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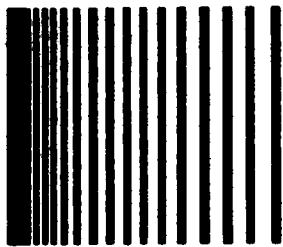


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THE SHOCK and VIBRATION DIGEST

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SVIC NOTES

Many interesting meetings relating to shock and vibration technology were held during 1984, and the two meetings that seemed the most interesting to me were the Second International Modal Analysis Conference and the Vibration Damping Workshop. Both of these meetings interested me because they revealed possible new directions for controlling noise and vibration; but more to the point, they represent growing branches of interest in the shock and vibration technology in the sense of greater involvement on the part of the shock and vibration technical community.

Fortunately, I was able to attend the Modal Analysis and Test Conference, and this meeting was reviewed in the April, 1984, issue of the **Shock and Vibration Digest**. Judging by the papers that were presented in that conference, modal analysis and testing is still a popular topic, and for many reasons. Modal analysis and testing is a dynamic field since new techniques are constantly being developed. New and unusual modal testing requirements often arise, and these often lead to some interesting questions. For example, the question of how to conduct a modal test at frequencies approaching 100 kHz arose in the panel session at the Modal Analysis Conference. The subject of modal testing and analysis appeals to a widely diverse group of users who routinely use it to solve noise and vibration problems; the diversity in the users seems to be increasing. And finally, possible new directions in modal testing and analysis cannot be ignored; detecting damage in structures from the changes in their modal properties is a good example.

Judging from the program of the Vibration Damping Workshop, this conference provided a broad snapshot of the damping technology, from characterizing the properties of damping materials to integrating damping treatments into the product design at an early stage. This latter topic represents a new direction in the use of the damping technology for controlling noise and vibration, and I believe the literature published on damping during 1984, and perhaps the past few years, has stressed this new direction in controlling noise and vibration. An effect of this recently published literature on damping will be to make a broader segment of the shock and vibration technical community aware of advances in the damping technology. But more important, it will provide them with the tools for preventing noise or vibration problems in future systems.

R.H.V.

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J.W.

EDITORS RATTLE SPACE

CRITERIA AND STANDARDS

Any person performing a test on new or old equipment recognizes the need for criteria, guidelines, and standards. A number, waveform, or spectrum alone means little when assessing the quality of equipment. Standards provide the mechanism for the use of techniques and methods in acquiring and processing data in a common manner. They establish the process that permits data taken by different investigators to be compared. It is an essential step in forming criteria and levels so desperately needed in the vibration field. I feel that the development of acceptable levels of vibration for equipment is one of immediate challenges of the vibration field.

Even though millions of vibration measurements are being made every year, acceptable levels of vibration are available for only general classes of equipment and special types of excitation. In the case of rotating machinery, vibration levels are available for general equipment for once-per-revolution frequency vibrations. These numbers provide guidelines for engineers but are not useful in assessing the severity of critical vibration problems. The data needed to develop detailed vibration criteria are being gathered. Unfortunately they are used only for the immediate task at hand.

The major reason data are not retained in a useful form is cost. Up to this time it was too costly to record and transmit data to a data bank. The advent of the microprocessor based devices has changed this situation. If data are taken according to standard guidelines it appears that they could be transmitted to a data bank with little extra cost to the plant. These data could be merged with those taken in other plants to provide the large sample needed to develop acceptable vibration levels for specific equipment. All engineers in the present and future would benefit from such a program -- similar to that sponsored by the U.S. Navy to develop balancing levels.

While the aforementioned type program has yet to be established on an ongoing basis, there are many organizations including American National Standards Institute involved in the development of standards. Many trade associations and societies such as the American Petroleum Institute and the Society of Automotive Engineers are heavily involved in this work. I suggest those interested in the future of standards and criteria contact one of the organizations and spend some effort on this important work. If you need direction in where to focus your efforts, call me at the Vibration Institute.

R. L. E.

APPLICATIONS OF THE CONFORMAL MAPPING METHOD TO THE SOLUTION OF MECHANICAL VIBRATIONS PROBLEMS

P.A.A. Laura*

Abstract. *Traditional applications of the method of conformal mapping are governed by the Laplace equation. However, in recent years the equation has also been used to solve wave propagation problems and those involving membrane and plate vibrations. In many instances it has been possible to obtain elegant approximate analytical solutions and algorithmic procedures; they have been implemented on desk computers and programmable pocket calculators.*

Most graduate engineers have learned that conformal mapping makes exact analytical solutions possible for two-dimensional boundary value problems governed by the Laplace equation:

$$\nabla^2 \phi = 0 \quad (1)$$

In some cases no solution could have been obtained otherwise because of the complexity of the given domain.

Application of the conformal mapping technique is straightforward for problems described by the Laplace equation provided the analytic function that performs the desired mapping is known. Determination of the mapping function is usually a very difficult task [1, 2]. But the partial differential equation is invariant under transformation.

In graduate courses on the mathematical theory of elasticity [3, 4] conformal mapping is usually applied to the solution of free torsion of prismatic rods governed by Poisson's equation

$$\nabla^2 \phi = -2G\theta \quad (\text{a constant}) \quad (2)$$

and to the plane elastic problem when equation (3) is to be solved.

$$\nabla^4 U = 0 \quad (3)$$

Solutions to equations (2) and (3) are considerably more difficult than is solving equation (1) because equations (2) and (3) do not remain invariant under transformation.

It is of historic interest that stress concentration factors in civil, mechanical, naval, and aeronautical structural systems were determined in many instances in the 1940s and 1950s using this approach. Early in the 1960s the first mathematical models of solid propellant rocket grains were analyzed; the conformal mapping method was used to transform the doubly connected cross section (circular region with a star-shaped perforation) into a circular annulus.

It is the object of this paper to present a brief survey of applications of the conformal mapping method to vibration problems involving rods, plates, and membranes. Conformal mapping has also been used recently to study the vibration characteristics of helicopter airframes. It is also of interest that conformal mapping [5, 6] can be used to solve many steady- and non-steady-state heat conduction problems in nuclear reactor technology.

SOLUTION OF THE HELMHOLTZ EQUATION CONFORMAL MAPPING

Small amplitude vibrations of an ideal membrane are governed by the classical, two-dimensional wave equation

$$\nabla^2 v = \frac{1}{c^2} \frac{\partial^2 v}{\partial t^2} \quad (4)$$

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subject to the boundary condition

$$v[L(x, y) = 0, t] = 0 \quad (5)$$

$L(x, y) = 0$ is the functional relation that defines the boundary of the domain.

In the case of normal modes

$$v(x, y, t) = V(x, y) e^{i\omega t} \quad (6)$$

Substitution of this relationship in equations (4) and (5) results in a time independent differential system.

$$\nabla^2 V + \left(\frac{\omega}{c}\right)^2 V = 0 \quad (7a)$$

$$V[L(x, y) = 0] = 0 \quad (7b)$$

Equation (7a) is the well known Helmholtz equation; it also governs other phenomena of fundamental importance such as wave propagation in hollow-piped electromagnetic and acoustical waveguides. The boundary condition in equation (7b) governs the propagation of TM waves and acoustical waves in soft walls.

For TE waves and in the case of acoustically hard waveguides equation (7b) is replaced by the Neuman-type boundary condition

$$\frac{\partial V}{\partial n} [L(x, y) = 0] = 0 \quad (7c)$$

where n is the outer normal to the domain.

If the domain is natural to one of the common coordinate systems for which (7a) can be solved by the classical method of separation of variables, solutions are available in standard textbooks. For more complicated domains approximate techniques must be used.

However, when the analytic function that transforms the given domain in the z -plane onto a simpler one in the ξ -plane, say a unit circle, is known (see Figure 1).

$$z = x + iy = f(\xi) \quad (8)$$

Equation (7) can then be transformed to obtain

$$\nabla^2 V + \left(\frac{\omega}{c}\right)^2 \left|f'(\xi)\right|^2 V = 0 \quad (9a)$$

$$V(r, \theta) \Big|_{r=1} = 0 \quad (9b)$$

$$\text{or} \quad \frac{\partial V}{\partial r} (r, \theta) \Big|_{r=1} = 0 \quad (9c)$$

Equation (9a) is more complicated than (7a), but the transformed differential system has an inherent advantage: the geometry of the domain is such that the boundary condition can be identically satisfied. Many approximate analytical procedures are now available; e.g., Galerkin, Ritz, [7].

Consider, for instance, the case of a membrane with rounded corners [8] (see Figure 2) with

$$z = f(\xi) = aL(\xi + \epsilon\xi^5), \quad L = 25/24, \quad \epsilon = -1/25 \quad (10)$$

Make

$$V(r, \theta) \cong b_1(1-r^2) + b_2(1-r^4) \quad (11)$$

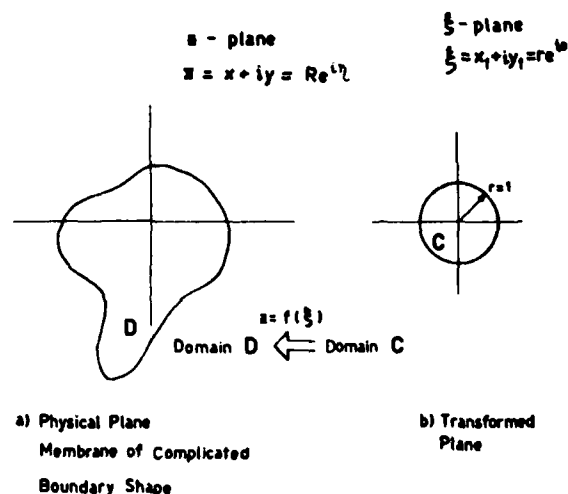


Figure 1. Conformal Mapping of a Given, Complicated Domain

Use the Galerkin method to obtain for the fundamental frequency coefficient

$$\omega_{01} \frac{a}{c} = 2.308$$

This value is in remarkably good agreement with another determined value [8].

Other studies dealing with vibrations of membranes are available in the literature [9]. The case of a composite membrane has been dealt with [10], as have electromagnetic waveguides [11-18] and acoustical waveguides [19-23]. The first analytical studies on simple mathematical models of vibrating solid propellant rocket motors were also based on the conformal mapping approach [24-26].

VIBRATIONS OF PLATES

In many cases printed circuit boards possess non-rectangular and non-circular shapes (see Figure 3a). Regular polygonal shapes with concentric circular perforations (Figure 3b) are of interest in nuclear reactor technology. Several studies have dealt with vibrating plates of complicated boundary shape [27-30]. Some work [31-34] has taken into account in-plane forces and the presence of concentrated masses.

SOUND RADIATION STUDIES

The conformal mapping method has been used in the study of sound radiation phenomena. Particularly valuable is a study due to Berger [36], who obtained a numerical solution for the transient vibration of

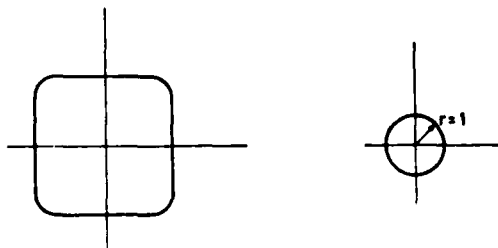
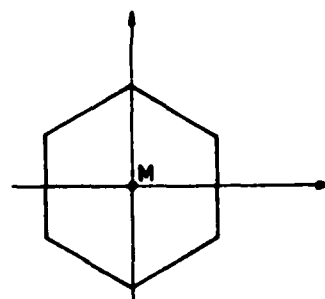


Figure 2. Square Membrane with Rounded Corners

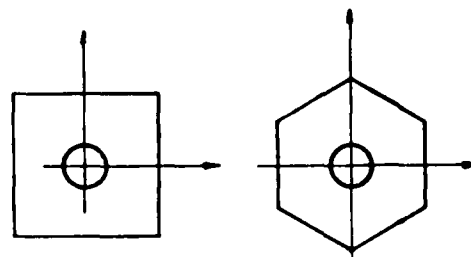
an arbitrary shell of revolution surrounded by an acoustic medium. The region external to the generating curve of the shell was mapped conformally onto the region external to the unit circle.

VIBRATIONS OF HELICOPTER AIRFRAMES

Bartlett [37] recently developed an interesting method to evaluate the effect of structural changes on the vibration characteristics of helicopter airframes. He assumed that the mass and stiffness matrices of the damped linear structure are real and symmetrical and that the damping matrix is symmetrical and positive definite. He also assumed that the changes made to the structure do not affect applied vibrational loads. He provided expressions for the vibration response of the airframe at a point in terms of mobilities. The author proved that the responses map onto circles in the complex plane and that the vector from the origin of the complex plane to a point on the circumference defines the magnitude and phase of the response for a particular structural mobility.



a) Printed Circuit Board of Hexagonal Shape Carrying a Concentrated Mass-



b) Nuclear Reactor Elements of Regular Polygonal Shape With a Concentric Circular Perforation-

Figure 3. Modern Applications of Conformal Mapping

CONCLUSIONS

Modern technology requires solutions for a never-ending number of problems in which the domain has a complicated geometry. The conformal mapping method provides an accurate and rather simple way to solve a large number of problems in many fields. Furthermore, in many instances it provides for an independent check for large computer-oriented solutions. Many of the results contained in the scientific literature quoted in this paper have been obtained using a microcomputer or a pocket programmable calculator.

REFERENCES

1. Kantorovitch, L.V. and Krylov, V.I., "Approximate Methods of Higher Analysis, Third Edition, Interscience Publishers, Inc., New York (1958).
2. Gaier, D., Konstruktive Methoden der Konformen Abbildung, Berlin-Göttingen, Heidelberg (1964).
3. Wang, C.T., Applied Elasticity, McGraw Hill Book Co., Inc. (1953).
4. Mushkhelishvili, N.I., Some Basic Problems of the Mathematical Theory of Elasticity, P. Noordhoff Ltd., Groningen, Holland (1953).
5. Laura, P.A.A. and Ercoli, R., "A Solution of the Unsteady Diffusion Equation in an Arbitrary Doubly Connected Region," *Nucl. Engrg. Des.*, **23**, pp 1-9 (1972).
6. Sanchez Sarmiento, G. and Laura, P.A.A., "Heat Transfer Analysis in Internally-Cooled Fuel Elements by Means of a Conformal Mapping Approach," *Nucl. Engrg. Des.*, **67**, pp 101-108 (1981).
7. Mazumdar, J., "Transverse Vibrations of Membranes of Arbitrary Shape by the Method of Constant Deflection Contours," *J. Sound Vib.*, **27**, pp 47-57 (1973).
8. Irie, T., Yamada, G., and Sonoda, M., "Natural Frequencies of Square Membrane and Square Plate with Rounded Corners," *J. Sound Vib.*, **86** (3), pp 442-448 (1983).
9. Laura, P.A.A., "On the Determination of the Natural Frequency of a Star Shaped Membrane," *J. Royal Aeronaut. Soc.*, **67**, pp 274-275 (1964).
10. Laura, P.A.A., Sanchez Sarmiento, G., Verniere de Irassar, P., Hill, D., and Mazumdar, J., "Fundamental Frequency of Composite Circular Membranes with Boundary Disturbances," *Fibre Sci. Tech.* (1984).
11. Meinke, H.H., "A Survey on the Use of Conformal Mapping for Solving Wave-Field Problems," *Symp. Electromagnetic Theory Antennas*, Copenhagen, June 25-30, Pergamon Press, pp 1113-1124 (1962).
12. Meinke, H.H., Lange, K.P., and Ruger, J.F., "TE and TM Waves in Waveguides of Very General Cross Section," *IEEE, Proc.*, **51** (11), pp 1436-1443 (1963).
13. Tischer, F.J., "Conformal Mapping in Waveguide Considerations," *IEEE, Proc.*, **51** (7), pp 501-503 (1963).
14. Tischer, F.J., "The Groove Guide. A Low-Loss Waveguide for Millimeter Waves," *IEEE Trans. Microwave Theory Tech.*, **MTT-11**, pp 291-296 (1963).
15. Chi, M. and Laura, P.A.A., "Approximate Method of Determining the Cutoff Frequencies of Waveguides of Arbitrary Cross Section," *IEEE Trans. Microwave Theory Tech.*, **MTT-12** (2), pp 162-164 (1964).
16. Wohlleben, R., "The TEM Characteristic Impedance of Some Complicated Cross Sections," *Proc. Fourth Colloquium Microwave Commun.* Budapest, III (1970).
17. Miyazaki, Y., "Optimal Modes in Dielectric, Thin, Film Fiber with Convex Surface by Conformal Mapping Technique," *IECE Trans.*, Japan, **E-59** (10), pp 1-6 (1976).
18. Laura, P.A.A., Sanchez Sarmiento, G., and Nagaya, K., "Numerical Experiments on the Determination of Cutoff Frequencies of Waveguides of Arbitrary Cross Section," *IEEE Trans. Microwave Theory Tech.*, **MTT-28**, pp 568-572 (1980).

19. Kashin, V.A. and Merkulov, V.V., "Determination of the Eigenvalues for Waveguide with Complex Cross Section," *Soviet Phys., Acoust.*, 11, pp 285-287 (1966).
20. Laura, P.A.A., "Calculations of Eigenvalues for Uniform Fluid Waveguide with Complicated Cross Section," *J. Acoust. Soc. Amer.*, 42, pp 21-26 (1967).
21. Roberts, S.B., "The Eigenvalue Problem for Two Dimensional Regions with Irregular Boundaries," *J. Appl. Mech., Trans. ASME*, 34, pp 618-622 (1967).
22. Hine, M.J., "Eigenvalues for a Uniform Fluid Waveguide with an Eccentric-Annulus Cross Section," *J. Sound Vib.*, 15 (3), pp 295-305 (1971).
23. Laura, P.A.A., Romanelli, E., and Maurizi, M.J., "On the Analysis of Waveguides of Doubly-Connected Cross Section by the Method of Conformal Mapping," *J. Sound Vib.*, 20 (1), pp 27-38 (1972).
24. Baltrukonis, J.H., Chi, M., and Laura, P.A.A., "Axial Shear Vibrations of Star Shaped Bars-Kohn-Kato Bounds," Eighth Midwest. Mech. Conf., Case Inst. Tech., Cleveland, OH, Developments in Mechanics, pp 449-467, Pergamon Press (1963).
25. Baltrukonis, J.H., Chi, M., and Laura, P.A.A., "Axial Shear Vibrations of Star Shaped Bars -- An Application of Conformal Transformation," Tech. Rept. No. 4 to NASA (The Catholic University of America, Washington, DC) (1962).
26. Laura, P.A.A. and Shahady, P.A., "Longitudinal Vibrations of a Solid Propellant Rocket Motor," Proc. Third Southeast. Conf. Theoret. Appl. Mech., Pergamon Press, pp 623-633 (1966).
27. Munakata, K., "On the Vibration and Elastic Stability of a Rectangular Plate Clamped at Its Four Edges," *J. Math. Phys.*, 31, pp 69-74 (1954).
28. Shahady, P.A., Pasarelli, R., and Laura, P.A.A., "Application of Complex Variable Theory to the Determination of the Fundamental Frequency of Vibrating Plates," *J. Acoust. Soc. Amer.*, 42, pp 806-809 (1967).
29. Laura, P.A.A. and Grosson, J., "Fundamental Frequency of Vibration of Rhombic Plates," *J. Acoust. Soc. Amer.*, 44, pp 823-824 (1968).
30. Yu, J.C.M., "Application of Conformal Mapping and Variational Method to the Study of Natural Frequencies of Polygonal Plates," *J. Acoust. Soc. Amer.*, 49, pp 781-785 (1971).
31. Laura, P.A.A., Gutierrez, R.H., and Steinberg, D.S., "Vibrations of Simply Supported Plates of Arbitrary Shape Carrying Concentrated Masses and Subjected to a Hydrostatic State of In-Plane Stresses," *J. Sound Vib.*, 55 (5), pp 49-53 (1977).
32. Gutierrez, R.H., Laura, P.A.A., and Grossi, R.O., "Transverse Vibrations of Plates with Stepped Thickness over a Concentric Circular Region," *J. Sound Vib.*, 69 (2), pp 285-295 (1980).
33. Pombo, J.L., Laura, P.A.A., Gutierrez, R.H., and Steinberg, D.S., "Analytical and Experimental Investigation of the Free Vibrations of Clamped Plates of Regular Polygonal Shape Carrying Concentrated Masses," *J. Sound Vibration*, 55 (4), pp 521-532 (1977).
34. Laura, P.A.A. and Gutierrez, R.H., "Transverse Vibrations of Thin, Elastic Plates with Concentrated Masses and Internal Elastic Supports," *J. Sound Vib.*, 75 (1), pp 135-143 (1981).
35. Pond, H.L., "Sound Radiation from a General Class of Bodies of Revolution," Naval Underwater Systems Center, New London, NUSC Rept. No. NL-3031 (1970).
36. Berger, B.S., "Transient Motion of an Elastic Shell of Revolution in an Acoustic Medium," *J. Appl. Mech., Trans. ASME*, 100 (1), pp 149-152 (1978).
37. Bartlett, F.D., Jr., "Flight Vibration Optimization via Conformal Mapping," *J. Amer. Helicopter Soc.*, 28 (1), pp 49-55 (1983).

