They are an invaluable tool for designing products and machines with high reliability and low noise level, vehicles and buildings with improved comfort and resistance to dynamic loads, as well as for obtaining increased safety of operation and optimum running parameters. In order to cope with the increasing demand for experimental measurement of vibration characteristics, young engineers and designers need an introductory book with emphasis on "what has to be measured" and "by what means" before learning "how measurements are done". The expertise to perform vibration measurements must be gained in time, with every new investigation and studied problem. A detailed presentation of instrumentation and measuring techniques is beyond the aim of this book. Such information can be found in product data sheets, application manuals and hand books supplied by equipment manufacturers. Only general principles and widely used methods are presented herein, in order to provide the reader with an overview of the instrumentation and techniques encountered in vibration measurement.

Analysis of Synchronous Belt Vibration in Automotive Valve Train Naohiko Mizuno 1988

Foundation Vibration Analysis John P. Wolf 2004 This book describes an alternative approach, based on the 'strength-of-materials' approach that has proved so successful in structural analysis. It employs tapered bars and beams, termed cones. This straightforward approach allows the analysis of most sites, and provides results of engineering accuracy obtained with conceptual clarity and physical insight."

Inverse Problems in Vibration G.M.L. Gladwell 2004-08-10 In the first, 1986, edition of this book, inverse problems in vibration were interpreted strictly: problems concerning the reconstruction of a unique, undamped vibrating system, of a specified type, from specified vibratory behaviour, particularly specified natural frequencies and/or natural mode shapes. In this new edition the scope of the book has been widened to include topics such as isospectral systems- families of systems which all exhibit some specified behaviour; applications of the concept of Toda flow; new, non-classical approaches to inverse Sturm-Liouville problems; qualitative properties of the modes of some finite element models; damage identification. With its emphasis on analysis, on qualitative results, rather than on computation, the book will appeal to researchers in vibration theory, matrix analysis, differential and integral equations, matrix analysis, non-destructive testing, modal analysis, vibration isolation, etc. "This book is a necessary addition to the library of engineers and mathematicians working in vibration theory." Mathematical Reviews

Vibration Analysis of Gas Turbine Rotors Srinivasa Rao Dokku 2018-09-20 Master's Thesis from the year 2016 in the subject Engineering - Mechanical Engineering, , language: English, abstract: The purpose of this report is to determine the lateral and torsional dynamic characteristics of the complete system under synchronous conditions of excitation and response. A damped natural response study was made in order to investigate the combined effect of oil film stiffness and damping coefficients on system damping and stability characteristics at all damped natural resonance speeds. An unbalance response analysis is also performed to study the system sensitivity. This study was performed to investigate the lateral vibration characteristics of the subject system in order to avoid vibration problems that might interfere with the smooth and reliable operation of the system. Total system studies are important in that often the coupling effects of marrying driver and driven equipment result in resonant speeds that are not calculable when investigating the response of the separate components. Oil film stiffness and damping for all bearings must be properly considered in the system calculations along with the effective stiffness and damping of pedestal supports as required. The above effects are in the following calculation to ensure the proper calculation of resonant speeds. The following study concerns itself with the lateral analysis of gas turbine, load coupling, and 50 Hz/15.75Kva generator. This study reports the lateral natural frequencies and mode shapes calculated from the mass and stiffness distribution of the beam elements modeled using the DYROBES software. An unbalanced response analysis is also performed to study the system sensitivity. The significance of torsional vibration in high speed rotating machinery is well established. It is desirable to keep all torsional natural frequencies away from operating speed as well as twice the electrical frequency of the system. However, this is not always feasible and, therefore torsional criticals can be tolerated within these regions provided the response to excitation levels are low enough to keep the alternating shear stress within acceptable levels. The following study concerns itself with the complete torsional analysis of gas turbine rotor including load coupling, gear box and 50Hz/15.75KVA generator rotor. This study reports the torsional natural frequencies, mode shapes and Campbell diagram by using transfer matrix method. The transient response shear stresses were also calculated for fault condition.