LITERATURE REVIEW: **survey and analysis of the Shock and Vibration literature**

The monthly Literature Review, a subjective critique and summary of the literature, consists of two to four review articles each month, 3,000 to 4,000 words in length. The purpose of this section is to present a "digest" of literature over a period of three years. Planned by the Technical Editor, this section provides the DIGEST reader with up-to-date insights into current technology in more than 150 topic areas. Review articles include technical information from articles, reports, and unpublished proceedings. Each article also contains a minor tutorial of the technical area under discussion, a survey and evaluation of the new literature, and recommendations. Review articles are written by experts in the shock and vibration field.

This issue of the DIGEST contains an article about machine tool vibrations.

Dr. V. Ramamurti and Mr. D. Ganapathi Rao of the Department of Applied Mechanics, Indian Institute of Technology, Madras, India have written a review of work done on machine tool vibrations and noise since 1981.

MACHINE TOOL VIBRATIONS -- A REVIEW

V. Ramamurti* and D. Ganapathi Rao**

Abstract. *The material reported here is work done on machine tool vibrations and noise since 1981.*

CHATTER IN MACHINE TOOLS

A major topic of interest is chatter in machine tools. The general concept of machine tool chatter has been discussed [1], as have methods adopted for reducing it [2]. It was concluded [2] that the continuous fluctuating cutting speed of machine tools partly reverses the chatter causing function. A unified systems approach for chatter analysis has been presented [3]. A theoretical approach for predicting chatter has been verified experimentally by turning a slender bar on a turret lathe [4]. Milling machine chatter has been a subject of discussion [5], as has chatter in lathes including general characteristics of chatter vibration [6] and the mechanism of exciting energy supply [7].

The conclusion after an experimental study of carbide face milling cutters was that increased tool wear due to vibration is governed mainly by the stiffness of certain elements in the cutting mechanism [8]. A distinction has been made between the vibration of a cutting tool and its resulting cutting marks [9]; the cutting marks are not a simple reproduction of the vibration. Two basic experiments have shown that certain machining operations result in a single change of cutting parameters that permanently eliminates regenerative chatter vibration [10].

Self-excited oscillations of machine tools have been studied [11-15]. A relation between fluctuations of rotational speed of a workpiece and frequencies of self-excited oscillations has been reported [11]. An adaptive control of the cutting process including self-excited oscillation has been the subject of a study [12]. Stick slip motion due to low driving speed has been reported [13]. Material parameters of a work-

piece that affect self-induced oscillation have been determined [14]. Vibrations of a forced self-excited system with time lag have been examined, as has the influence of initial conditions on steady-state behavior [15].

GENERAL DYNAMIC ANALYSIS

Dynamic analysis and optimal selection of parameters of a lathe spindle under random cutting loads have been undertaken [16]. Free vibration behavior of lathe spindles has been studied [17]. A general vibration study has been used to diagnose the health of a machine [18]. A minicomputer has been used to determine the frequency response of machine tools [19]. Effects of machine vibrations on the accuracy and quality of machine parts have been evaluated [20].

Methods have been developed to study static and dynamic behaviors of machine tools [21]. A test procedure for vibration analysis has been developed to check a machining setup [22]. Experiments have been conducted on the nonlinearity of cutting forces [23]. Stability of machine tools under regenerative cutting conditions has been studied [24]. Instrumentation for testing the vibration stability of machine tools in shop conditions has been reported [25]. Discussions on the dynamic stability of a vibrating hammer are available [26].

Static stiffness of machine tool spindles has also been a subject of discussion [27]. Dynamic stiffness of machine tool feed systems has been presented in a theoretical analysis [28]; an experimental evaluation of damping capacity has been done [29]. The use of preloaded bearings to maximize the dynamic stiffness has been discussed [30].

Modal analysis of machine tool structures based on experimental data has been reported [31, 32]. A

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new method for altering natural frequencies to maximize intervals between adjacent frequencies has been developed [33], as has a new mathematical model of the dynamic characteristics of machine structures [34]. The dynamics of metal cutting have been discussed [35, 36], as have the vibration and stability of band saws [37, 38] and the dynamic design of machine tool foundations [39].

Classical techniques and the dynamic data system (DDS) approach have been compared for accuracy in identifying the structural systems of machine tools [40]. The DDS approach has been applied to the analysis of dynamic characteristics of a machine tool system in the time domain. Impulse responses have been applied to machine tool structures to identify vibration characteristics [42]. A mathematical model of the structural dynamics of a machine tool with nonproportional viscous damping effect has been developed using the method of state space vector analysis [43]. New parameters for evaluating static rigidity and dynamic characteristics for optimizing the structural design of machine tools under different type of cutting arrangements and operations have been identified [44].

A comparative study of dynamic characteristics using hydraulic and epoxy resin concretes for machine tool structures showed that epoxy resin concrete had better characteristics than hydraulic concrete [45]. A method for determining the rigidity coefficient and the damping of flexible elements of machine tool drives has been proposed [46].

An expression for determining the amplitude-phase frequency relationship of an elastic system of a machine tool during cutting was based on information about relative tool and workpiece vibrations [47]. A method for the structural improvement of machine tool vibration stability during cutting has been proposed [48], as has a method for estimating the mean square frequency and using it to reduce the amplitude and frequency of a near-periodic signal to a single variable [49]. An algorithm of a program for calculating the vibration stability of boring units has been proposed [50]; suggestions for utilizing the results to improve the quality of the equipment being designed were also indicated. A mathematical description and analysis of the rotational accuracy of a machine tool spindle have been presented [51].

NOISE IN MACHINE TOOLS

The noise and vibration produced by workshop machinery has been surveyed [52], and recommendations for noise abatement of machines have been given [53]. The design of low noise machine tools [54], and noise abatement in the development of manufacturing concepts [55] have been discussed. Structure-borne noise in machine tools has been presented in a linear model [56]. A novel damper for reducing tool noise has been proposed [57]. It has been shown that the noise level of a machine can be predicted at the design stage [58, 59]. Computer-aided design in predicting a sound field has been described [60]. Current methods for monitoring noise generation have been surveyed [61], and results of the design of a jumbo drill have been summarized [62]. Test data have been used to discuss the effect of increased noise on cutting force and temperature [63]. It has been shown that the noise level distribution of various machine concentrations cannot be described simply by summing up sound levels from individual plants and machine tools [64].

REFERENCES

1. Das, M.K., "Machine Tool Chatter," CME, Chart. Mech. Engrg., V28 (9), pp 22-27 (Sept 1981).
2. Tetsutaro, H., "Method for Reducing Machining Chatter," Tool Prod., 46 (7), pp 85-87 (Oct 1980).
3. Nigm, M.M., "Method for the Analysis of Machine Tool Chatter," Intl. J. Mach. Tool Des. Res., 21 (3/4), pp 251-261 (1981).
4. Eman, K.F. and Wu, S.M., "Forecasting Control of Machining Chatter," ASME Produc. Engrg. Div. Publ. 2, Comput. Applic. Mfg. Syst., Plan. Cont. Rab. Pres. Winter Ann. Mtg. ASME, Chicago, IL, pp 37-52 (Nov 16-21, 1980).
5. Tlustý, J. and Ismail, F., "Special Aspects of Chatter in Milling," J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 105, pp 24-32 (Jan 1983).

6. Marui, E., Ema, S., and Kato, S., "Chatter Vibration of Lathe Tools," J. Engrg. Indus., Trans. ASME, 105 (2), pp 100-106 (May 1983).
7. Marui, E., Ema, S., and Kato, S., "Chatter Vibration of Lathe Tools," J. Engrg. Indus., Trans. ASME, 105 (2), pp 107-113 (May 1983).
8. Mehta, M.K., Pandey, P.C., and Chakravarti, G., "Investigation of Tool Wear and the Vibration Spectrum in Milling," Wear, 91 (2), pp 219-234 (Nov 1, 1983).
9. Depci, D., Yanchi, Y., Xieqing, H., and Gu Chongxian, "New Concept of the Formation of Cutting Marks during Metal Cutting Vibration," Chi Hsieh Kung Ch'eng Hsueh Pan, 17 (1), pp 37-49 (1981).
10. Schulz, H. and Russak, W., "Beseitigen Von Regenerativen Ratterschwingungen Beim Drehen und Ausbohren Mit Bohrstangen," Werkstatt Betr., 116 (1), pp 21-24 (Jan 1983).
11. Ohno, S. and Arai, T., "On the Relation between the Fluctuations of the Rotational Speed of the Work Piece and the Fluctuation of the Frequency of the Self-excited Machine Tool Vibration," Bull. JSME, 22 (172) (Oct 1979).
12. Koval, M.I., "Adaptive Control System with Limitation of Machine Self-excited Vibration," Mach. Tool, 51 (2), pp 17-22 (1980).
13. Soavi, F., "Theoretical Analysis of Self-excited Vibrations in a Machine Tool, Isolated Mounting Base System," Meccanica, 15 (1), pp 54-69 (Mar 1980).
14. El'Yasberg, M.E. and Savinov, I.A., "Determining Work Piece Material Parameters Which Affect Self-induced Vibration," Machine Tool, 50 (12), pp 30-34 (1979).
15. Yoshitake, Y., Inoue, J., and Sueoka, A., "Vibrations of a Forced Self-excited System with Time Lag," Bull. JSME, 26 (221), p 1943 (Nov 1983).
16. Sharan, A.M., Sankar, S., and Sankar, T.S., "Dynamic Analysis and Optimal Selection of Parameters of a Finite Element Modelled Lathe Spindle under Random Cutting Forces," J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 105 (4), pp 467-475 (Oct 1983).
17. Sharan, A.M., Sankar, T.S., and Sankar, S., "Dynamic Behaviour of Lathe Spindles with Elastic Supports including Damping by Finite Element Analysis," Shock Vib. Bull., U.S. Naval Res. Lab., Proc. 51, pp 83-96 (Oct 21-23, 1980).
18. Harvey, R.E., "Vibration Analysis, A Powerful Instrument for Cutting Down Time," Iron AGE, 225 (23), pp 42-44 (Aug 11, 1982).
19. Yuce, M., Sadak, M.M., and Tobias, S.A., "Pulse Excitation Technique for Determining Frequency Response of Machine Tools Using an On-line Mini-computer and a Non-contacting Electromagnetic Exciter," Inst. Mach. Tool Des. Res., 23 (1), pp 39-51 (1983).
20. Pavlov, A.G., "Effectiveness of Reducing Machine Tool Vibrations," Sov. Engrg. Res., 1 (7), pp 15-17 (July 1981).
21. Proessler, E.K., "Experimentall-Rechnerische Analyse von Maschinenschwingungen," Fortschr Ber VDI Z, Pt. 11 (36), p 135 (1981).
22. Hoshi, T., "Vibration Analysis Test Procedure Developed for Checking Machining Set Up," Ann CIRP, 29 (1), pp 257-261 (1980).
23. Kudinov, V.A., "Experimental Investigation of the Nonlinearity of the Dynamic Characteristics of Cutting Tool Process," Machine Tool, 49 (11), pp 14-18 (Nov 1978).
24. Stepan, G., "Stability of Machine Tool Vibrations under Regenerative Cutting Conditions," Perid. Polytech. Mech. Engrg., 24 (3), pp 169-174 (1980).
25. Skvortsov, V.I., "Instrumentation for Testing the Vibration Stability of Machine Tools in Shop Conditions," V.I. Mach. Tool, 51 (8), pp 16-18 (1980).
26. Inoue, J. and Miyaora, S., "Dynamic Stability of a Vibrating Hammer," J. Vib., Acoust.,

- Stress, Rel. Des., Trans. ASME, 105 (3), pp 321-325 (July 1983).
27. Shuzi, Y., "Study of the Static Stiffness of Machine Tool Spindles," Intl. J. Mach. Tool Des. Res., 21 (1), pp 23-40 (1981).
 28. Shiozaki, S., "Dynamic Stiffness of Machine Tool Feed Driving System, 1: Theoretical Analysis on the Damping Capacity of Slideway," Bull. JSME, 23 (180), pp 991-996 (June 1980).
 29. Mizukane, M., Purukawa, Y., and Shiozaki, S., "Dynamic Stiffness of Machine Tool Feed Driving System, 2: Experimental Evaluation of the Damping Capacity of a Slideway," Bull. JSME, 23 (180), pp 997-1002 (June 1980).
 30. Wardle, F.P., Lacey, S.J., and Poon, S.Y., "Dynamic and Static Characteristics of a Wide Speed Range Machine Tool Spindle," Precision Engrg., 5(4), pp 175-183 (Oct 1983).
 31. Eman, K.F. and Kim, K.J., "Modal Analysis of Machine Tool Structures Based on Experimental Data," J. Engrg. Indus., Trans. ASME, 105 (4), pp 282-287 (Nov 1983).
 32. Soneys, R., Van Honacker, P., and Van Deurzen, U., "Practical Applications of Modal Analysis on Machine Tools," Natl. Conf. Publ. Inst. Engr. Austral., 80/5, Prog. Pap - Intl. Conf. Mfg. Engr. Melbourne, Austral, pp 210-214 (Aug 25-27, 1980).
 33. Yoshimura, M., "Optimum Design of Machine Structures with Respect to an Arbitrary Degree of Natural Frequency and a Frequency Interval between Adjacent Natural Frequencies," Bull. Jpn. Soc. Precis. Engrg., 14 (4), pp 236-242 (Dec 1980).
 34. Inamura, T. and Saba, T., "Stiffness and Damping Identification of the Elements of a Machine Tool Structure," Ann CIRP, Mfg. Tech., 28 (1) (1979).
 35. Chang, H.C., Sadek, M.M., and Tobias, S.A., "Relative Assessment of the Dynamic Behavior and Cutting Performance of a Bonded and a Cast-Iron Horizontal Milling Machine," J. Engrg. Indus., Trans. ASME, 105 (3), pp 187-196 (Aug 1983).
 36. af Heurlin, M., "Study of Dynamic Effects in Machining," Tiet Julk Helsingin Tek Korkeakolulu, No. 65 (1980).
 37. Reynolds, D.D. and Wilson, F.L., "Mechanical Test Stand for the Measurement of the Vibration Levels of Chain Saws during Cutting Operations," J. Sound Vib., 88 (1), pp 65-84 (May 8, 1983).
 38. Ulsoy, A.G. and Mote, C.D., Jr., "Vibration of Wide Band Saw Blades," J. Engrg. Indus., Trans. ASME, 104, pp 71-76 (Feb 1982).
 39. McGoldrick, P.F. and Baghshi, B.S., "Technique for the Dynamic Design of Machine Tool Foundations," Proc. Joint Polytechnique Symp. Mfg. Engrg. (June 11-13, 1979).
 40. Eman, K.F. and Wu, S.M., "Comparative Study of Classical Techniques and the Dynamic Data System (DDS) Approach for Machine Tool Structure Identification," Mfg. Engrg. Trans. 1980, Proc. 8th North Amer. Mfg. Res. Conf., Univ. Missouri - Rolla, pp 401-404 (May 19-21, 1980).
 41. Peng, Z., Tian, X., and Liu, Y., "Analysis of Dynamic Characteristics of Machine Tool via Dynamic Data System (DDS) Methodology," Tianjin Daxue Xuebac, 3, pp 23-38 (1982).
 42. Wang, X., Sato, H.Y., and Ohori, M., "Method for the Identification of Vibration Characteristics by Using Impulse Responses and Its Application to Machine Tool Structure," Chi Hsieh Kung Cheng Hsueh Pav, 19 (3), pp 32-42 (Sept 1983).
 43. Ze-min, Peng and Guan-fu Wang, "Mathematical Model of Machine Tool Dynamics via State Space Vector Methodology," Tianjin Daxue Xuebao, 2, pp 13-22 (1982).
 44. Yoshimura, M., "Analysis of Evaluative Parameters for Static and Vibrational Characteristics at the Fundamental Design Stage of Machine Tool Structures," Bull. Jpn. Soc. Precis. Engrg., 16 (4), pp 237-242 (Dec 1982).

45. Moriwaki, T., Ueno, S., and Iwata, K., "Comparative Assessment of Dynamic Characteristics of Concretes for Machine Tool Structures," Mem. Fac. Engrg., Kobe Univ., No. 29, pp 49-59 (Sept 1982).
46. Berczynski, Stefan, Mackowiek Henryk, and Ziemlewicz, Zbigniew, "Badania Dynamiczne Napędów Obrabiarek," *Przeł. Mech.*, 40 (14), pp 5-7 (July 11, 1981).
47. Kushnir, E.F., "Determination of the Amplitude-phase Frequency Characteristic of Machine Tool Elastic Systems during Cutting," *Sov. Engrg. Res.*, 3 (3), pp 66-69 (Mar 1983).
48. Elyasberg, M.E., "Method for the Structural Improvement of Machine Tool Vibration Stability during Cutting," *Sov. Engrg. Res.*, 3 (4), pp 59-64 (Apr 1983).
49. Miyashi, Y., "Estimation and Application of Mean Square Frequency," *Bull. Jpn. Soc. Precis. Engrg.*, 16 (3), pp 155-160 (Sept 1982).
50. Sofranova, A.A. and Shitov, A.M., "Algorithm of a Program for Calculating the Vibration Stability of Boring Units," *Sov. Engrg. Res.*, 2 (6), pp 79-81 (June 1982).
51. Zhang, H., "Mathematical Description and Analysis of the Rotational Accuracy of a Machine Tool Spindle," *Chi Hsieh Kung Cheng Hsueh Pao*, 18 (1), pp 65-73 (Dec 1982).
52. Banerjee, J. and Lalwani, R.J., "Noise and Vibrations Generated by Workshop Machines," *Noise Vib. Cont. Worldwide*, 13 (3), pp 128-131 (Apr 1982).
53. Allen, R., "Control of Noise," *Prod. Finish (London)*, 34 (10), pp 45-46 (Oct 1951).
54. Kloecker, Max, "Gerauschminderung an Spanenden Werkzeugmaschinen Ursachenanalysen, Vorgehführung Konstruktiver Massnahmen," *Fortschr Ber VDIZ Reihe 11*, No. 47 (1982).
55. Bley, H. and Haeusler, J., "Abbau Von Gerauschbelastungen Bei Der Entwicklung Von Fertigungs-konzepten," *Werkstatt Betr.*, 114 (11), pp 807-809 (Nov 1981).
56. Schwartz, J., "An Evaluation of a Linear Model for Description of a Structure-borne Noise in Machine Tools," *Industrie Anzeiger*, 11 (37), pp 29-30 (May 11, 1983).
57. DiBianca, A.J., Lacey, J.A., Kennedy, W.C., and Scarton, H.A., "A Novel Damper for Reducing Percussive Tool Noise," *Quieting the Noise Source, Noise Contr.*, pp 99-104 (Mar 21-23, 1983).
58. Jeypalan, R.K. and Halliwell, N.A., "Machinery Noise Predictions at the Design Stage Using Acoustic Modelling," *Appl. Acoust.*, 14 (5), pp 361-376 (Sept/Oct 1981).
59. Halliwell, N.A., "Machinery Noise Considerations at the Design Stage," *Phys. Tech.*, 12 (3), pp 97-102 (May 1981).
60. Hodgson, D.A. and Sadek, M.M., "Technique for the Prediction of the Noise Field from an Arbitrary Vibrating Machine," *IMEchE, Proc.*, 197, Part C, pp 189-197 (Sept 1983).
61. Avakian, V.A., "Finding Machine Tool Noise Sources by the Vibration Diagnostics Method," *Mach. Tool*, 50 (3), pp 11-14 (1979).
62. Dutta, P.K., Runsadler, P.W., Jr., and Bartholomac, R.C., "Development of a Quiet Jump Drill: Evaluation of Design Concepts," *Noise Contr.*, pp 169-176 (Mar 21-23, 1983).
63. Wang, R., "Several Problems of the Built-up Noise in Metal Cutting," *Chi Hsieh Kung Cheng Hsueh Pao*, 17 (1), pp 89-100 (1981).
64. Bley, H., Guenther, K.G., Haeusler, J., and Noe, S.L., "Machine Concentration and Noise Annoyance in the Workshop," *Ann. CIRP*, 29 (1), pp 269-273 (1980).

BOOK REVIEWS

DISCRETE FOURIER TRANSFORMATION AND ITS APPLICATIONS TO POWER SPECTRA ESTIMATION

C. Geckinli and D. Yavuz

Studies in Electrical and Electronic Engineering 8,
Elsevier Publishing Company, New York, NY
1983, 340 pages, \$78.75

This book is the culmination of a seven year effort that began with lecture notes used in preliminary form at the Moore School of Electrical Engineering of the University of Pennsylvania, other universities, seminars, and training programs. The authors concentrate on the discrete Fourier transform (DFT), its most efficient computerized version of the fast Fourier transform (FFT), and the application of these methods to power spectra estimation.

In the first chapter the authors present a concise yet comprehensive introduction to the Fourier transformation. This chapter constitutes a review of relevant terminology and concepts that form the basis for the remainder of the text. It is not intended to replace standard books on the subject but to set the stage and provide a brief guided tour of the subject so that the presentation is self-contained.

The second chapter introduces the DFT and develops the FFT as a technique for calculating DFT coefficients most efficiently. The third chapter comprises half of the main body of the text and covers in considerable detail the subject of power spectra estimation through DFT techniques. The material on data and spectral methods is new and instructive. A great deal of this exposition appears for the first time in a textbook.

A significant feature of this book is Appendix B. It contains 14 complete examples with actual input data and output for a wide range of signal types. These examples provide actual numerical results that illustrate the effects of changing sampling rates and input/output data intervals. This is an excellent

supplement to the application-oriented information and program listings throughout the book.

Despite the fact that the FFT has been around for about 20 years, not many textbooks have been devoted to it. A notable exception is the book by E.O. Brigham, published by Prentice-Hall in 1974. It is indeed fortunate that within a period of another decade an excellent book containing the application of the FFT to power spectra estimation has appeared. It would be most desirable to decrease the sampling time of these milestones in textbook writing to half its current interval.

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INTER-NOISE '83 NOISE CONTROL: THE INTERNATIONAL SCENE

R. Lawrence, Editor

Noise Control Foundation, Poughkeepsie, NY
1983, 1242 pages, \$72.00

This two-volume set is the proceedings of the 1983 International Conference on Noise Control Engineering that took place in July, 1983, in Edinburgh, Scotland. Sponsored by the International Institute of Noise Control Engineering, the Conference was jointly organized by the Institute of Acoustics of the United Kingdom and the Fellowship of Engineering.

The Inter-Noise proceedings have always been characterized by a large number of short papers covering an extremely wide range of subject areas related to sound and vibration. This conference was no exception and consisted of nearly 300 technical papers. International participation has also been a hallmark

of the Inter-Noise conferences and the international theme was duly reflected by authors representing 28 countries.

One cannot easily generalize on the technical quality of these proceedings due to the number of contributions and the wide variety of subject areas included. This reviewer has often felt that the Inter-Noise Series would benefit from a reduction in the number of papers and a corresponding increase in the detail of those papers retained. However, in many of the more technically sophisticated papers, references to previously published works partially compensate for the lack of detail.

A particularly valuable feature of the Inter-Noise Proceedings is the Distinguished Lecture Series, wherein a number of recognized authorities present overviews of their areas of specialization. These overviews are oriented toward the general acoustics/noise control practitioner and often include historical background notes to illustrate significant developments that have led to the present state of the art. Selected titles of this series are "Effects of Vibrations on Humans," "Acoustic Consultancy," and "The Acoustical Design of Concert Halls," and the 1983 Rayleigh Medal Lecture by Eugen Skudrzyk, "Understanding the Dynamic Behavior of Complex Vibrators."

Among the wide variety of subject areas covered by the conference papers can be identified groups of papers devoted to specific subjects in which strong research and development efforts have recently been concentrated. Active sound control is certainly an example with 16 very interesting contributions. A number of these contributions are based on impressive results produced by the Wolfson Centre for the Electronic Cancellation of Noise and Vibration at Essex University, U.K.

Marine applications of noise and vibration control are also a dominant theme. Five papers were related to off-shore platforms, and another five had to do with surface vessels.

In the area of probability analysis applied to traffic noise and transmission loss of building structures was a series of eight papers co-authored by M. Ohta of Hiroshima University. These contributions are characterized by a degree of mathematical sophistication

beyond that usually found in the Inter Noise Conference proceedings.

A prime source of technical papers since the inception of the Inter-Noise Conferences has been the propagation of sound in air and the effects of ground surfaces, barriers, and turbulence. In this Conference, we again find a substantial number of contributions of both a theoretical and a practical nature.

In summary, this well-organized publication offers a wealth of subject matter to the noise/vibration specialist and the beginner as well. Indeed, it would be difficult to find an active worker in the field who could not find something of interest in these proceedings.

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TIME SERIES AND SYSTEM ANALYSIS WITH APPLICATIONS

S.M. Pandit and S.M. Wu
John Wiley & Sons, New York, NY
1983, 586 pages

Engineers now consider time series as the response of a system that can be modeled with increasing degrees of freedom when the data justify it. The method of least squares is used to improve the fit until it is statistically significant. As stated by the authors, "The new modelling strategy can greatly reduce the tedious chore of searching for an appropriate model . . . This book will bring together time series and systems analysis to provide . . . specialists with a new tool . . . make time series analysis useful to engineers and scientists. This book is application oriented . . . both stochastic and deterministic approaches are presented." This procedure has been applied to machine tools, systems analysis, nuclear power plant surveillance, vibration analysis, and biomedical engineering.

The book contains 11 chapters and an elaborate appendix including computer programs. Chapter 1

introduces time series: correlation, regression, dynamics, stochastic difference/differential equations, and applications. The next chapter covers autoregressive moving average models (ARMA) in detail. Topics include simple and multiple regression models, first order autoregression models such as random walk, second order ARMA -- also designated ARMA (2, 1) -- a nonlinear model of ARMA (2, 1), and least square estimates in simple and multiple regressions. Chapter 3 describes characteristics of the ARMA model including Green's function, implicit and explicit ARMA (2, 1) systems in terms of Green's function, and higher order ARMA models; i.e., ARMA (m, n). The next section discusses autocovariance functions as applied to AR (1), MA (1), and ARMA (2, 1) models as well as the relationship between Green's function and the autocovariance function. The concluding section is a short discourse on partial autocorrelation and autospectrum applied to ARMA models.

The next chapter has to do with modeling. Topics include dynamics, autocovariance, adequacy of the system approach, estimation of AR and ARMA models, checks of adequacy utilizing the statistical approach of F criterion, and checks on residual autocorrelations. Examples are given of a grinding wheel profile and mechanical vibration data using a higher order ARMA model, i.e., ARMA (6, 5).

Chapter 5 reports on forecasting and includes prediction as an orthogonal projection using AR (1) models and the general ARMA (n, m) model as examples. Other topics are exponential smoothing and relationship with ARMA and comparisons among Weiner-Kolmogorov prediction theory, ARMA models, and exponential smoothing.

The following chapter has to do with the uniform sampling of continuous systems. First order differential equations, Dirac delta functions, first order autoregressive system A (1), the standard stochastic differential equation, a uniformly sampled first order system, and limitations of the sampling interval and autocovariance function are described.

Chapter 7 reports on second order systems and random vibration. Differential equations for a damped spring-mass-system, the second order autoregressive system A (2), uniformly sampled second order autoregressive systems, and regions of static and

dynamic stability are described. The concluding sections cover the A (2) model from discrete data, including spectral estimation and the effects of sampling interval, natural frequency, and damping. Examples considered are profile model characterization of a grinding wheel and experimental verification of a proposed ARMA model and true value. The reviewer believes that this method will be most used in random vibration theory, response spectra analysis, and experimentation applied to random vibration analysis.

The next chapter is concerned with the AM (2, 1) model and its application to exponential smoothing. Chapter 9 treats stochastic trends and seasonality with application to money market rates, investment modeling, and modeling of consumer and wholesale price indices.

The tenth chapter focuses on deterministic trends, seasonality, and nonstationary series including linear trends with crack propagation as an example. For the data used the deterministic data have the greatest influence. However, the reviewer believes that more extensive studies of crack propagation data will indicate that the stochastic part will exert a greater influence. Other topics are exponential trends employing first order dynamics and differential equations, periodic trends, and general nonstationary models.

The topic of the last chapter is multiple series. This encompasses transfer functions, ARMA including velocity (i.e., ARMAV), examples, optimal control employing minimum mean squared error control strategy, effects of a large lag, and forecasting by leading indicators. The appendices include normal distribution, chi square, t, and F distribution tables.

This is a different book. The reviewer believes that a table of nomenclature would be an added feature for the reader. Matrix methods, although mentioned, should be expanded and applied to time series analysis. Time series will become more important in testing. It should be slanted toward modal analysis and important fluid-structure aspects of data analysis.

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SHORT COURSES

JANUARY

RELIABILITY METHODS IN MECHANICAL AND STRUCTURAL DESIGN

Dates: January 7-11, 1985

Place: Tucson, Arizona

Objective: The objective of this short course and workshop is to review the elements of probability and statistics and the recent theoretical and practical developments in the application of probability theory and statistics to engineering design. Special emphasis will be given to fatigue and fracture reliability.

Contact: Special Professional Education, Harvill Bldg., Box 9, College of Engineering, University of Arizona, Tucson, AZ 85721 - (602) 621-3054.

FEBRUARY

VIBRATION AND SHOCK SURVIVABILITY, TESTING, MEASUREMENT, ANALYSIS, AND CALIBRATION

Dates: February 4-8, 1985

Place: Santa Barbara, California

Dates: March 11-13, 1985

Place: Washington, D.C.

Dates: May 6-10, 1985

Place: Boston, Massachusetts

Dates: June 3-7, 1985

Place: Santa Barbara, California

Dates: August 26-30, 1985

Place: Santa Barbara, California

Objective: Topics to be covered are resonance and fragility phenomena, and environmental vibration and shock measurement and analysis; also vibration and shock environmental testing to prove survivability. This course will concentrate upon equipments and techniques, rather than upon mathematics and theory.

Contact: Wayne Tustin, 22 East Los Olivos Street, Santa Barbara, CA 93105 - (805) 682-7171.

MACHINERY VIBRATION ANALYSIS

Dates: February 19-22, 1985

Place: Tempe, Arizona

Dates: August 13-16, 1985

Place: Nashville, Tennessee

Dates: October 29 - November 1, 1985

Place: Oak Brook, Illinois

Objective: This course emphasizes the role of vibrations in mechanical equipment, instrumentation for vibration measurement, techniques for vibration analysis and control, and vibration correction and criteria. Examples and case histories from actual vibration problems in the petroleum, process, chemical, power, paper, and pharmaceutical industries are used to illustrate techniques. Participants have the opportunity to become familiar with these techniques during the workshops. Lecture topics include: spectrum, time domain, modal, and orbital analysis; determination of natural frequency, resonance, and critical speed; vibration analysis of specific mechanical components, equipment, and equipment trains; identification of machine forces and frequencies; basic rotor dynamics including fluid-film bearing characteristics, instabilities, and response to mass unbalance; vibration correction including balancing, vibration control including isolation and damping of installed equipment; selection and use of instrumentation; equipment evaluation techniques; shop testing; and plant predictive and preventive maintenance. This course will be of interest to plant engineers and technicians who must identify and correct faults in machinery.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

MARCH

PENETRATION MECHANICS

Dates: March 18-22, 1985

Place: San Antonio, Texas

Objective: This course presents the fundamental

principles of penetration mechanics and their application to various solution techniques in different impact regimes. Analytical, numerical, and experimental approaches to penetration and perforation problems will be covered. Major topic headings of the course are: fundamental relationships, material considerations, penetration of semi-infinite targets, perforation of thin targets, penetration/perforation of thick targets, hydrocode solution techniques, experimental techniques. Discussions will include such topics as fragment or projectile breakup, obliquity, yaw, shape effects, and ricochet. Shock propagation, failure mechanisms and modeling, constitutive relations, and equation-of-state will be presented in the context of penetration mechanics. Developed fundamental relationships will be applied in the following areas: hypervelocity impact, long rod penetration; spaced and composite armors, explosive initiation, hydrodynamic ram, fragment containment, earth penetration, crater/hole size, spallation, shaped charge penetration.

Contact: Ms. Deborah J. Stowitts, Southwest Research Institute, 6220 Culebra Road, San Antonio, TX 78284 - (512) 684-5111, Ext. 2046.

VIBRATION CONTROL

Dates: March 25-29, 1985

Place: Manassas, Virginia

Dates: June 3-7, 1985

Place: San Diego, California

Objective: This vibration control course will include all aspects of vibration control except alignment and balancing. (These topics are covered in separate Institute courses.) Specific topics include active and passive isolation, damping, tuning, reduction of excitation, dynamic absorbers, and auxiliary mass dampers. The general features of commercially available isolation and damping hardware will be summarized. Application of the finite element method to predicting the response of structures will be presented; such predictions are used to minimize structural vibrations during the engineering design process. Lumped mass-spring-damper modeling will be used to describe the translational vibration behavior of packages and machines. Measurement and analysis of vibration responses of machines and structures are included in the course. The course emphasizes the practical aspects of vibration control. Appropriate

case histories will be presented for both isolation and damping.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

MODAL TESTING OF MACHINES AND STRUCTURES

Dates: March 26-29, 1985

Place: Manassas, Virginia

Dates: August 13-16, 1985

Place: Nashville, Tennessee

Objective: Vibration testing and analysis associated with machines and structures will be discussed in detail. Practical examples will be given to illustrate important concepts. Theory and test philosophy of modal techniques, methods for mobility measurements, methods for analyzing mobility data, mathematical modeling from mobility data, and applications of modal test results will be presented.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

MAY

ROTOR DYNAMICS

Dates: May 6-10, 1985

Place: Syria, Virginia

Objective: The role of rotor/bearing technology in the design, development and diagnostics of industrial machinery will be elaborated. The fundamentals of rotor dynamics; fluid-film bearings; and measurement, analytical, and computational techniques will be presented. The computation and measurement of critical speeds vibration response, and stability of rotor/bearing systems will be discussed in detail. Finite elements and transfer matrix modeling will be related to computation on mainframe computers, minicomputers, and microprocessors. Modeling and computation of transient rotor behavior and non-linear fluid-film bearing behavior will be described. Sessions will be devoted to flexible rotor balancing including turbogenerator rotors, bow behavior, squeeze-film dampers for turbomachinery, advanced concepts in troubleshooting and instrumentation,

and case histories involving the power and petrochemical industries.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

OCTOBER

VIBRATIONS OF RECIPROCATING MACHINERY

Dates: October 29 - November 1, 1985

Place: Oak Brook, Illinois

Objective: This course on vibrations of reciprocating machinery includes piping and foundations. Equipment that will be addressed includes reciprocating compressors and pumps as well as engines of all types. Engineering problems will be discussed from the point of view of computation and measure-

ment. Basic pulsation theory -- including pulsations in reciprocating compressors and piping systems -- will be described. Acoustic resonance phenomena and digital acoustic simulation in piping will be reviewed. Calculations of piping vibration and stress will be illustrated with examples and case histories. Torsional vibrations of systems containing engines and pumps, compressors, and generators, including gearboxes and fluid drives, will be covered. Factors that should be considered during the design and analysis of foundations for engines and compressors will be discussed. Practical aspects of the vibrations of reciprocating machinery will be emphasized. Case histories and examples will be presented to illustrate techniques.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

NEWS BRIEFS: news on current and Future Shock and Vibration activities and events

Announcement

2nd NATIONAL CONFERENCE AND WORKSHOP ON TAILORING ENVIRONMENTAL STANDARDS TO CONTROL CONTRACT REQUIREMENTS

**June 24-26, 1985
Leesburg, Virginia**

The Second National Conference and Workshop on Tailoring Environmental Standards to Control Contract Requirements will be held June 24-26, 1985 at the Xerox Facility in Leesburg, Virginia. This meeting is sponsored by the Institute of Environmental Sciences.

For further information contact: Institute of Environmental Sciences, 940 E. Northwest Highway, Mt. Prospect, Illinois 60056 - (312) 255-1561.

Announcement

19th MIDWESTERN MECHANICS CONFERENCE

**September 9-11, 1985
Columbus, Ohio**

The Nineteenth Midwestern Mechanics Conference will be held September 9-11, 1985 at The Ohio State University, Columbus, Ohio. Midwestern Mechanics Conferences have been held every two years since 1949. The program will consist of keynote and invited lecturers, as well as contributed papers. Contributed papers are solicited in all areas of mechanics.

For further information contact: Dr. A.W. Leissa, Department of Engineering Mechanics, Ohio State University, 155 W. Woodruff Avenue, Columbus, Ohio 43210 - (614) 422-2731.

ABSTRACTS FROM THE CURRENT LITERATURE

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MECHANICAL SYSTEMS

ROTATING MACHINES

(Also see Nos. 2743, 2796)

84-2630

Broadband Rotor Noise Analyses

A.R. George and S.-T. Chou

Cornell Univ., Ithaca, NY, Rept. No. NASA-CR-3797, 98 pp (Apr 1984)

N84-22365

Key Words: Rotors, Noise generation

The various mechanisms which generate broadband noise on a range of rotors studied include load fluctuations due to inflow turbulence, turbulent boundary layers passing the blades' trailing edges, and tip vortex formation. Existing analyses are used and extensions to them are developed to make more accurate predictions of rotor noise spectra and to determine which mechanisms are important in certain circumstances. Calculations based on the various prediction methods in existing experiments were compared. The present analyses are adequate to predict the spectra from a wide variety of experiments on fans, full scale and model scale helicopter rotors, wind turbines, and propellers to within about 5 to 10 dB.

84-2631

Comparison of Broadband Noise Mechanisms, Analyses, and Experiments on Rotors

A.R. George and S.-T. Chou

Cornell Univ., Ithaca, NY, J. Aircraft, 21 (8), pp 583-592 (Aug 1984) 15 figs, 58 refs

Key Words: Rotors, Noise generation, Turbulence, Vortex shedding

A study is made of the various mechanisms which generate broadband noise on a range of rotors. The sources considered are load fluctuations due to inflow turbulence, turbulent boundary layers passing the blades' trailing edges, and tip vortex formation. Vortex shedding noises due to laminar boundary layers and blunt trailing edges are not considered as they can be prevented in most cases. Various prediction methods have been reviewed and extended in some cases.

An extensive search was made of existing experiments and calculations based on the various prediction methods were made. This study shows that present analyses are adequate to predict the spectra from a wide variety of experiments on fans, full-scale and model-scale helicopter rotors, wind turbines, and propellers to within about 5 to 10 dB. Better knowledge of the inflow turbulence improves the accuracy of the predictions.

84-2632

Finite Element-Integral Acoustic Simulation of JT15D Turbofan Engine

K.J. Baumeister and S.J. Horowitz

NASA Lewis Res. Ctr., Cleveland, OH 44135, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 405-513 (July 1984) 14 figs, 2 tables, 22 refs

Key Words: Turbofan engines, Simulation, Finite element technique, Noise prediction, Engine noise

An iterative finite element integral technique is used to predict the sound field radiated from the JT15D turbofan inlet. The sound field is divided into two regions: the sound field within and near the inlet which is computed using the finite element method and the radiation field beyond the inlet which is calculated using an integral solution technique. The velocity potential formulation of the acoustic wave equation was employed in the program.

84-2633

Experimental Measurement of Alford's Force in Axial Flow Turbomachinery

J.M. Vance and F.J. Laudadio

Texas A&M Univ., College Station, TX 77843, J. Engrg. Gas Turbines Power, 106 (3), pp 585-590 (July 1984) 18 figs, 6 refs

Key Words: Turbomachinery, Force measurement, Fluid-induced excitation, Experimental data

This paper presents the results of experimental measurements made on a small, high-speed, axial-flow test apparatus to verify the existence of Alford's force and to investigate the validity of his mathematical prediction model. The measurements show that the cross-coupled aerodynamic force is linearly proportional to rotor eccentricity and to stage torque, as predicted by Alford's theory. However, it was found that the force is also speed-dependent, and that the inlet flow conditions to the stage have a pronounced effect.