Vibration Analysis Robert K. Vierck 1979

Comparison Between the Measurement and Numerical Analysis of the Vibration Induced by the High-Speed Train ??? 2005

Structural Vibration Analysis C. F. Beards 1983-01-01

Vibrational Emission of Multiple Types of Trains from Source to Receiver Taha Alyousef 2017 In-motion trains' vehicles generate high intensity vibrations. The manner in which vibrations impact buildings' structures varies upon many factors that were discussed in this research. In this study, an analytical comparison of the difference in vibration emission between two types of trains (passenger train and cargo trains) concerning ground-borne vibration was conducted and two types of wave barriers (Open trench and in-filled trench) near buildings were analyzed. Solutions were discussed at the source, at the path and at the receiver. Yet, a particular emphasis was made at the receiver. Moreover, vibrations emission from trains, transmission in the ground and admittance into buildings were considered meticulously. The field measurement was conducted in Lucas County, Ohio, next to a train track where passenger and cargo trains operated on the same track. A private property was chosen near the train where the field measurement took place. Three 3-D accelerometers were placed at four different distances to measure the incoming vibrations. The process of collecting data lasted about two weeks. Over 40 train measurements were recorded for analysis. Low and high frequency waves are tackled differently when it comes to vibration attenuation and damping techniques to protect potential structures. This research has elaborated on the difference in wave emission of different trains by predicting such vibrations at the source and mitigating the by-product effects of vibrations at the receiver. The other part of this study is concerning ground vibration countermeasures, i.e., wave barriers (open and in-filled trenches) around buildings. The wave barrier method is achieved by excavating a trench between the source of vibration and the potential affected structure. One aim of this study was to identify which mitigation practice served the potential affected building best, under the influence of low and high frequency waves, with reference to efficacy and practicality. Vibration interaction occurrence at track-ground-building has been examined by researchers. Nonetheless, no emphasis has been found on how different trains and the variance in wave frequencies affect nearby buildings. Therefore, the intension of this study is to fulfill that gap by elucidating such an occurrence.

Vibration Problems in Engineering W. Weaver, Jr. 1991-01-16 The Fifth Edition of this classic work retains the most useful portions of Timoshenko's book on vibration theory and introduces powerful, modern computational techniques. The normal mode method is emphasized for linear multi-degree and infinite-degree-of-freedom systems and numerical methods dominate the approach to nonlinear systems. A new chapter on the finite-element method serves to show how any continuous system can be discretized for the purpose of simplifying the analysis. Includes revised problems, examples of applications and computer programs.

Train Internal Noise Due to Wheel-Rail Interaction Wenjun Luo 2019 In order to investigate different potentially effective methods to decrease the noise inside passenger trains, this article employs the acoustic-solid coupling theory and the finite element (FE)-statistical energy analysis (SEA) hybrid method to study the vibration response of the train body under wheel-rail excitation and the internal noise response caused by the vibration of the train body. The contribution of plates to the noise inside the train is also analyzed. The results show that the vibration of the floor has the greatest influence on the noise inside the train. Furthermore, compared with the FE method alone, the FE-SEA hybrid method shortens the computation time and improves the efficiency of the calculation.

Vibration Analysis and Control System Dynamics C. F. Beards 1981

Environmental Vibrations and Transportation Geodynamics Xuecheng Bian 2017-06-27 This book includes keynote presentations, invited speeches, and general session papers presented at the 7th International Symposium on Environmental Vibration and Transportation Geodynamics (formerly the International Symposium on Environmental Vibration), held from October 28 to 30, 2016 at Zhejiang University, Hangzhou, China. It discusses topics such as the dynamic and cyclic behaviors of soils, dynamic interaction of vehicle and transportation infrastructure; traffic-induced structure and soil vibrations and wave propagation; soil-structure dynamic interaction problems in transportation; environmental vibration analysis and testing; vehicle, machine and human-induced vibrations; monitoring, evaluation and control of traffic induced vibrations; transportation foundation deformation and deterioration induced by vibration; structural safety and serviceability of railways, metros, roadways and bridges; and application of geosynthetics in transportation infrastructure. It is a valuable resource for government managers, scientific researchers, and engineering professionals engaged in the field of geotechnical and transportation engineering.

Measurement and Analysis of Train Induced Ground Vibration Hugo P. Verhas 1977

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