84-2634

Flight Effects on Fan Noise with Static and Wind-Tunnel Comparisons

J.S. Preisser and D. Chestnutt

NASA Langley Res. Ctr., Hampton, VA, J. Aircraft, 21 (7), pp 453-461 (July 1984) 17 figs, 25 refs

Key Words: Turbofan engines, Turbofans, Fans, Noise generation, Flight simulation, Aircraft noise

A flight test program utilizing a JT15D-1 turbofan engine has been conducted with the objective of studying flight effects on fan noise and evaluating the simulation effectiveness of both a wind-tunnel and a static test configuration incorporating an inlet control device (ICD). In conjunction with synchronized laser-radar tracking and meteorological profile information, data obtained from a linear array of ground microphones were narrowband-analyzed and ensemble-averaged to yield highly accurate far-field flight acoustic results. Utilizing appropriate corrections, flight, wind-tunnel, and static acoustic data were normalized to a static-equivalent, 100-ft radius, lossless reference condition. Data comparisons showed that both the static test with ICD and wind tunnel were generally very effective in simulating flight blade-passage-frequency noise levels.

84-2635

Vane Stagger Angle and Camber Effects in Fan Noise Generation

J.B.H.M. Schulten

National Aerospace Lab., NLR, Amsterdam, The Netherlands, AIAA J., 22 (8), pp 1071-1079 (Aug 1984) 7 figs, 7 refs

Key Words: Fan noise, Noise generation, Ducts, Vanes

The problem of sound generated by the interaction of velocity disturbances with stator vanes in an annular duct is considered theoretically. The duct carries a uniform subsonic main flow and is assumed to be anechoic. In this problem it seems consistent to model the vanes by flat plates parallel to the duct axis. However, this modeling may yield an unrealistically low acoustic power. In the present paper a nonplanar lifting surface approximation of the vanes shows that at frequencies prevailing in current turbofans even a small vane inclination significantly affects the sound generation process.

84-2636

Reduction of Discrete Frequency Noise in Small, Subsonic Axial-Flow Fans

J.M. Fitzgerald and G.C. Lauchle

Pennsylvania State Univ., Box 30, State College, PA 16804, J. Acoust. Soc. Amer., 76 (1), pp 158-166 (July 1984) 13 figs, 2 tables, 21 refs

Key Words: Fans, Noise reduction, Electronic test equipment

The discrete frequency noise radiated from representative types of axial-flow fans used in electronic equipment is studied in detail. Narrow-band analysis of the discrete frequency noise radiated by these types of fans has been conducted in an anechoic environment. The farfield sound pressure level and radiated directivity of the discrete frequency noise are presented. The influence of operating condition on the radiated sound is determined.

84-2637

Aerodynamic Far Field Noise in Idling Circular Sawblades

C.D. Mote, Jr. and Wen Hua Zhu

Univ. of California, Berkeley, CA 94720, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 441-446 (July 1984) 7 figs, 12 refs

Key Words: Saws, Circular saws, Blades, Noise generation

The acoustic pressure radiated to the far field from dipole sources at the rim of a rotating circular sawblade is investigated theoretically and experimentally. Scattering from the sawblade surfaces and the presence of dipole source components in both the normal and radial coordinate directions explain the observed directivity and the dependence of the sound pressure upon sawblade rim velocity.

84-2638

Vortex Shedding: The Source of Noise and Vibration in Idling Circular Saws

M.C. Leu and C.D. Mote, Jr.

Cornell Univ., Ithaca, NY 14853, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 434-440 (July 1984) 13 figs, 1 table, 15 refs

Key Words: Saws, Circular saws, Noise generation, Vibration generation, Vortex shedding

Vortices separating from the edges of cutting teeth were shown to be the dominant source of pressure fluctuation

and hence noise in circular saws. Measurements of pressure on the surfaces of the blade and teeth showed: strong periodicity of the pressure on the tooth lateral surfaces, a 180 degree phase difference between the pressure variations on both tooth lateral surfaces, and pressure variations dominantly occurring on the tooth surfaces rather than the blade surfaces. The presence of an afterbody, downstream of the blade and tooth edges of flow separation, was found necessary for significant aerodynamic excitation of the blade and generation of noise by the flow.

METAL WORKING AND FORMING

84-2639

Means for the Reduction of Machine Tool Noise (Wege zur Geräuschminderung an spanenden Werkzeugmaschinen)

M. Klocker

VDI-Z., 126 (10), pp 345-351 (May 1984) 11 figs, 10 refs

(In German)

Key Words: Machine tools, Noise reduction, Design techniques, Finite element technique, Computer programs

The concept of noise reduction of machine tools should be integrated into the construction stage and improvements carried out on the finished equipment. The paper describes possibilities for the analysis of noise generation and the appropriate means for attacking the problem. One of such means is finite element technique combined with a digital computer program. The theoretical results are confirmed by means of a silent machine tool gear and a gear box.

84-2640

Self-Excited Chatter and Its Marks in Turning

T. Kaneko, H. Sato, Y. Tani, and M. O-Hori

Inst. of Industrial Science, Univ. of Tokyo, 22-1, Roppongi 7 chome, Minato-ku, Tokyo, Japan, J. Engrg. Indus., Trans. ASME, 106 (3), pp 222-228 (Aug 1984) 20 figs, 16 refs

Key Words: Chatter, Lathes, Machine tools

Investigations were made on self-excited chatter of the work which is held at one end on a lathe machine. Analysis was carried out by a two-degrees-of-freedom system. It was verified that introduction of the multiple regenerative effect governs the finite amplitude of the vibration after it is

excited. It was also shown that behavior of the work displacement rotating around the origin during the vibration could be explained by taking into account a resistive force which is inversely proportional to the cutting speed and is proportional to the velocity of the vibration. Phase difference of the vibration occurring for each turn of the work was measured by making use of a microcomputer system.

84-2641

Buckling Loads and Natural Frequencies of Drill Bits and Fluted Cutters

E.B. Magrab and D.E. Gilsinn

National Bureau of Standards, Washington, DC 20234, J. Engrg. Indus., Trans. ASME, 106 (3), pp 196-204 (Aug 1984) 10 figs, 17 refs

Key Words: Drills, Buckling, Natural frequencies, Mode shapes, Beams

The buckling loads, natural frequencies and mode shapes of twist-drill bits and certain fluted cutters under a variety of combinations of twist angle, cross-section geometry, and axial loading have been obtained. The drill bit is modeled as a twisted Euler beam under axial loading that is clamped at both ends. The governing system of differential equations is solved by the Galerkin procedure. Explicit forms for the basis functions used to generate the Galerkin coefficients are presented in general form in an appendix. They may be used for obtaining numerical results for that class of problems which use the Rayleigh-Ritz-Galerkin methods with beam-type functions as the basis functions.

MATERIALS HANDLING EQUIPMENT

84-2642

Accidental Loads in Crane Girders: A Case Study

A.J. Reis, C.S. Oliveira, and J.R.T. Azevedo

Tech. Univ. of Lisbon, Portugal, ASCE J. Struc. Engrg., 110 (7), pp 1679-1686 (July 1984) 7 figs, 3 refs

Key Words: Girders, Cranes (hoists)

The case of a crane transporting a large mass suspended by two sets of cables is considered. The dynamic behavior and the forces induced in the crane, due to the failure of one of the hanging mechanisms, are studied using two 3 degrees of freedom mathematical models. The highly nonlinear differential equations of motion are derived and integrated

by Runge-Kutta algorithm. The influence of the stiffness of the cables, the initial configuration of the system, the value of the hanging force corresponding to the cable release, and the stiffness of the braking system of the trolley are analyzed.

Through modal analysis, the modal participation factor and the modal ground acceleration in consideration of the phase-different effect are obtained, so that the influence of the phase-different effect can also be judged in a response spectrum of this modal ground acceleration.

STRUCTURAL SYSTEMS

BRIDGES

84-2643

Role of Indicial Functions in Buffeting Analysis of Bridges

R.H. Scanlan

Princeton Univ., Princeton, NJ 08544, ASCE J. Struc. Engrg., 110 (7), pp 1433-1446 (July 1984) 2 figs, 30 refs

Key Words: Bridges, Flutter, Wind-induced excitation

The problem of the wind buffeting of bluff bodies, in this instance bridge decks, is reexamined from the standpoint of linearized theory. The links of flutter derivatives to aerodynamic indicial functions are first recalled and extended. The possibility that these functions offer of simplifying investigative aerodynamic tests of bridge models is discussed. The gust response problem is set up for a two-dimensional model in the time domain, employing aerodynamic indicial functions. A theoretical framework is offered for future wind tunnel model investigations under turbulent flow.

84-2644

Earthquake Response Analysis of Cable-Stayed Bridges under the Action of Travelling Waves

Xiang Haifan

J. of Tung-Chi Univ., (2), pp 1-9 (1983)

CSTA No. 624-83.107

Key Words: Bridges, Cable-stayed structures, Phase effects, Earthquake response, Seismic response, Modal analysis

The influence of the phase-different effect on earthquake response of a bridge is analyzed. The equation of motion of a cable-stayed bridge under non-coherent excitation of supports is derived using the matrix of influence function.

BUILDINGS

84-2645

Circu-Rectangular Bundled Tube Office Tower - A Case History

J.S. Notch

Ellisor & Tanner, Inc., Houston, TX, ASCE J. Struc. Engrg., 110 (7), pp 1598-1612 (July 1984) 12 figs

Key Words: Buildings, Multistory buildings, Towers, Wind-induced excitation

This paper documents the structural design and analysis as it evolved in the planning of a new office tower. Aeroelastic wind tunnel models predicted that extreme dynamic oscillation of the tower may occur due to the configuration of existing tall buildings surrounding the site. Dynamic wind force resistance for the silver reflective glass structure was provided by a four-celled bundled framed tube system. The bundled tube frames are comprised of two-story high tree column modules located at 15 ft on centers around the building perimeter. The interior tubular cell partitions are framed by three tree beam diagonal truss frames quadsecting the tower's curvirectangular plan shape.

TOWERS

(See No. 2645)

FOUNDATIONS

(Also see Nos. 2759, 2760)

84-2646

Effect of Embedment on Foundation-Soil Impedances

A.N. Lin and P.C. Jennings

California Inst. of Tech., Pasadena, CA, ASCE J. Engrg. Mech., 110 (7), pp 1060-1075 (July 1984)

7 figs, 3 tables, 36 refs

Key Words: Interaction; soil-foundation, Mechanical impedance, Buildings

A 10-ft square, one-story model structure was subjected to horizontally incident SH-waves to determine the effect of foundation embedment on the response. Structural and foundation-soil impedances were calculated from the fundamental resonant frequency and mode shape. The resulting impedance values and embedment factors were then compared to theoretical values. The translatory and rocking impedances for the unembedded case were found to be in agreement with values obtained from analytical formulations.

84-2647

Dynamics of Structures on Two-Spring Foundation Allowed to Uplift

C.-S. Yim and A.K. Chopra

Univ. of California, Berkeley, CA, ASCE J. Engrg. Mech., 110 (7), pp 1124-1146 (July 1984) 7 figs, 10 refs

Key Words: Foundations, Rigid foundations, Elastic supports

The dynamics of structures with their foundation mat supported only through gravity and thus permitted to uplift from the supporting system, are investigated. In its fixed base condition the structure is idealized as a single-degree-of-freedom system attached to a rigid foundation mat, which is supported at each edge by a spring-damper element. Analytical expressions are presented for the free vibration response of the system and the effects of foundation uplift are examined. An effective numerical procedure, based on expressions of the Rayleigh-Ritz concept, to evaluate the structural response to earthquakes, is presented.

84-2648

Use of Ritz Vectors in Wave Propagation and Foundation Response

E.P. Bayo and E.L. Wilson

Univ. of California, Berkeley, CA, Earthquake Engrg. Struc. Dynam., 12 (4), pp 499-505 (July/Aug 1984) 3 figs, 4 tables, 6 refs

Key Words: Foundations, Wave propagation, Finite element technique, Ritz method

The accuracy of a numerical method is demonstrated for the dynamic analysis of large complex finite element systems in which the spatial distribution of the loading is constant. The method is based on the use of a special class of Ritz vectors which were previously proposed and can be generated with

minimum numerical effort. The purpose of this paper is to extend the use of these vectors to the solution of wave propagation and foundation response problems. The method is applied to one-, two- and three-dimensional problems.

84-2649

Running Stability of Large Rotor Bearing Foundation Models (Laufstabilität grosser Rotor-Gleitlager-Fundament-Konstruktionen)

D. Bosin

Technische Univ., Berlin, Fed. Rep. Germany, Rept. No. ILR-MITT-124/1983, 71 pp (1983)

N84-21887

(In German)

Key Words: Foundations, Machine foundations, Bearings, Rotors, Stability, Finite element technique

A finite element model of large turborotors including stiffness and damping of bearings and foundation and rotor stiffness was developed. A modal condensation procedure was employed to reduce substructure unknowns and the stability limit was iterated by eigenvalue computation. Threshold speed and unstable eigenfrequency was calculated for a system of 16 reduced degrees of freedom (rotor-bearing model) and for a system of 46 reduced degrees of freedom (rotor-bearing-foundation model). The influence of rotor mass and stiffness, oil film stiffness and damping, Sommerfeld number, types of journal bearings, and mass, stiffness, and damping of the foundation was studied.

84-2650

Lateral Response of a Single Pile in Overconsolidated Clay to Relatively Low Frequency Harmonic Pile-Head Loads and Harmonic Ground Surface Loads

G.W. Blaney

Ph.D. Thesis, Univ. of Houston, 505 pp (1983)

DA8408976

Key Words: Pile structures, Clays, Harmonic excitation

The results of horizontal harmonic pile-head load tests on a single 10-inch diameter steel pipe pile imbedded in stiff over-consolidated clay are presented. The measured response of the pile to harmonic ground-surface loads is also presented. The dynamic response of the instrumented pile cap, pile, and surrounding soil were recorded on a high-resolution 60-channel digital recording system, and transfer functions were computed between the input loads and all instrument locations by a software system developed specially for the project.

84-2651

Laboratory Investigation of Vibratory Compaction of Dry Soils

C.R. Webster

Army Military Personnel Ctr., Alexandria, VA, 118 pp (May 1984)
AD-A140 218

Key Words: Soils, Vibratory techniques

In arid regions where water may not be available for standard field compaction operations, compaction of soils at low moisture contents may be necessary. To determine whether these cohesive and cohesionless soils can be adequately compacted in a dry state, a laboratory vibratory soil compactor was built and used to conduct the investigation. After analyzing the effects of frequency of vibration, acceleration, static weight, and moisture content on compaction, a comparison of the unit weights obtained by standard and vibratory methods was made.

HARBORS AND DAMS

84-2652

Effect of Artificial Gaps on the Dynamic Behaviours of Dams

Zhou Jing, et al

China Civil Engrg. J., 16 (3), pp 33-44 (1983)
CSTA No. 624-83.119

Key Words: Dams, Discontinuity containing media, Natural frequencies

The frequency drop in free vibration of an elastic structure after artificial gapping is demonstrated. A simplified method -- ascending the matrix order and perturbation -- is proposed to determine the free vibration characteristics of an elastic structure with and without gaps. Numerical examples calculating the free vibration characteristics of a gapped gravity dam and an arch dam are given.

84-2653

On Free Liquid Oscillations in Irregular Basins

H.M. Safwat

Univ. of Alexandria, El-Hadrah, Alexandria, Egypt,
ASCE J. Engrg. Mech., 110 (7), pp 1147-1160 (July 1984) 18 refs

Key Words: Dams, Sloshing, Geometric imperfection effects, Fundamental frequency

Complex variable methods have been devised to investigate the effect of geometric irregularities on the dynamic characteristics of inviscid liquids in circular basins. The fundamental frequency of the slosh mode has been determined by the stationary property of Schwarz quotients. Lower and upper bounds for the frequency have been obtained by a comparison theorem. Results show that frequencies are decreased with the increase of out-of-roundness parameters.

CONSTRUCTION EQUIPMENT

(See No. 2651)

POWER PLANTS

(Also see No. 2702)

84-2654

Investigation of the Earthquake Behavior of the Research Reactor FRJ-2 (Dido)

J. Altes, H. Graffi, and D. Koschmieder

Inst. fuer Nukleare Sicherheitsforschung, Kernforschungsanlage Juelich GmbH, Fed. Rep. Germany,
Rept. No. JUEL-SPEZ-222, 26 pp (Oct 1983)
N84-22047

Key Words: Nuclear reactors, Earthquake response

Finite element calculations were carried out for the reactor FRJ-2 in order to determine its integrity after an earthquake. Results indicate a displacement of 5 mm occurring during 0.25 g safe shutdown earthquake for the reactor block in the horizontal and vertical directions, and 16 mm for the crane way in the horizontal direction, but without danger for the primary circuit.

84-2655

The Generation of Spectrum Compatible Accelerograms for the Design of Nuclear Power Plants

A. Preumont

Belgonucleaire, Rue du Champ de Mars, 25 1050, Brussels, Belgium, Earthquake Engrg. Struc. Dynam., 12 (4), pp 481-497 (July/Aug 1984) 9 figs, 1 table, 56 refs

Key Words: Nuclear power plants, Seismic design, Accelerograms

Based on the main features of the computer program THGE, the paper reviews the techniques which are available for the construction of an accelerogram whose response spectrum matches a design spectrum. A sample accelerogram is generated as the product of the stationary random sequence by a deterministic shape function. Procedures are described which are available, both in the frequency domain and in the time domain, to improve the agreement between the response spectrum and the target.

VEHICLE SYSTEMS

GROUND VEHICLES

(Also see No. 2806)

84-2656

Design Features of Low-Noise Tire Treads (Konstruktionsmerkmale geräuscharmer Reifenprofile)

T. Reese, D. Denker, G. Muller, and D. Zoglowek
Automobiltech. Z., 86 (6), pp 261-264 (June 1984)
16 figs, 8 refs
(In German)

Key Words: Interaction: tire-pavement, Noise reduction, Noise generation

This paper deals with the influence of car tires' tread pattern design on tire/road noise. With the aid of modern acoustic measuring technology, a large number of tires with geometrically simple tread patterns, as well as standard tires, were tested systematically in respect to noise. All measurements were made with vehicles on the road. From the results of these investigations conclusions were drawn regarding technical measures intended to improve the noise characteristics of tires' tread patterns.

84-2657

Mathematical Modelling to Simulate the Transient Dynamic Longitudinal Force in Draw Bars of a Train-Consist

J.S. Rao, E. Raghavacharyulu, and N. Kumar

Indian Inst. of Tech., Delhi, Hauz Khas, New Delhi --
110016, India, J. Sound Vib., 94 (3), pp 365-379
(June 8, 1984) 11 figs, 6 tables, 8 refs

Key Words: Railroad trains, Draw-bars, Transient response, Modal analysis

This paper deals with the theory and development of a computer-oriented mathematical model to determine the transient response and coupling (draw-bar) forces of a train-consist subjected to different train handling conditions. The longitudinal motion is assumed to take place independently and the equations of motion for the system are set up in a matrix form. A transfer matrix method is adopted to determine the free vibration characteristics. The response of the system due to the transient forces is obtained by modal analysis with account taken altogether of five modes, including the rigid body mode. The displacement response and the draw-bar forces obtained for a typical train-consist are presented in tables and figures. The computer programs developed can be used to lay down train handling and make up procedures to avoid possible dangerous conditions of draw-bar failures.

84-2658

Curving Simulation of Four Axle Railway Vehicles with Conventional Two Axle Bogies

T. Hirotsu, F. Iwasaki, K. Terada, and M. Ariga
Hitachi Res. Lab., Hitachi, Ltd., Mito, Japan, Bull.
JSME, 27 (228), pp 1272-1279 (June 1984) 15 figs,
5 refs

Key Words: Railroad cars, Cornering effects, Interaction: rail-vehicle

A dynamic model is developed for curving of four axle rail vehicles with conventional two axle bogies, and equations of their motion are derived. Digital simulations are made to obtain time history of rail-wheel vertical and lateral forces during curving.

SHIPS

84-2659

A Method for the Prediction of Noise and Velocity Levels in Ship Constructions

A.C. Nilsson

Danish Acoustical Inst., Technical Univ., Bldg. 352,

DK-2800, Lyngby, Denmark, J. Sound Vib., 94 (3), pp 411-429 (June 8, 1984) 11 figs, 23 refs

Key Words: Ships, Noise prediction, Noise reduction

Models describing the propagation of flexural waves in ribbed steel structures typical for ship constructions are presented. Two models are discussed. One is valid in the low frequency range -- in the octave bands with center frequencies from 31.5 Hz to 125 Hz. The other model can be used in the 250 Hz to 8 kHz octave bands. Predicted results are compared to the results of full-scale measurements carried out on a ship.

84-2660

Upper Ball Joint Force Variations Due to Riser Tensioner and Vessel Motions

J.E. Lovell

Ph.D. Thesis, Texas A&M Univ., 119 pp (1983)
DA8408452

Key Words: Ships, Marine risers

An analysis of the variation of forces acting on the upper ball joint of a riser string due to drill ship motion and riser tensioner dynamics has been conducted. The analysis includes the effect of breakaway torque on the tensioner sheaves while assuming vessel and upper ball joint motion to be independent. General equations for the tensioner cable forces and for the forces exerted on the riser upper ball joint by the slip joint-tensioner system are derived and solved. The variation in tensioner cable forces is compared to data generated in field operations.

84-2661

Reflections on Trends in Dynamics - The Navy's Perspective

H.C. Pusey

NKF Engineering Associates, Inc., Vienna, VA, Shock Vib. Bull., No. 54, Pt. 1, pp 59-64 (June 1984) 18 refs (Proc. Shock Vib. Symp., Oct 18-20, 1983, Jet Propulsion Lab., Pasadena, CA. Spons. SVIC, Naval Res. Lab., Washington, DC)

Key Words: Ships

Dynamics, that branch of mechanics which deals with forces and their relation to the motion of bodies, is an area that is important to designers of equipment for all types of systems.

In this paper the dynamics is considered from the perspective of the Navy. Some trends in that area are examined and some problems that will require attention in the future are highlighted.

84-2662

Fatigue Considerations in View of Measured Load Spectra

W.G. Dobson, R.F. Brodrick, J.W. Wheaton, J. Giannotti, and K.A. Stambaugh

Teledyne Engineering Services, Waltham, MA, Rept. No. TR-3049-4, SSC-315, 59 pp (1983)
AD-A140 221

Key Words: Ships, Fatigue life, Experimental data

Crack propagation in HY-80 and CS ship steel under typical ship loading time-histories was studied. The loading histories were selected from recorded service stress data which were generated during voyages by the SL-7 containership. Samples of the data were imposed on laboratory specimens as a tape loop signal speeded up by a factor of 25. Analysis of the results indicated that the crack growth during this random loading compared closely with that of constant-amplitude loading if the stress intensity range were expressed as the root-mean-square. It was also determined that significant crack growth retardation effects were present and that omission of low-amplitude high-frequency components of the loading had little effect on the time rate of growth of cracks.

84-2663

Measurements of the Impulse Response and Reverberation Underwater in the Depressurized Towing Tank Marin

A. Debruijn

Technisch Physische Dienst TNO-TH, Delft, The Netherlands, Rept. No. TPD-208.730/1, TDCK-78124, 27 pp (Dec 21, 1982)

N84-22374

(In Dutch)

Key Words: Underwater structures, Towed systems, Impulse response

The underwater impulse response of a depressurized towing tank was determined. An electrodynamic underwater sound source generated a chirp consisting of a relatively long sinusoidal pressure signal with frequency modulation. By

signal processing, the chirp was compressed to a short idealized pulse. The reflectograms obtained with the chirp are also converted to true impulse response data. For a number of positions in the tank, typical for the usual hydrophones, the impulse responses are calculated with the aid of a sound source at the propeller source line. From the echograms it can be seen that the bottom and side wall reflections are not significant in comparison with the direct signal. The impulse response data are used to calculate the reverberation curves by adopting Schroeder's concept of the integrated impulse response.

AIRCRAFT

(Also see Nos. 2634, 2792)

84-2664

Modified Shielding Jet Model for Twin-Jet Shielding Analysis

C.H. Gerhold and J. Gilbride

Texas A&M Univ., College Station, TX 77843, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 421-426 (July 1984) 8 figs, 15 refs

Key Words: Aircraft noise, Noise reduction, Shielding

An analytical model to estimate the shielding of noise emitted from a point noise source has been developed assuming the shielding jet to be a cylinder of constant radius with uniform flow across the cross section. Comparison to experiment indicated that the model overestimates diffraction of sound around the jet in the far downstream region. The shielding jet model is modified to include widening downstream of the nozzle exit. This not only represents a more realistic model of the jet, but is also expected to improve the shielding estimate downstream.

84-2665

Analysis of the Effect of Heated Jet Flow on the Far Field Radiation from a Noise Source

C.H. Gerhold

Texas A&M Univ., College Station, TX 77843, J. Vib., Acoust., Stress, Res. Des., Trans. ASME, 106 (3), pp 427-433 (July 1984) 8 figs, 12 refs

Key Words: Aircraft noise, Noise reduction, Shielding, Noise shielding

One factor which influences the radiation of jet noise is the interaction with the heated moving flow of a parallel twin

jet. Because of the temperature and flow discontinuity between the jet and the surrounding air, the parallel jet acts as a partial barrier between the noise source and the receiver. An analytical model of jet shielding has been developed consisting of the sound field emitted from a stationary, discrete frequency point source, which impinges on a cylinder of locally parallel flow. The model is analyzed to identify the zones in which the various shielding mechanisms dominate. The effects of such parameters as jet temperature and flow speed are investigated. The analytical model is compared to experimental results for the shielding of a point noise source adjacent to a subsonic, isothermal air jet.

84-2666

General Equations of Motion for an Elastic Wing and Method of Solution

V.J.E. Stark

Saab Scania AB, Linköping, Sweden, AIAA J., 22 (8), pp 1146-1153 (Aug 1984) 5 figs, 4 tables, 20 refs

Key Words: Aircraft wings, Equations of motion, Time domain method

Equations in the time domain for arbitrary motion of a finite elastic wing in linearized flow are derived by means of more general indicial aerodynamic coefficients than those previously defined. Solution by the Laplace transformation shows that the normal response contains a line integral that depends on the discontinuity of the aerodynamic transfer functions across the negative real axis. For these functions, approximations of the Garrick type are utilized in a root-locus method in which no augmented states are needed.

84-2667

Noise Transmission Characteristics of Advanced Composite Structural Materials

L.A. Roussos, C.A. Powell, F.W. Grosveld, and L.R. Koval

NASA Langley Res. Ctr., Hampton, VA, J. Aircraft, 21 (7), pp 528-535 (July 1984) 8 figs, 6 tables, 10 refs

Key Words: Aircraft, Composite materials, Noise transmission

An experimental and theoretical research program has begun to develop an understanding of the noise transmission characteristics of composite materials. Such an understanding will ensure that the weight advantage of composites in aircraft fuselage design is not compromised by high noise transmis-

sion or heavy acoustic treatments. Noise transmission tests have been conducted on large unstiffened panels representative of the outer skin or inner trim panels of aircraft fuselages. An analytical model based on infinite panel theory has been developed which allows for exact modeling of the anisotropic properties of the panels.

84-2668

Parameter Identification Applied to the Oscillatory Motion of an Airplane Near Stall

J.G. Batterson and V. Klein

NASA Langley Res. Ctr., Hampton, VA, J. Aircraft, 21 (7), pp 498-504 (July 1984) 10 figs, 9 refs

Key Words: Aircraft vibration, Flight test data, Parameter identification technique, Regression analysis

An application is presented of a stepwise regression incorporating polynomial splines to oscillatory flight data from a light research airplane operating at near-stall angles of attack. It is shown that data from several experiments can be combined into a large data set for analysis and that hysteresis phenomena can be observed in this large data set.

84-2669

Reliability Analysis and Cost Optimization of Fatigue-Critical Components under Scheduled Inspection Maintenance in Service

Shiung Chen

Ph.D. Thesis, The George Washington Univ., 208 pp (1984)

DA8405297

Key Words: Aircraft, Fatigue life

Conventional deterministic design of aircraft fatigue-critical components has resulted in conservation underestimation and poor utilizations of inherent fatigue life. The effect of scheduled inspection maintenance in service normally are not accounted for at the design stage. In this dissertation probabilistic methodologies are developed for reliability analyses and cost optimization of fatigue-critical components under scheduled inspection maintenance in service. Emphasis is placed on the development of retirement-for-cause analysis methodologies for gas turbine engine components, based on fracture mechanics approach.

84-2670

Transonic Pressure Distributions on a Rectangular Supercritical Wing Oscillating in Pitch

R.H. Ricketts, M.C. Sandford, D.A. Seidel, and J.J. Watson

NASA Langley Res. Ctr., Hampton, VA, J. Aircraft, 21 (8), pp 576-582 (Aug 1984) 14 figs, 13 refs

Key Words: Aircraft wings, Oscillation

Steady and unsteady aerodynamic data were measured on a rectangular wing with a 12% thick supercritical airfoil mounted in the NASA Langley Transonic Dynamics Tunnel. The wing was oscillated in pitch to generate the unsteady aerodynamic data. The purpose of the wind-tunnel test was to measure data for use in the development and assessment of transonic analytical codes. The effects on the wing pressure distributions of Mach number, mean angle of attack, and oscillation frequency and amplitude were measured.

84-2671

Divergence/Flutter Suppression System for a Forward Swept-Wing Configuration with Wing-Mounted Stores

M. Rimer, R. Chipman, and R. Mercadante

Grumman Aerospace Corp., Bethpage, NY, J. Aircraft, 21 (8), pp 631-638 (Aug 1984) 20 figs, 8 refs

Key Words: Aircraft wings, Wing stores, Flutter, Active flutter control

The conceptual design of an active control system has been developed for a forward swept-wing configuration with stores to prevent the destiffening of the primary wing-bending mode with increasing airspeed, thereby suppressing the inherent aeroelastic instability (divergence/body-freedom-flutter). The architecture includes wing-mounted and fuselage-mounted accelerometers to detect relative wing motion and an outboard wing flaperon to control this motion. By virtually eliminating the instability, the design enables the aircraft to carry significant wing-mounted stores while retaining the clean-wing flight envelope.

84-2672

Nonlinear Finite Element Method in Crashworthiness Analysis of Aircraft Seats

A.O. Bolukbasi and D.H. Laananen

Simula Inc., Tempe, AZ, J. Aircraft, 21 (7), pp 512-519 (July 1984) 15 figs, 15 refs

Key Words: Crash research (aircraft), Aircraft seats, Crashworthiness, Finite element technique

A three-dimensional mathematical model of an aircraft seat, occupant, and restraint system has been developed for use in the analysis of light aircraft crashworthiness. Because of the significant role played by the seat in overall system crashworthiness, a detailed finite element model of the seat structure is included. The seat model can accommodate large displacements, nonlinear material behavior, and local buckling.

MISSILES AND SPACECRAFT

(Also see No. 2830)

84-2673

DNA ICBM Technical R&D Program

M.I. Kovel

Defense Nuclear Agency, Washington, DC, Shock Vib. Bull., No. 54, Pt. 1, pp 23-41 (June 1984) 25 figs (Proc. Shock Vib. Symp., Oct 18-20, 1983, Jet Propulsion Lab., Pasadena, CA. Spons. SVIC, Naval Res. Lab., Washington, DC)

Key Words: Missiles

After a brief introduction of the Defense Nuclear Agency, the DNA program on basing of primarily small missiles, namely hard silos and hard mobile launchers, is described.

84-2674

Air Force Space Technology Center Space Technology - Emphasis 84

F.J. Redd

Air Force Space Technology Center, Kirtland AFB, NM, Shock Vib. Bull., No. 54, Pt. 1, pp 55-57 (June 1984) (Proc. Shock Vib. Symp., Oct 18-20, 1983, Jet Propulsion Lab., Pasadena, CA. Spons. SVIC, Naval Res. Lab., Washington, DC)

Key Words: Spacecraft, Test facilities

The mission of AFSTC, to centralize the planning and execution of space technology in support of future Air Force space systems requirements, is described.

BIOLOGICAL SYSTEMS

HUMAN

84-2675

Lubrication of Elastic-Isoviscous Line Contacts Subject to Cyclic Time-Varying Loads and Entrainment Velocities

J.B. Medley and D. Dowson

Univ. of Waterloo, Waterloo, Canada, ASLE, Trans., 27 (3), pp 243-251 (July 1984) 7 figs, 28 refs

Key Words: Lubrication, Cyclic loading, Time dependent parameters, Joints (anatomy), Seals

An analytical approach was developed for the difficult problem of predicting the dynamic variation in fluid-film thickness of elastic-isoviscous line contacts under isothermal conditions. A numerical solution procedure was constructed and applied to the experiments of Hirano and Murakami who were investigating the lubrication of O-ring seals. Reasonable agreement was obtained. The present approach was extended to the lubrication of compliant layered surfaces as part of a study of human ankle joint lubrication.

MECHANICAL COMPONENTS

ABSORBERS AND ISOLATORS

(Also see Nos. 2710, 2743, 2806)

84-2676

An Active Sound Absorber with Porous Plate

D. Guicking and E. Lorenz

Drittes Physikalisches Institut, Univ. of Göttingen, Göttingen, Fed. Rep. Germany, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 389-392 (July 1984) 6 figs, 3 refs

Key Words: Acoustic absorbers, Active absorption

An active equivalent of a resonance absorber with a porous plate is described. The porous layer is backed by a loud-

speaker driven such that zero sound pressure is maintained in the air gap between foil and speaker. The simultaneous control of magnitude and phase has been achieved in analog technique by a combination of open-loop and closed-loop control, utilizing single sideband modulation of the compensation signal with a weak infrasonic auxiliary signal.

84-2677

Active Impedance Control for One-Dimensional Sound

D. Guicking and K. Karcher

Drittes Physikalisches Institut, Univ. of Göttingen, Göttingen, Fed. Rep. Germany, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 393-396 (July 1984) 6 figs, 10 refs

Key Words: Acoustic absorption, Active absorption, Acoustic impedance, Active control

Generalizing the concept of active sound absorption, a system for active impedance control has been developed, so far for plane waves at normal incidence. The active reflector is a loudspeaker driven by the incident sound wave. Its feeding signal is derived from a wave separator with two microphones splitting up the standing wave field into incident and reflected wave. This system permits easy control of the reflection coefficient and eliminates feedback instability.

84-2678

Antivibration Mountings. 1970 - April, 1984 (Citations from the Engineering Index Data Base)

NTIS, Springfield, VA, 66 pp (May 1984)
PB84-866177

Key Words: Mountings, Vibration isolators, Bibliographies

This bibliography contains 94 citations concerning mechanical and fluid antivibration mountings. Citations are included which offer vibration damping methods for buildings as well as machinery. New materials and new methods are discussed in the automotive, machinery, nuclear and construction industries. Various methods of measuring vibration are also presented.

84-2679

Finite Amplitude Vibrations of a Body Supported by Simple Shear Springs

M.F. Beatty

Univ. of Kentucky, Lexington, KY 40506, J. Appl. Mech., Trans. ASME, 51 (2), pp 361-366 (June 1984)
3 figs, 12 refs

Key Words: Mountings, Springs, Elastomers, Vibration analysis

The exact solution of the problem of the undamped, finite amplitude oscillations of a mass supported symmetrically by simple shear mounts, and perhaps also by a smooth plane surface or by roller bearings, is derived for the class of isotropic, hyperelastic materials for which the strain energy is a quadratic function of the first and second principal invariants and an arbitrary function of the third. The Mooney-Rivlin and Hadamard material models are special members for which the finite motion of the load is simple harmonic and the free fall dynamic deflection always is twice the static deflection. Otherwise, the solution is described by an elliptic integral which may be inverted to obtain the motion in terms of Jacobi elliptic functions.

84-2680

Generalized Rigid-Body Dynamics System Simulation and the Application to the Behavior of Suspended Agricultural Tractors

P.W. Claar, II

Ph.D. Thesis, Iowa State Univ., 405 pp (1983)
DA8407061

Key Words: Suspension systems (vehicles), Tractors

Low frequency terrain-induced tractor vibration levels exceed proposed International Standards Organization fatigue-decreased proficiency limits. A suspension system is needed to protect the operator and attenuate the vibration inputs to the chassis and the operator platform for high speed farming systems. Computer simulation modeling of the suspension system provides information for the design and about its performance. The design considerations for off-road vehicle operator ride comfort, the means to improve ride comfort, and computer simulation techniques to evaluate ride comfort are discussed. A matrix-computer procedure for the vibrational analysis of articulated planar and spatial mechanisms is presented and the development of a chassis suspension system is discussed.

84-2681

Eccentricities of Resultant Loads from Compression Coil Springs (Exzentrische Lagen der Reaktionskräfte bei Schraubendruckfedern)

G.D. Go

Kapellenstrasse 42, 5860 Iserlohn 5, Germany, Automobiltech. Z., 86 (5), pp 227-232 (May 1984) 8 figs (In German)

Key Words: Suspension systems (vehicles), Shock absorbers, Wear

The factors influencing the locations of eccentric centers, the seating loads and engineering applications for the future to cut development costs and time are presented. The seating loads can be used right during the development of a suspension system to gain knowledge concerning its service life and response when in operation. The finite-element approach used was based on the theory of forces of the first order for straight beams.

TIRES AND WHEELS

(See No. 2810)

BLADES

(Also see No. 2709)

84-2682

Flapping-Torsional Response of Helicopter Rotor Blades to Turbulence Excitation

Jon-Shen Fuh

Ph.D. Thesis, Univ. of Illinois at Urbana-Champaign, 166 pp (1983)

DA8409925

Key Words: Blades, Propeller blades, Helicopters, Torsional response, Turbulence, Fluid-induced excitation

Dynamics of a helicopter rotor system in atmospheric turbulence is investigated theoretically. Modeling turbulence components as stationary random processes, differential equations governing the coupled flapping-torsional motion of a rotor blade are derived. The blade is treated as being rigid and centrally hinged for the flapping motion, and as being elastic with a linear deformation mode for the torsional motion. Classical steady theory is used to formulate the aerodynamic forces due to blade flapping. For those due to blade pitching, a quasi-steady theory is used. The governing equations so obtained contain random turbulence terms in the coefficients and the inhomogeneous parts. In the second stage of investigation, the analytical procedure is extended to multibladed systems.

BEARINGS

(Also see No. 2812)

84-2683

Investigation of Friction and Wear of Dynamically Loaded Hydrodynamic Bearings with Abrasive Contaminants

A. Ronen and S. Malkin

Technion-Israel Inst. of Tech., Haifa 32000, Israel, J. Lubric. Tech., Trans. ASME, 105 (4), pp 559-568 (Oct 1983) 16 figs, 10 refs

Key Words: Bearings, Wear

A test system is described for investigating friction and wear of hydrodynamic bearings under cyclical dynamic loading conditions with contaminant abrasive particles in the oil supply. Dynamic loading on the test bearing is synchronized with the shaft rotation, so that the oil film thickness history can be determined from the measured shaft orbit for any point on the shaft and liner periphery. Either clean or contaminated oil can be supplied to the test bearing from two separate oil supply systems. Experimental results obtained for six shaft/liner bearing material combinations were similar to those previously obtained for static loading.

84-2684

Energy Loss Due to Misalignment of Journal Bearings

Z.S. Safar

Cairo Univ., Cairo, Egypt, Trib. Intl., 17 (2), pp 107-109 (Apr 1984) 5 figs, 4 refs

Key Words: Bearings, Journal bearings, Alignment

An analysis of a journal bearing describing a maximum allowable value of misalignment at a length to diameter ratio of unity is presented. The journal misalignment is allowed to vary in direction up to a direction normal to the axial plane containing the load vector. The results demonstrate that journal misalignment influences bearing behavior.

84-2685

Stability Analysis of Externally-Pressurized Gas-Lubricated Porous Bearings with Journal Rotation. Part I. Cylindrical Whirl

D.K. Pal and B.C. Majumdar

Indian Inst. of Tech., Kharagpur, India, Trib. Intl., 17 (2), pp 83-91 (Apr 1984) 13 figs, 1 table, 7 refs

Key Words: Bearings, Journal bearings, Gas bearings, Whirling

Whirl stability (cylindrical) of externally-pressurized gas-lubricated porous journal bearings, considering one-dimensional flow through the porous matrix, is analyzed by a first-order perturbation method. The effect of supply pressure, feeding parameter, porosity parameter and length-to-diameter ratio on the stability is also investigated.

84-2686

Stability Analysis of Externally-Pressurized Gas-Lubricated Porous Bearings with Journal Rotation. Part 2. Conical Whirl

D.K. Pal and B.C. Majumdar

Indian Inst. of Tech., Kharagpur, India, Trib. Intl., 17 (2), pp 92-98 (Apr 1984) 10 figs, 9 refs

Key Words: Bearings, Journal bearings, Gas bearings, Whirling

The stability analysis of externally pressurized gas journal bearings under conical mode of vibration is obtained using a first-order perturbation method. The effect of journal speed, feeding parameter, supply pressure, porosity parameter and length-to-diameter ratio on the conical whirl and whirl ratio is investigated.

84-2687

Bifurcation Theory Applied to Oil Whirl in Plain Cylindrical Journal Bearings

C.J. Myers

Dept. of Applied Mathematical Studies, Univ. of Leeds, Leeds LS2 9JT, UK, J. Appl. Mech., Trans. ASME, 51 (2), pp 244-249 (June 1984) 6 figs, 1 table, 17 refs

Key Words: Bearings, Self-excited vibrations, Oil whirl phenomena

An analysis of the self-excited oscillations of a rotor supported in fluid film journal bearings is presented. It is shown that Hopf bifurcation theory may be used to investigate small-amplitude periodic solutions of the nonlinear equations of motion for rotor speeds close to the speed at which the steady-state equilibrium position becomes unstable. A numerical investigation supports the findings of the analytic work.

84-2688

Literature Review of Tilting Pad and Turbulent Hydrostatic Journal Bearings for Nuclear Main Coolant Pumps

R.D. Flack and P.E. Allaire

Univ. of Virginia, Charlottesville, VA 22901, Shock Vib. Dig., 16 (7), pp 3-12 (July 1984) 4 figs, 58 refs

Key Words: Bearings, Tilt pad bearings, Hydrostatic bearings, Cooling systems, Pumps, Reviews

Research regarding tilting-pad and turbulent hydrostatic journal bearings is reviewed. Included are both theoretical and experimental work. Both static and dynamic characteristics are considered. The purpose of this paper is to enable a practicing engineer to apply presently available methods so that he can reliably predict load capacities and dynamic coefficients for the bearings.

GEARS

(Also see No. 2694)

84-2689

Estimating Dynamic Loads on Gear Teeth

M.F. Spotts

Northwestern Univ., Evanston, IL, Mach. Des., 56 (16), pp 84-88 (July 12, 1984) 4 figs

Key Words: Gear teeth, Error analysis

One of the most widely accepted procedures for estimating dynamic loads involves the use of a mass/spring model that simulates the effects of manufacturing errors. Errors in tooth profile and tooth spacing are major causes of dynamic loads. Factors that influence dynamic forces include operating speed, spring constant of meshing gear teeth, and mass of the rotating gears. All of these factors are considered in the method presented in this article for estimating dynamic tooth loads and spur gears.

84-2690

Root Stresses and Bending Fatigue Breakage of Planet Gear

S. Oda, K. Miyachika, and A. Takeda

Tottori Univ., 4 101 Minami, Koyama-cho, Tottori, Japan, Bull. JSME, 27 (227), pp 995-1001 (May 1984) 18 figs, 6 refs

Key Words: Gears, Fatigue tests, Finite element technique

A root stress analysis by means of the two-dimensional finite element method and a bending fatigue test for planet and idle gears were carried out. The effects of rim thickness and internal pressure due to a press-fitted bush on the root stresses and the position of the fatigue crack initiation were investigated.

84-2691

Laws of Motion for Non-Vibrating Cranks

H. Dresig and J. Rossler

Technische Hochschule Karl-Marx-Stadt, Sektion Maschinen-Bauelemente, Maschinenbautechnik, 33 (5), pp 201-204 (1984) 5 figs, 10 refs
(In German)

Key Words: Cranks, Design techniques, Computer programs, Vibration control

The maximum operating speeds of many cam gears are restricted by forced vibrations. The speeds can be increased to almost resonant speeds of the highest harmonics by means of a new cam profile design. A computer program, KUSY, was developed which synthesizes such cam profiles. Tests showed that the new profile enabled to raise the maximum operating speeds of various machinery. A test with a warped knitting loom is described.

COUPLINGS

84-2692

Subharmonic Resonances in Prime Mover Systems Incorporating Diesel Engines (Subharmonische Resonanzen in dieselmotorischen Antriebsanlagen)

V. Zouli

Frydantska 1316/11, 182 00 Praha 8/CSSR, MTZ Motortech. Z., 45 (6), pp 253-255 (June 1984) 4 figs, 5 refs
(In German)

Key Words: Couplings, Flexible couplings, Diesel engines, Subharmonic oscillations

Wherever a flexible shaft coupling with a nonlinear characteristic is connected to a diesel engine to drive machinery, there is a risk that subharmonic resonances will occur in view of the fact that they represent a phenomenon typical of

nonlinear oscillations. This article describes a method of calculating the amplitude of subharmonic nonlinear oscillations; it can be also applied using simple computer technology. The conditions at which subharmonic oscillations can originate are specified.

84-2693

Selection of Flexible Couplings for Marine Propulsion Engines with Power Take-Off (Auswahl elastischer Kupplungen für Schiffsdieselmotoren mit Leistungsverzweigung)

F. Martinek

Eichenweg 35, A-5302 Henndorf, Germany, MTZ Motortech. Z., 45 (6), pp 251-252 (June 1984) 1 fig, 1 table, 3 refs
(In German)

Key Words: Couplings, Flexible couplings, Marine engines, Torsional vibrations

The author describes the process of making a preliminary selection with or without computer assistance of the flexible couplings to be used in a typical marine propulsion system incorporating a medium-speed, 4-stroke diesel engine to drive a propeller through a reduction gear and an auxiliary alternator through a step-up gear. After such an initial coupling selection on the basis of torque, simple formulae can be used to predict torsional vibrations.

LINKAGES

84-2694

Application of the Analysis of Bi-Parametric Dissipative Oscillations to the Crank with Connecting Rod Assembly and to the Eccentric Gear

I. Misicu

Polytechnical Inst., Bucharest, Romania, Rev. Roumaine Sci. Tech., Mecanique Appl., 29 (2), pp 187-192 (Mar/Apr 1984) 6 figs, 2 refs

Key Words: Cranks, Connecting rods, Gears

On the basis of a previously developed analysis of bi-parametric dissipative oscillations, a procedure is developed for determining the critical stability parameters for two types of usual mechanisms -- a crank with a connecting rod assembly and an eccentric gear.

SEALS

(Also see No. 2813)

84-2695

A Study on the Dynamic Characteristics of Pump Seal (1st Report, In Case of Annular Seal with Eccentricity)

Bo Suk Yang, T. Iwatsubo, and R. Kawai
Graduate School of Science and Tech., Kobe Univ.,
Rokkodai Nada-Ku, Kobe, Japan, Bull. JSME, 27
(227), pp 1047-1053 (May 1984) 5 figs, 11 refs

Key Words: Seals, Pumps

The dynamic characteristics of the annular pressure seal employed in pumps have been theoretically deduced with consideration for the effect of eccentricity of rotor. Turbulent flow is assumed in both circumferential and axial directions, and effect of inertia of the fluid is considered. An equation for the pressure increment due to journal translation is derived in terms of the effective viscosities, based on the rotational and axial flow Reynolds numbers.

84-2696

Pumping Action of Aligned Smooth Face Seals Due to Axial Vibrations -- Theory

M. Kaneta, Y. Jonnouchi, and F. Fukahori
Kyushu Inst. of Tech., Sensui-cho, Tobata, Kita-Kyushu, 804, Japan, J. Trib., Trans. ASME, 106 (3), pp 344-351 (July 1984) 7 figs, 26 refs

Key Words: Seals, Periodic excitation

This is an analytical study of the mechanism of pumping action produced in two axially symmetrical disks. The disks have a continuous parallel film thickness between them, and one of them has a recess at the center and is subjected to a normal sinusoidal oscillation. It is found out that whether the pumping action is inward or outward depends upon a shift of phase between a variation of flow resistance due to a periodic fluctuation of the film thickness between seal faces and a variation of pressure in the recess.

STRUCTURAL COMPONENTS

STRINGS AND ROPES

(Also see No. 2828)

84-2697

Nonlinear Generation of Missing Modes on a Vibrating String

K.A. Legge and N.H. Fletcher
Univ. of New England, Armidale 2351, Australia,
J. Acoust. Soc. Amer., 76 (1), pp 5-12 (July 1984)
7 figs, 1 table, 9 refs

Key Words: Strings, Vibration analysis

The nonlinear transfer of energy among modes of different frequencies on a vibrating string is investigated both theoretically and experimentally. The nonlinearity is associated with the well-known variation of string tension caused by the vibration modes, but it is essential that at least one of the end supports has finite mechanical admittance if there is to be any mode coupling. If the nonrigid bridge support has zero admittance in a direction parallel to the string, the coupling is of third order in the mode amplitudes. For a more realistic model in which the string changes direction as it passes over a bridge of finite admittance there are additional coupling terms of second order.

CABLES

84-2698

Dynamic Phenomena in Ropeways After a Haul Rope Rupture

B. Portier
Service de Mecanique, Laboratoire Central des Ponts et Chaussees, 58 Boulevard Lefebvre, 75732 Paris Cedex 15, France, Earthquake Engrg. Struc. Dynam., 12 (4), pp 433-449 (July/Aug 1984) 8 figs, 2 tables, 16 refs

Key Words: Cable cars, Cables

An accurate prediction of the dynamical behavior of reversible aerial ropeways is presented. A mechanical and numerical model is developed in order to check the safety of any such ropeway after a haul rope rupture. The model uses very

simple first-order finite elements, accounting for nonlinear effects caused by large displacements. The numerical integration is very efficient, and suits the capabilities of small microcomputers; it does not require matrix inversions nor stiffness matrix evaluations.

84-2699

Dynamic Relaxation Analysis of the Non-Linear Static Response of Pretensioned Cable Roofs

W.J. Lewis, M.S. Jones, and K.R. Rushton
The Polytechnic, Wolverhampton, England, Computer Struc., 18 (6), pp 989-997 (1984) 9 figs, 5 tables, 15 refs

Key Words: Cables, Roofs, Dynamic relaxation

A summary of various existing methods of cable roof analysis is followed by a detailed description of a dynamic relaxation technique that can be applied for the solution of such structures. Theoretical analysis of static response of pretensioned cable networks is presented using a nonlinear energy approach. Solutions are obtained by dynamic relaxation, a numerical finite difference technique. Detailed results are presented for a pretensioned cable truss.

BARS AND RODS

84-2700

Investigation of Stress Wave Propagation through Intersecting Bars

K.R.Y. Simha and W.L. Fournery
Univ. of Maryland College Park, MD 20742, J. Appl. Mech., Trans. ASME, 51 (2), pp 345-353 (June 1984) 19 figs, 21 refs

Key Words: Bars, Stress waves, Wave propagation

A general formulation is presented for the analysis of stress wave propagation through the junction of rectangular bars. The analysis is applied to the case of two bars meeting at right angles and is used to theoretically predict the passage of longitudinal waves through the junction. An experimental investigation of the phenomenon, using dynamic photoelasticity is conducted with a high-speed multiple spark gap camera of the Cranz-Schardin type. Three different geometries are tested to represent the most common types of junctions encountered in practice.

84-2701

Propagation of Elastic Waves in a Finite Length Bar with a Variable Cross Section

M. Daimaruya, M. Naitoh, and K. Hamada
Muroran Inst. of Tech., 27-1 Mizumoto-cho, Muroran, Japan. Bull. JSME, 27 (227), pp 872-878 (May 1984) 9 figs 12 refs

Key Words: Bars, Variable cross section, Elastic waves, Wave propagation, Impact excitation

The propagation of elastic waves in a finite length bar with a variable cross section subjected to an arbitrary longitudinal impact loading is investigated. The solution is obtained by the application of the Laplace transform. The results of this analysis can be applied only to a thin bar with small changes of area and to waves which are long compared to the lateral dimensions of the bar. Numerical calculations are carried out for the case of truncated cones, and strain wave histories at various stations along the bar are shown for two kinds of impact loading.

84-2702

Analysis of Vibration of a Group of Rods in a Fluid by Approximation of Flow-path Network (Report I. Simplified Vibration Model of a Group of Rods)

H. Tomita and Y. Sasaki
Toshiba Res. and Dev. Ctr., Toshiba Corp., 1, Komukai, Toshiba-cho, Saiwaiku, Kawasaki 210, Japan, Bull. JSME, 27 (227), pp 956-964 (May 1984) 19 figs, 6 refs

Key Words: Rods, Submerged structures, Multibeam systems, Fluid-induced excitation, Nuclear fuel elements, Seismic design

A practical approximate method of analysis of a group of rods in a fluid is presented. A simplified model of the rod/fluid system is presented and its applicability to practice is verified through theoretical and experimental analysis.

84-2703

Analysis of Vibration of a Group of Rods in a Fluid by Approximation of Flow-Path Network (Report II. Continuous Body Model of a Group of Rods)

H. Tomita
Toshiba Res. and Dev. Ctr., Toshiba Corp., 1, Komukai, Toshiba-cho, Saiwaiku, Kawasaki 210, Japan, Bull. JSME, 27 (227), pp 965-973 (May 1984) 13 figs, 3 refs

Key Words: Rods, Submerged structures, Multibeam systems, Fluid-induced excitation, Nuclear fuel elements, Seismic design

In this paper a group of rods is treated as if it were a continuous body as a whole. A more generalized and widely applicable model of the rod/fluid system is presented, and its validity for practical use is shown through experiment.

BEAMS

84-2704

Stress-Displacement Analysis in Random Coupled Vibration of Bundles of Elastic Rods

D. Dinca

National Inst. for Scientific and Technical Creation, Bdul Picii 220, 79622, Bucharest, Romania, Rev. Roumaine Sci. Tech., Mecanique Appl., 29 (2), pp 147-158 (Mar/Apr 1984) 2 figs, 2 tables, 8 refs

Key Words: Beams, Tube arrays, Fluid-induced excitation, Bernoulli-Euler method, Rayleigh method, Timoshenko theory

A stress-displacement analysis is developed for a bundle of parallel, cylindrical, elastic rods, immersed in an ideal incompressible fluid, using three beam models: the Bernoulli-Euler model, the Rayleigh model which includes the rotatory inertia effect, and the Timoshenko one which includes both the rotatory inertia effect and the shear forces effect. Numerical results are obtained for two types of random loads.

84-2705

Three-Dimensional Harmonic Vibrations of a Circular Beam

D.E. Panayotounakos and P.S. Theocaris

The National Technical Univ. of Athens, 5, K. Zographou St., Zographou, Athens 624, Greece, J. Appl. Mech., Trans. ASME, 51 (2), pp 375-382 (June 1984) 1 fig, 2 tables, 11 refs

Key Words: Beams, Natural frequencies, Harmonic excitation, Transverse shear deformation effects, Rotatory inertia effects

An analytical treatment for the determination of the natural frequencies of a circular uniform beam, subjected

to three-dimensional harmonic loads, is presented. Each differential element of the beam has six degrees of freedom; i.e., three translations and three rotations. This problem, in the most general case of response, is associated with a partial linear differential system composed of four coupled 3×1 vectorial equations. The influences of transverse shear deformation and rotatory inertia are also included in the analysis.

84-2706

Dynamic Stability of Thin Walled Beams under Traveling Horizontal Follower Load Systems

T. Aida

Yamaguchi Univ., Ube, Japan, J. Sound Vib., 94 (3), pp 431-444 (June 8, 1984) 10 figs, 5 refs

Key Words: Beams, Moving loads

The dynamic elastic instability of a thin walled beam under traveling horizontal transverse follower load systems caused by nosing and yawing motions of vehicles; e.g., magnetically levitated vehicles, is considered. It is shown that the perturbation equation of motion of this beam system becomes Hill's equation and a parametrically excited unstable coupled vibration occurs. Furthermore, the boundary frequency equations of the simple parametric resonance are obtained by Bolotin's method, and the stability maps of a simply supported beam are shown, as influenced by load mass and damping.

84-2707

Improved Finite-Difference Vibration Analysis of Pretwisted, Tapered Beams

K.B. Subrahmanyam and K.R.V. Kaza

NASA Lewis Res. Ctr., Cleveland, OH, Rept. No. E-1923, NASA-TM-83549, 13 pp (1984)
N84-16588

Key Words: Beams, Variable cross section, Finite difference technique, Vibration analysis

An improved finite difference procedure based upon second order central differences is developed. Several difficulties encountered in earlier works with fictitious stations that arise in using second order central differences, are eliminated by developing certain recursive relations. The need for forward or backward differences at the beam boundaries or other similar procedures is eliminated in the present theory. By using this improved theory, the vibration characteristics of pretwisted and tapered blades are calcu-

lated. Results of the second order theory are compared with published theoretical and experimental results and are found to be in good agreement.

84-2708

Bending of Beams Subjected to Transverse Impacts

R.L. Woodward

Materials Res. Labs., Ascot Vale, Australia, Rept. No. MRL-R-886, 24 pp (Apr 1983)
AD-A137 840

Key Words: Beams, Impact excitation, Computer programs

Transverse projectile impacts on the ends of free-free beams of circular cross section produced evidence of hinges in the beams and strain distributions which could be used for comparisons with a rigid-plastic approach to the dynamic response of structures and for comparisons with a finite element computer code solution. The rigid-plastic approach describes the mechanism of bending and hinge development and motion correctly but the simplifications inherent in the model prevent it from accurately predicting the detail. The computer code EPIC-2 gives extremely good simulations of the problem.

84-2709

Blade Excitation Due to Gyroscopic Forces

F. Sisto, A.T. Chang, and M. Sutcu

Dept. of Mech. Engrg., Stevens Inst. of Tech., Rotordynamic Problems in Power Plants, Intl. Conf., Intl. Fed. for Theory of Machines and Mechanisms, Tech. Comm. for Rotor Dynamics, Sept 28 - Oct 1, 1982, Rome, Italy, pp 279-284, 5 figs, 5 refs

Key Words: Beams, Cantilever beams, Blades, Rotor blades (turbomachinery), Mountings, Whirling, Seismic excitation

A turboblade mounted on a spinning and precessing rotor is modeled as a uniform cantilever beam (with bending in one plane) with the objective of efficiently conducting parametric studies. The effect that is considered is the response due to a harmonic variation with time of the precessional rate such as is attributable to whirling, seismic ground motion, or other periodic disturbances acting upon mounts of the axial turbomachine. The results are presented in the form of (self-excited) instability criteria. The effects of viscous damping and negative damping (rate of growth) of the unstable vibration are also studied for the case of a constant (nonharmonic) precession rate.

84-2710

Vibrations of Beams with an Absorber Consisting of a Viscoelastic Solid and a Beam

H. Yamaguchi and H. Saito

Tohoku Univ., Sendai, Japan, Earthquake Engrg. Struc. Dynam., 12 (4), pp 467-479 (July/Aug 1984)
10 figs, 7 refs

Key Words: Beams, Dynamic vibration absorption (equipment)

This paper considers the response of a beam with a dynamic vibration absorber, which consists of a viscoelastic solid and a double-cantilever viscoelastic beam, attached to the center of the main beam. The ends of the main beam are built in and excited sinusoidally by the base motion. The transfer matrix method is used in the analysis. The displacement transmissibility; i.e., the ratio of the displacement at the center of the main beam to that of the base is investigated in the numerical example.

84-2711

Shear Strength of Reinforced Concrete Beam-Column Joints under Low Reversed Cyclic Loading

Research Group on Frame Joints, J. Bldg. Structure, 4 (6), pp 1-17 (1983)
CSTA 624-83.132

Key Words: Joints (junctions), Beam-columns, Reinforced concrete, Cyclic loading, Seismic design

Thirty specimens of beam-column joints in reinforced concrete frames under low reversed cyclic loading cases are tested. The investigation includes deformability, shear strength, failure mechanism in joint core region and their effecting factors, such as the confinement of concrete by orthogonally connected beams, axial stress ratio, shear stress ratio, stirrup ratio and slip of beam bars. A seismic design method for calculating shear resisting values and recommendations of beam-column joint core are presented.

PANELS

84-2712

Influence of Geometric Imperfections and In-Plane Constraints on Nonlinear Vibrations of Simply Supported Cylindrical Panels

D. Hui

Ohio State Univ., Columbus, OH 43210, J. Appl. Mech., Trans. ASME, 51 (2), pp 383-390 (June 1984) 6 figs, 22 refs

Key Words: Panels, Cylinders, Vibration analysis, Large amplitudes

This paper deals with the effects of initial geometric imperfections on large-amplitude vibrations of cylindrical panels simply supported along all four edges. In-plane movable and in-plane immovable boundary conditions are considered for each pair of parallel edges. Depending on whether the number of axial and circumferential half waves are odd or even, the presence of geometric imperfections (taken to be of the same shape as the vibration mode) of the order of the shell thickness may significantly raise or lower the linear vibration frequencies.

84-2713

Free Vibrations of Oval Cylindrical Panels

V.K. Koumoussis and A.E. Armenakas

Consulting Engr., Athens, Greece, ASCE J. Engrg. Mech., 110 (7), pp 1107-1123 (July 1984) 7 figs, 3 tables, 10 refs

Key Words: Panels, Cylindrical plates, Natural frequencies, Mode shapes, Geometric effects, Flugge shell theory, Donnell theory

The dynamic characteristics of oval cylindrical panels, with simply supported curved edges and various boundary conditions along the straight edges, are established on the basis of the Flugge or Donnell type theories. Numerical results are presented and the effect of the ovality as well as other geometric parameters of the panels are investigated.

84-2714

Vibrations of Axially Loaded Stiffened Cylindrical Panels with Elastic Restraints

J. Singer, O. Rand, and A. Rosen

Dept. of Aeronautical Engrg., Technion-Israel Inst. of Tech., Haifa, Israel, J. Sound Vib., 93 (3), pp 397-408 (Apr 8, 1984) 3 figs, 2 tables, 33 refs

Key Words: Panels, Cylinders, Stiffened structures, Vibration analysis, Computer programs

A method has been developed for analysis of the vibration and buckling of preloaded stiffened cylindrical panels with

different boundary conditions along the straight edges, including elastic restraints. In the analysis linear, "smeared" stiffener, Flugge type theory is used. A computer program VIBUPAL has been developed.

84-2715

Free Vibration of Noncircular Cylindrical Panels with Simply Supported Curved Edges

V.K. Koumoussis and A.E. Armenakas

National Technical Univ., Athens, Greece, ASCE J. Engrg. Mech., 110 (5), pp 810-827 (May 1984) 3 figs, 13 refs

Key Words: Panels, Cylindrical plates, Donnell theory, Flugge shell theory

A method is presented, employing Flugge and Donnell type theories, for obtaining the dynamic characteristics of cylindrical panels of noncircular cross section, having simply supported curved edges and any boundary conditions along their straight edges. Special formulas are derived for symmetric and doubly-symmetric cylindrical panels.

PLATES

(Also see Nos. 2734, 2763, 2764)

84-2716

Criteria for Placing the Points of Measurement to Obtain the Vibrating Energy of Plates (Critères de maillage pour la mesure d'énergie vibratoire des plaques)

P. Millot, J.L. Guyader, C. Boisson, and C. Lesueur
Laboratoire des Sciences de l'Habitat de l'Ecole Nationale des Travaux Publics de l'Etat, 69120 Vaulx en Velin, France, Acustica, 55 (2), pp 101-112 (May 1984) 16 figs, 13 refs
(In French)

Key Words: Plates, Vibration measurement, Measurement techniques

The aim of this paper is to help to determine criteria for placing the points of measurement on a plate excited by a wide-band random noise force, in order to obtain its vibrating energy. The main parameters which affect the error of method associated with a plate are the number of modes within the bandwidth of excitation, the type of distribution, and the number of points. The results de-

scribe two plates which are typical of the problems found in industrial and architectural acoustics.

84-2717

Vibration of Four-Sides Supported One-Way Continuous Rectangular Orthotropic Elastic Plates with Added Masses

Zhang Wohua and Xu Zhixin

J. of Tung-Chi Univ., (2), pp 26-40 (1983)

CSTA No. 624-83.109

Key Words: Plates, Rectangular plates, Natural frequencies, Mode shapes, Added mass effects, Harmonic excitation

Analytic solutions for the natural frequency and mode of a one-way continuous four-sides supported rectangular orthotropic elastic plate with added masses and the steady response of the plate with complex damping under harmonic excitation are presented.

84-2718

Stability and Vibrations of Geometrically Nonlinear Cylindrically Orthotropic Circular Plates

D. Shilkrut

The Pearlstone Ctr. for Aeronautical Engrg. Studies, Ben-Gurion Univ. of the Negev, Beer Sheva, Israel, J. Appl. Mech., Trans. ASME, 51 (2), pp 354-360 (June 1984) 7 figs, 13 refs

Key Words: Plates, Circular plates, Low frequencies, Vibration analysis

The stability analysis of axisymmetrical equilibrium states of geometrically nonlinear, orthotropic, circular plates that are deformed by multiparameter loading, including thermal influence, is presented. The dynamic method (method of small vibrations) is used to accomplish this purpose. The behavior of the plate in different cases is revealed.

84-2719

On the Resonance Frequencies of Water-Loaded Circular Plates

F.M. de Espinosa and J.A. Gallego-Juarez

Laboratorio de Ultrasonidos, Instituto de Acustica, Consejo Superior de Investigaciones Cientificas,

Serrano 144, Madrid-6, Spain, J. Sound Vib., 94 (2), pp 217-222 (May 22, 1984) 2 figs, 2 tables, 9 refs

Key Words: Plates, Circular plates, Resonant frequencies, Underwater structures

The studies on the increase of inertia, and the corresponding reduction in frequency, of plates when vibrating in water have been confined mainly to the lower modes of vibration and for plate radii much less than a wavelength of sound in the fluid. In this paper, a method is presented which, subject to certain approximations, permits the evaluation of the influence of the fluid on the frequency of any vibration mode whose deflection curve in a vacuum is known. The method has been applied to water-loaded circular plates vibrating in their axisymmetric modes.

84-2720

Nonlinear Transient Response of Isotropic Circular Plates

P.C. Dumir, Y. Nath, and M.L. Gandhi

Indian Inst. of Tech., New Delhi-110016, India, Computer Struc., 18 (6), pp 1009-1018 (1984) 12 figs, 1 table, 9 refs

Key Words: Plates, Circular plates, Transient response, Time dependent excitation, Nonlinear theories

The nonlinear transient response for stresses and deflection of thin linear elastic circular plates subjected to different time-dependent loads is investigated. Space-wise discretization is done using the collocation method with the zeros of a Chebyshev polynomial as collocation points. Newmark- β scheme is used for time-marching. Time and space-wise convergence studies are carried out. Both the linear and nonlinear transient response of clamped and simply supported circular plates under six different sets of transient loads are obtained.

84-2721

Dynamic Response of a Prestressed, Orthotropic Thick Plate Strip to a Moving Line Load

S. Chonan

The Univ. of British Columbia, 2324 Main Mall, Vancouver, Canada, J. Sound Vib., 93 (3), pp 427-438 (Apr 8, 1984) 6 figs, 10 refs

Key Words: Strips, Plates, Moving loads

A study of the steady state response of an orthotropic plate strip to a moving line load is presented. The plate is of

infinite length and subjected to initial-in-plane stresses parallel and perpendicular to the edges. The solution is obtained on the basis of a thick plate theory which takes into account the effects of shear deformation and rotatory inertia. The critical speed of the load which brings about a resonance effect in the system is determined. Further, the bending moment in the plate is calculated for several values of the load speed and the initial stress parameters and shown graphically as a function of the space variable moving with the load.

84-2722

Free Vibration Analysis of Rectangular Cantilever Plates with Symmetrically Distributed Point Supports Along the Edges

H.T. Saliba

Univ. of Ottawa, Ottawa, Ontario K1N 6N5, Canada, J. Sound Vib., 94 (3), pp 381-395 (June 8, 1984) 6 figs, 3 tables, 6 refs

Key Words: Plates, Cantilever plates, Free vibration, Method of superposition

Through exploitation of the superposition method, a highly accurate analytical solution is provided for the free vibration problem of rectangular cantilever plates with symmetrically distributed point supports along the free edges. Tables of eigenvalues for a wide range of plate aspect ratio are provided.

84-2723

Diffuse Waves in Finite Plates

R.L. Weaver

Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801, J. Sound Vib., 94 (3), pp 319-335 (June 8, 1984) 4 figs, 17 refs

Key Words: Plates, Power spectral density, Acoustic emission, Sound waves, Wave propagation

The diffuse field assumption of room acoustics is shown to lead to a relationship between the total spectral energy density of a linear elastic wave disturbance in a finite plate and the power density as observed on the surface. For times long compared with acoustic transit times across the length of the plate, the diffuse field assumption allows the theorist to neglect the details of edge reflections under the assumption that an eventual steady state energy balance is maintained among the different branches of wave propagation.

Application of these ideas to acoustic emission source characterization is discussed.

84-2724

Non-Linear Transient Response of Flat Plate to Air Shock Wave

J.N. Lee

Naval Postgraduate School, Monterey, CA, 121 pp (Dec 1983) AD-A140 491

Key Words: Plates, Transient response, Shock waves, Computer programs

The nonlinear elasto-plastic response of a clamped flat plate to a typical air shock wave is investigated. The nonlinear effects of the plate responses due to the material and geometric nonlinearity are studied. The necessity of the modification of old armored vehicles is reviewed and the NAS-TRAN code is employed. The theoretical background of the nonlinear transient analysis is described, a step by step procedure of analyzing the dynamic load problem by shock wave using NASTRAN code is developed, and sensitivity analyses are performed.

SHELLS

(Also see No. 2737)

84-2725

Vibration and Damping Analysis of a Multilayered Cylindrical Shell, Part I: Theoretical Analysis

N. Alam and N.T. Asnani

Aligarh Muslim Univ., Aligarh, India, AIAA J., 22 (6), pp 803-810 (June 1984) 1 fig, 11 refs

Key Words: Shells, Cylindrical shells, Layered materials, Vibration analysis, Layered damping

The governing equations of motion for the nonaxisymmetric and axisymmetric variational of a general multilayered cylindrical shell having an arbitrary number of orthotropic material layers are derived using variational principles. The refined analysis considers bending, extension, and shear deformations in all layers of a multilayered cylindrical shell, including rotary and longitudinal translatory as well as transverse inertias. The solution for a radially simply supported shell is obtained and the procedure for determining the damping effectiveness in terms of the system loss factor for all families of the modes of vibration in a multilayered shell with elastic and viscoelastic layers is reported.

84-2726

Dynamic Instability of a Circular Cylindrical Shell Subjected to a Simultaneous Action of Compressive Forces and Temperature Field, Both Periodical in Time

C.V. Massalas

Univ. of Ioannina, Greece, Rev. Roumaine Sci. Tech., Mecanique Appl., 29 (2), pp 159-171 (Mar/Apr 1984) 7 figs, 6 refs

Key Words: Shells, Cylindrical shells, Dynamic stability, Axial excitation, Temperature effects

The problem of the dynamic stability of a clamped cylindrical shell subjected to the simultaneous action of longitudinal compressive forces and temperature field, both periodical in time, in the case of the temperature-dependent modulus of elasticity, is formulated on the basis of Donnell's linear theory and Galerkin's method. Numerical results for the vibration frequencies, buckling load and the boundaries of the principal instability regions are presented and the influence of the temperature field on them is extensively discussed.

84-2727

Natural Frequencies of Fluid-Coupled Circular Cylindrical Shells (Eigenschwingungen von Durch Flüssigkeit Gekoppelten Kreiszyklinderschalen)

Nguyen-Xuan-Hung

Polytechnic Institute of Hanoi, Vietnam, Rev. Roumaine Sci. Tech., Mecanique Appl., 29 (1), pp 31-49 (Jan/Feb 1984) 19 figs, 4 refs
(In German)

Key Words: Shells, Cylindrical shells, Fluid-filled containers, Submerged structures, Natural frequencies

Natural frequencies of two fluid-coupled circular cylindrical shells are investigated. Special cases, namely, vibration of fluid-filled and submerged shells, are compared with experimental results.

84-2728

Acoustic Scattering from Air-Filled Cylindrical Shells in Water (Diffusion d'une onde ultrasonore par des tubes remplis d'air immerges ans l'eau)

G. Maze, J. Ripoché, A. Derem, and J.L. Rousselot
Universite de Haute Normandie, Laboratoire d'Elec-

tronique et d'Automatique, groupe "Ultrasons," U.E.R.S.T., Place Robert Schuman, 76610 Le Havre, Acustica, 55 (2), pp 69-85 (May 1984) 25 figs, 39 refs

(In French)

Key Words: Shells, Cylindrical shells, Submerged structures, Underwater sound, Sound waves, Wave scattering

The Resonance Isolation and Identification Method (RIIM) allows a direct verification of the Resonance Scattering Theory (RST). The resonance spectra (recording of the backscattered echo versus the frequency just after the excitation) of aluminum elastic cylinders and cylindrical shells insonified by a plane acoustic wave are quasi-linear. Resonances result from standing waves on the circumference of the cylinder. These standing waves originate from surface waves which propagate around it in two opposite directions. The mode number also is determined by experimentation (RIIM).

84-2729

Non-Stationary Response of Non-Linear Liquid Motion in a Cylindrical Tank Subjected to Random Base Excitation

M. Sakata, K. Kimura, and M. Utsumi

Tokyo Inst. of Tech., Meguro-ku, Tokyo 152, Japan, J. Sound Vib., 94 (3), pp 351-363 (June 8, 1984) 6 figs, 1 table, 11 refs

Key Words: Cylindrical shells, Tanks (containers), Fluid-filled containers, Storage tanks, Base excitation, Random excitation, Seismic excitation

The nonstationary response of nonlinear liquid motion in a cylindrical tank subjected to lateral earthquake excitation is investigated by modeling the earthquake excitation as an amplitude modulated non-white random process having a dominant frequency. The nonstationary standard deviation and mean responses of the liquid surface displacement are calculated and it is shown that the linear liquid motion theory is not necessarily sufficient to evaluate the safety of tanks, since the nonlinear analysis leads to a positive value of the mean response for the liquid surface displacement at the tank wall, while the linear theory predicts zero mean response.

84-2730

Dynamic Behavior of Liquid Free Surface in a Cylindrical Container Subject to Vertical Vibration

H. Hashimoto and S. Sudo

Inst. of High Speed Mechanics, Tohoku Univ., Sendai, Japan, Bull. JSME, 27 (227), pp 923-930 (May 1984) 17 figs, 15 refs

Key Words: Cylindrical shells, Fluid-filled containers, Sloshing

A series of experimental studies on the dynamic behavior of the gas-liquid interface are reported. These studies are concerned with the liquid sloshing phenomena induced by vertical vibration of a cylindrical container. The disappearance of the harmonic surface wave motion, the formation of 1/2-subharmonic motion, the mechanism of the surface disintegration and the behavior of spray-excited low frequency waves are investigated.

84-2731

Axisymmetric Vibrations of Thick Shells of Revolution

K. Suzuki, T. Kosawada, and S. Takahashi
Yamagata Univ., Yonezawa, Japan, Bull. JSME, 27 (227), pp 980-986 (May 1984) 9 figs, 10 refs

Key Words: Shells, Shells of revolution, Axisymmetric vibrations, Natural frequencies, Mode shapes, Transverse shear deformation effects, Rotatory inertia effects

Using an improved thick shell theory, the axisymmetric vibrations of barrel-like shells of revolution are analyzed. The equations of vibration are solved exactly by a series solution. Natural frequencies and mode shapes of symmetric shells of revolution with both ends clamped and with both ends simply supported are obtained.

84-2732

Nonlinear Interactions in Resonance Response of Thin Shells

A. Tesar

Inst. of Structures and Architecture, Slovak Academy of Sciences, Bratislava, Czechoslovakia, Computer Struc., 18 (6), pp 1047-1055 (1984) 10 figs, 9 refs

Key Words: Shells, Resonant response, Nonlinear theories

The transfer matrix analysis of nonlinear dynamic response of stiffened thin shells in resonance regions of vibration are presented. Considered is the interaction of geometric and physical nonlinearities. Direct time integration procedures to solve the equations of motion are used. Corresponding incremental transfer matrices are formulated in an updated Lagrangian reference mesh.

84-2733

Thin Shell Theories and Acoustic Wave Scattering by Infinitely Long Cylindrical Shells of Arbitrary Cross Section

S. Baskar, V.V. Varadan, and V.K. Varadan
Ohio State Univ., Columbus, OH 43210, J. Acoust., Soc. Amer., 75 (6), pp 1673-1679 (June 1984) 8 figs, 1 table, 12 refs

Key Words: Shells, Sound waves, Wave scattering

The scattering of acoustic waves by an infinitely long cylindrical shell immersed in a fluid is analyzed. A new approach has been proposed using thin shell theory incorporating the impedance of the shell in the T-matrix formulation. Numerical results are presented for the farfield backscattering amplitude as a function of frequency. Calculations were made for infinitely long circular and elliptic cylindrical shells immersed in water for various shell thicknesses for waves incident at an arbitrary angle in the plane normal to the axis of the cylinder. The impedance resulting from the use of various shell theory approximations for circular cylindrical shells is presented.

84-2734

Some Problems of Stability of Propagation of Non-Linear Waves in Shells and Plates

A.G. Bagdoyev and L.A. Movsisian

Inst. of Mechanics of the Academy of Sciences of Armenian S.S.R., Yerevan, U.S.S.R., Intl. J. Nonlin. Mech., 19 (3), pp 245-253 (1984) 1 fig, 12 refs

Key Words: Shells, Plates, Fluid-induced excitation, Stability

Equations of modulations, taking into account the second order derivatives of amplitude and stability conditions, are obtained. The general results are applied to the stability problems of propagation of quasimonochromatic waves in plates, shells, plates in contact with fluid, shells containing fluid, plate in magnetic field, tree-layered plate and visco-elastic plate.

84-2735

Exact Solutions of Moderately Thick Laminated Shells

J.N. Reddy

Virginia Polytechnic Inst. and State Univ., Blacksburg, VA 24061, ASCE J. Engrg. Mech., 110 (5), pp 794-809 (May 1984) 2 figs, 7 tables, 28 refs

Key Words: Shells, Layered materials, Fundamental frequency

An extension of the Sanders shell theory for doubly curved shells to a shear deformation theory of laminated shells is presented. The theory accounts for transverse shear strains and rotation about the normal to the shell midsurface. Exact solutions of the equations are presented for simply supported, doubly curved, cross-ply laminated shells under sinusoidal, uniformly distributed, and concentrated point load at the center. Fundamental frequencies of cross-ply laminated shells are also presented.

84-2736

Complex Response Analysis of Shells of Revolution Including Uniform Base Translation and Rocking

Bor-Jen Lee and P.L. Gould

Washington Univ., St. Louis, MO, Earthquake Engrg. Struc. Dynam., 12 (4), pp 507-519 (July/Aug 1984) 16 figs, 1 table, 8 refs

Key Words: Shells, Interaction: soil-structure, Substructuring methods

A complex response algorithm for the dynamic analysis of axisymmetric thin shells supported on an interactive foundation is developed. The substructure deletion method is employed through the utilization of a dynamic boundary system at the contact area between the superstructure and the substructure. A new mathematical formulation in conjunction with the shell behavior is developed to deal with rigid body motions due to the negation of the fixed base assumption. Four foundation conditions are considered to examine the effect of base flexibility on the seismic response of cooling towers.

PIPES AND TUBES

84-2737

Acoustic Spectrogram and Complex-Frequency Poles of a Resonantly Excited Elastic Tube

G.C. Gaunaurd and D. Brill

Naval Surface Weapons Ctr., R-43, White Oak, Silver Spring, MD 20910, J. Acoust. Soc. Amer., 75 (6), pp 1680-1693 (June 1984) 19 figs, 30 refs

Key Words: Tubes, Cylindrical shells, Shells, Sound waves, Wave scattering

A study of the resonance scattering undergone by an air-filled hollow elastic cylinder excited by an incident plane acoustic wave is presented. The boundary value problem is constructed, its classical solution, based on the resonance scattering theory is obtained, and a variety of useful computed results are generated.

84-2738

Interactions Between Self and Parametrically Excited Motions in Articulated Tubes

A.K. Bajaj

Purdue Univ., West Lafayette, IN 47907, J. Appl. Mech., Trans. ASME, 51 (2), pp 423-429 (June 1984) 4 figs, 22 refs

Key Words: Tubes, Fluid-filled containers, Self-excited vibrations, Parametric vibration

The nonlinear dynamics of a two-segment articulated tubes system conveying a fluid is studied when the flow is harmonically perturbed. The mean value of the flow rate is near its critical value when the downward vertical position gets unstable and undergoes Hopf bifurcation into periodic solutions. The harmonic perturbations are assumed to be in parametric resonance with the linearized system. The method of Alternate Problems is used to obtain the small nonlinearized subharmonic solutions of the system.

84-2739

Guidelines for the Instability Flow Velocity of Tube Arrays in Crossflow

S.S. Chen

Components Tech. Div., Argonne National Lab., Argonne, IL 60439, J. Sound Vib., 93 (3), pp 439-455 (Apr 8, 1984) 6 figs, 6 tables, 36 refs

Key Words: Tube arrays, Fluid-induced excitation

Fluid flowing across a tube array can cause dynamic instability. Once large-amplitude oscillations occur, severe damage may result in a short time. Such instability must be avoided in design. This paper presents a brief review of different instability models and stability maps developed based on a semi-analytical model and published experimental data.

84-2740

The Effect of Tube Mass on the Flow Induced Response of Various Tube Arrays in Water

D.S. Weaver and H.C. Yeung

McMaster Univ., Hamilton, Ontario, Canada, J. Sound Vib., 93 (3), pp 409-425 (Apr 8, 1984) 12 figs, 3 tables, 17 refs

Key Words: Tubes, Heat exchangers, Fluid-induced excitation, Geometric effects

Experiments were run in a water tunnel to study the effect of mass ratio on the cross-flow induced response of heat exchanger tube arrays with a pitch ratio of 1.5. All four standard tube array geometries were examined and three different tube masses were used for each geometry. Response curves and frequency data are presented including Strouhal numbers, vorticity resonance amplitudes and fluidelastic stability thresholds.

84-2741

Seismic Performance Evaluation of Lifelines

L.R.L. Wang and Y.H. Yeh

Univ. of Oklahoma, Norman, OK, Rept. No. LEE-005, NSF/CEE-82112, 122 pp (Nov 1982) PB84-184175

Key Words: Lifeline systems, Seismic response

Experimental methods suitable for either overall or parametric seismic performance evaluation of lifeline systems are summarized. Ground motion characteristics, called the most influential parameter of all lifeline systems, are examined. Active field testing methods, passive field testing methods, and laboratory testing methods of below-ground systems are described. Parameters of importance to buried lifeline systems, such as lateral and longitudinal soil resistance characteristics and joint resistant behavior, are discussed. For above-ground lifeline systems, seismic observations, field testings, and model testing of bridges, above-ground pipelines, and communication lifelines are presented.

DUCTS

84-2742

Experiments on Sound Radiation from a Duct with a Circumferentially Varying Liner

C.R. Fuller and R.J. Silcox

NASA Langley Res. Ctr., Hampton, VA, AIAA J., 22 (6), pp 781-785 (June 1984) 11 figs, 1 table, 9 refs

Key Words: Ducts, Acoustic linings, Sound waves, Wave radiation

The radiation of sound from an asymmetrically lined duct is experimentally studied for various hard-walled standing mode sources. Measurements were made of the directivity of the radiated field and amplitude reflection coefficients in the hard-walled source section. These measurements are compared with baseline hard-wall and uniformly lined duct data. The dependence of these characteristics on mode number and angular location of the source is investigated. A comparison between previous theoretical calculations and the experimentally measured results is made.

84-2743

Design and Flight Test of a Kevlar Acoustic Liner

H.C. Lester, J.S. Preisser, and T.L. Parrott

NASA Langley Res. Ctr., Hampton, VA, J. Aircraft, 21 (7), pp 491-497 (July 1984) 9 figs, 5 tables, 14 refs

Key Words: Ducts, Acoustic linings, Noise reduction, Turbofan engines, Turbopans

The design, fabrication, and flight evaluation of a Kevlar acoustic liner for a JT15D turbofan engine are summarized. The liner was designed to suppress by a measurable amount a dominant BPF tone. This tone or spinning mode was produced for research purposes by installing 41 circumferentially-distributed small-diameter rods upstream of the 28 fan blades. Duct liner attenuations calculated by a finite-element procedure are compared to far-field power (insertion) losses deduced from flight data. The finite-element program modeled the variable geometry of the JT15D inlet and used a uniform flow with a boundary layer roll-off to model the inlet flowfield.

84-2744

Geometry and Static Flow Effects on Acoustic Radiation from Ducts

R.J. Silcox

NASA Langley Res. Ctr., Hampton, VA, AIAA J.,

22 (8), pp 1087-1093 (Aug 1984) 11 figs, 3 tables, 10 refs

Key Words: Ducts, Sound waves, Wave propagation

An experimental study of the effects of geometry, flow, frequency, and source structure on the radiation and reflection of sound from duct inlets has been conducted. This work extends a previous study by comparing two inlet shapes typical of static and flight testing and by considering higher-order radial modes. Measurements of the internal and radiated acoustic fields are presented in terms of modal reflection coefficients and absolute radiated pressure directivity.

84-2745

A Study of Active Control of Noise in Ducts

J. Tichy, G.E. Warnaka, and L.A. Poole
Pennsylvania State Univ., State College, PA 16801,
J. Vib., Acoust., Stress, Rel. Des., Trans. ASME,
106 (3), pp 399-404 (July 1984) 4 figs, 2 tables,
9 refs

Key Words: Noise reduction, Ducts, Active control

Some new theoretical results on the development of a one-dimensional noise cancellation system in a duct are presented. There are several parts of the actual system design: the generation of the cancelling sound field and the placement of the feedback microphone, the design of the adaptive filter and the considerations including the system stability. This paper concentrates on the analysis of the sound field in a direct relationship with the feedback microphone position.

BUILDING COMPONENTS

84-2746

An Experimental/Analytical Study of the Dynamic Response of Staggered Structural Wall Systems

M.E. Kreger
Ph.D. Thesis, Univ. of Illinois at Urbana-Champaign,
339 pp (1983)
DA8409974

Key Words: Walls, Earthquake response, Experimental data

The Imperial County Services Building of El Centro, California sustained severe damage during the 15 October 1979

Imperial Valley earthquake. Response of the structure during the earthquake was recorded by 13 strong-motion accelerographs. Vertical-load-carrying and lateral-force-resisting systems are described, and corrected acceleration records, calculated base shear and moment waveforms, response spectra, and Fourier amplitude spectra are presented.

DYNAMIC ENVIRONMENT

ACOUSTIC EXCITATION

(Also see Nos. 2664, 2665, 2737, 2764)

84-2747

Noise Reduction in Sheet Metal Manufacture (Lärm-minderung bei der Blechverarbeitung)

P. Grund
VDI-Z., 126 (10), pp 337-344 (May 1984) 12 figs,
9 refs
(In German)

Key Words: Noise reduction, Industrial facilities

A systematic procedure for the reduction of noise in the sheet metal industry is described. Means for the determination of main noise sources are listed and the prevailing ones in sheet metal industry are discussed. In addition, silent production means such as silent hammers and grinding wheels, and alternative production methods to replace noisy manufacturing procedures are presented.

84-2748

A Numerical Method for Ocean-Acoustic Normal Modes

M. Porter and E.L. Reiss
Northwestern Univ., Evanston, IL 60201, J. Acoust. Soc. Amer., 76 (1), pp 244-252 (July 1984) 3 figs,
11 tables, 13 refs

Key Words: Sound waves, Wave propagation, Oceans, Normal modes, Finite difference technique

The method of normal modes is frequently used to solve acoustic propagation problems in stratified oceans. The propagation numbers for the modes are the eigenvalues of the

boundary value problem to determine the depth dependent normal modes. Errors in the numerical determination of these eigenvalues appear as phase shifts in the range dependence of the acoustic field. Such errors can severely degrade the accuracy of the normal mode representation, particularly at long ranges. A fast finite difference method to accurately determine these propagation numbers and the corresponding normal modes is presented.

84-2749

The First Order Non-Linear Sound Field of a Two-Frequency Spherical Source

S.M. Baxter

Inst. of Sound and Vib. Res., Univ. of Southampton, Southampton SO9 5NH, UK, J. Sound Vib., 94 (3), pp 337-349 (June 8, 1984) 31 refs

Key Words: Sound waves, Wave propagation

Nonlinear effects in the sound field of a two-frequency omnidirectional spherical source are discussed. The source is imbedded in an infinite uniform medium. Absorption and dispersion in the medium have an arbitrary dependence on frequency. The first order nonlinear correction to the pressure field is computed by using Westervelt's virtual sources approach. Advantages of the present solution are its simplicity of form, its applicability to broad parameter ranges, and the ease with which its qualitative behavior at large distances from the source can be studied.

84-2750

Acoustic Diffraction Analysis by the Impulse Response Method: A Line Impulse Response Approach

H. Lasota, R. Salamon, and B. Delannoy

Institut Industriel du Nord, C.N.R.S.E.R.A. 593, Valenciennes, B.P. 48, 59650 Villeneuve d'Ascq, France, J. Acoust. Soc. Amer., 76 (1), pp 280-290 (July 1984) 9 figs, 1 table, 33 refs

Key Words: Sound waves, Wave diffraction, Impulse response

Acoustic diffraction of plane impulsive waves is considered for free-field, baffled, and pressure release boundary conditions, in the case of an arbitrary spatial distribution of combined, amplitude-time delay modulation in an aperture. The method is based on the impulse response analysis of parallel aperture lines, the line impulse responses being then integrated to give an aperture impulse response. A closed-form, analytical expression is derived for lines having an arbitrary amplitude modulation. In the case of nonmodulated aper-

tures of an arbitrary shape, the aperture impulse response is also of an analytical form, directly involving the aperture contour line.

84-2751

Non-Linear Self-Excited Acoustic Oscillations in Cavities

J.J. Keller

Brown Boveri Res. Centre, CH-5405, Baden, Switzerland, J. Sound Vib., 94 (3), pp 397-409 (June 8, 1984) 7 figs, 8 refs

Key Words: Sound waves, Acoustic excitation, Self-excited vibrations, Cavities

Nonlinear acoustic oscillations in covered cavities, excited by a jet which is wall-bounded on one side, are discussed on the basis of a second-order theory. With the shear layer at the free edge of the jet considered as a simple (stable) vortex sheet the matching conditions between the acoustic wave fields in the jet and the cavity are introduced in a general second-order equation for wave fields in rectangular resonators. This procedure leads to a second-order wave equation containing a time lag. Solutions are computed with the help of an evolution scheme and compared with experiments.

84-2752

Wave Models of Turbulent Flow over Compliant Surfaces

J.E. Ffowcs-Williams

Cambridge Univ., Cambridge, UK, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 364-368 (July 1984) 3 figs, 4 refs

Key Words: Sound generation, Fluid-induced excitation, Turbulence

The mechanics by which sound evolves from unsteady boundaries and flow can be represented in acoustic analogies which provide a formal structure for analyzing the process of sound creation. The acoustic analogy of Lighthill has been the firmest foundation for modeling the jet noise problem. Studies of that problem have gradually increased in sophistication and scope to a point where the analogy itself has been developed to display characteristics that are novel and a little startling. This paper will describe some of the developments leading to notions that turbulence can be influenced by well-chosen external stimuli and speculate a little on areas where these effects might have significant practical applications.

84-2753

Long-Range Acoustic Scattering by Surface Inhomogeneities Beneath a Turbulent Boundary Layer

D.G. Crighton

Univ. of Leeds, Leeds, UK, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 376-382 (July 1984) 16 refs

Key Words: Sound waves, Wave scattering, Turbulence, Fluid-induced excitation

The interaction of low frequency turbulent boundary layer eddies and acoustic power and the acoustic fields produced by it, are examined in detail in this paper for the inhomogeneities represented by a simple line support rib, a simple point support rib, and an edge to a plane elastic plate, either with or without an adjacent rigid baffle, and with a range of edge conditions.

84-2754

Reverberation Times of Closed Sound Paths with Low Damping (Nachhallzeiten schwach gedämpfter geschlossener Wellenzüge)

W. Kuhl

Am Reisenbrook 7a, D-2000, Hamburg, 67, Germany, Acustica, 55 (3), pp 187-192 (June 1984) 10 figs, 10 refs
(In German)

Key Words: Sound waves, Reverberation, Damping

The reverberation time of the sound path perpendicular to two parallel plates can be calculated by adding three damping components. It is shown by two examples, how the reverberation time in rooms with low diffusivity can differ in one direction or in a part of the room from that in the diffuse sound field.

84-2755

Application of the BIE Method to Sound Radiation Problems Using an Isoparametric Element

A.F. Seybert, B. Soenarko, F.J. Rizzo, and D.J. Shippy

College of Engrg., Univ. of Kentucky, Lexington, KY 40506, J. Vib., Acoust., Stress, Rel. Des., Trans.

ASME, 106 (3), pp 414-420 (July 1984) 6 figs, 29 refs

Key Words: Sound waves, Wave radiation

The application of the Boundary Integral Equation (BIE) method for the numerical solution of radiation problems governed by Helmholtz's equation is discussed. An isoparametric element formulation is introduced in which both the surface geometry and the acoustic variables on the surface of the radiating body are represented by quadratic shape functions within the local coordinate system. A general result for the surface velocity potential is derived. This result includes the case where the surface may have a nonunique normal (e.g., at the edge of a body). The BIE method is used to obtain numerical solutions for three radiation problems involving spherical and cubical geometry.

84-2756

Recent Modeling of Turbulent Wall Pressure and Fluid Interaction with a Compliant Boundary

D.M. Chase

Chase, Inc., Cambridge, MA 02142, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 328-333 (July 1984) 15 refs

Key Words: Underwater sound, Boundary value problems

The relation of wall-pressure amplitude to fluctuating Reynolds-stress source amplitudes in the boundary layer is reviewed for inviscid, slightly compressible flow along a rigid planar boundary. An orthotropic wall-similarity model for source spectra is constructed and applied in this framework to derive a rough model for the wavevector-frequency spectrum of turbulent wall pressure, including radiative wavenumbers. By extension to a compliant boundary, with nonlinear, fluctuating Reynolds stress omitted, an expression is given for fluid-loading impedance and energy exchange in the presence of flow with arbitrary mean velocity profile, in terms of a solution to the homogeneous equation for pressure on a rigid wall.

SHOCK EXCITATION

(Also see Nos. 2729, 2741)

84-2757

Pseudospectral Solutions of One- and Two-Dimensional Inviscid Flows with Shock Waves

L. Sakell

Naval Res. Lab., Washington, DC, AIAA J., 22 (7), pp 929-934 (July 1984) 22 figs, 5 refs

Key Words: Shock waves, Wave propagation

A new approach is presented for the utilization of pseudo-spectral techniques for the solution of inviscid flows with shock waves using the full Euler equations of motion. Artificial viscosity is applied together with low pass spectral filtering to damp out numerical oscillations that arise ahead of and behind the shock waves. Both second- and fourth-order artificial viscosity schemes are utilized. Solutions are presented for the one-dimensional propagating shock wave problem and for two-dimensional supersonic wedge flow.

84-2758

The Collapse of a Gas Bubble Near a Solid Wall by a Shock Wave and the Induced Impulsive Pressure

A. Shima, Y. Tomita, and K. Takahashi
Inst. of High Speed Mechanics, Tohoku Univ., Sendai, Japan, IMechE Proc., 198 (8), pp 81-86 (1984) 6 figs, 16 refs

Key Words: Bubble dynamics, Shock waves, Wave propagation

An experimental study concerning shock wave-bubble interaction was conducted in order to obtain a unified consideration of the mechanism of the impulsive pressure generation induced by the cavitation bubble collapse. It was found that the relation between the maximum impulsive pressure and the relative distance is closely similar to the known result obtained from a single spark-generated bubble.

84-2759

A Comparison of Approximate Techniques for Non-Linear Seismic Soil Response

A. Corsanego, G. Solari, and D. Stura
Istituto di Scienza delle Costruzioni, Univ. of Genova, Genova, Italy, Earthquake Engrg. Struc. Dynam., 12 (4), pp 451-466 (July/Aug 1984) 10 figs, 11 refs

Key Words: Soils, Seismic response, Equivalent linearization method

Some equivalent linearization techniques, applicable to problems dealing with nonlinear seismic amplification of layered soils, are systematically treated and critically compared. The discussion concerns theoretical consistency, operative modalities,

computational complexity and numerical reliability of these methods.

84-2760

Low-Frequency Transfer of Seismic Energy by Superficial Soil Deposits and Soft Rocks

B. Mohammadioun and A. Pecker
Commissariat a l'Energie Atomique, Institut de Protection et de Sûreté Nucleaire, Département d'Analyse de Sûreté, CEN Fontenay-aux-Roses, B.P. No. 6, 92260 Fontenay-aux-Roses, France, Earthquake Engrg. Struc. Dynam., 12 (4), pp 537-564 (July/Aug 1984) 26 figs, 1 table, 26 refs

Key Words: Ground motion, Seismic design, Earthquake resistant structures

Recordings of recent strong earthquakes obtained on alluvial sites show that the maximum horizontal accelerations tend towards a limit of about 0.45 to 0.50g, associated with large displacements. By contrast, vertical accelerations do not appear to be subject to such a limit. Theoretical linear elasticity models, when applied to superficial layers of low strength, seem to be inadequate for the prediction of near-field ground motions in alluvial deposits.

VIBRATION EXCITATION

(Also see Nos. 2730, 2831)

84-2761

Javelin Dynamics with Measured Lift, Drag, and Pitching Moment

M. Hubbard and H.J. Rust
Univ. of California, Davis, CA 95616, J. Appl. Mech., Trans. ASME, 51 (2), pp 406-408 (June 1984) 3 figs, 8 refs

Key Words: Aerodynamic characteristics, Computerized simulation

Optimal release conditions for the javelin are studied using computer simulation. Included are two important and realistic assumptions: initial velocity attainable by the thrower is dependent on the throwing angle, and the aerodynamic center of pressure moves as a function of angle of attack. Aerodynamic forces and moments, previously measured in wind tunnel tests, are incorporated in the simulation. Range contours are presented in the two-space of initial angle of attack -- initial flight path angle, assuming zero initial angular velocity.

84-2762

Dynamic Analysis of Plane Mechanisms with Multi Degrees of Freedom by Taking the Frame Vibration into Consideration (Zur Dynamischen Analyse Ebener Mechanismen Mit Mehreren Freiheitsgraden Unter Berücksichtigung der Gestellschwingungen)

Nguyen Van Khang

Polytechnische Hochschule Hanoi, Hanoi, Vietnam, Rev. Roumaine Sci. Tech., Mecanique Appl., 29 (1), pp 65-79 (Jan/Feb 1984) 3 figs, 6 refs
(In German)

Key Words: Vibration excitation, Frames, Mechanisms, Perturbation theory

The differential equation for the determination of the effect of small vibrations of a frame on the elastic members of a plane mechanism is presented. The conditions for dynamic stability and for periodic vibration of the mechanism are obtained by means of perturbation method.

84-2763

Excitation of Plates and Hydrofoils by Trailing Edge Flows

W.K. Blake

David W. Taylor Naval Ship R&D Ctr., Bethesda, MD, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 351-363 (July 1984) 20 figs, 2 tables, 28 refs

Key Words: Plates, Fluid-induced excitation

The flow-induced vibration of lifting surfaces is discussed from the perspective of the properties of the various flow regimes that exist on the surfaces. Depending on the Reynolds number and the geometry of the foil, the flow excitation may be tonal (generated by periodic vortex shedding) or random (generated by turbulent flow on the surface). Conditions are cited for the existence of vortex shedding excitation, and relationships are given for estimating the levels of flow-induced vibration to be expected from each flow source.

84-2764

The Influence of Surface Compliance on the Production of Sound by a Turbulent Boundary Layer

M.S. Howe

Univ. of Southampton, Southampton, UK, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 383-388 (July 1984) 1 fig, 20 refs

Key Words: Sound generation, Plates, Fluid-induced excitation, Underwater sound

The theory of aerodynamic sound in the form developed by Ffowcs-Williams and Hawkings is applied to investigate the production of sound by turbulent boundary layer flow over a thin, flexible plate. Conventional theories of boundary layer noise attribute the radiation to the boundary layer quadrupoles and their (passive) images in the plate, and neglect the interaction of turbulence with the finite amplitude motion of the plate caused by the wall pressure fluctuations. This interaction generates sound whose intensity is characteristic of aerodynamic sources of dipole type.

84-2765

Effects of Surface Irregularity on Turbulent Boundary Layer Wall Pressure Fluctuations

T.M. Farabee and M.J. Casarella

David W. Taylor Naval Ship Res. and Dev. Ctr., Ship Acoustics Dept., Bethesda, MD, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 343-350 (July 1984) 14 figs, 11 refs

Key Words: Turbulence, Boundary value problems, Fluid-induced excitation

Measurements were made of the mean velocity profiles and wall pressure field upstream and downstream of the flow over both a backward-facing and forward-facing step. For each configuration the velocity profiles show that the effects of the separation-reattachment process persist more than 24 step heights downstream of the step. Extremely high values of the RMS wall pressure are measured near reattachment. These values are 5 and 10 times larger than on a smooth flat plate for the backward-facing step and the forward-facing step, respectively.

84-2766

Estimation of the Wavevector-Frequency Spectrum of Turbulent Boundary Layer Wall Pressure by Multiple Linear Regression

Y.F. Hwang and F.E. Geib

David W. Taylor Naval Ship R&D Ctr., Bethesda, MD, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 334-342 (July 1984) 4 tables, 14 refs

Key Words: Turbulence, Boundary value problems, Fluid-induced excitation

The wavevector-frequency spectrum of the turbulent boundary layer wall pressure in the incompressible, inviscid domain in the intermediate and high frequencies range is examined. The rationale of using a linear regression model for estimating the normalized wavevector-frequency spectrum with a set of measured response data from a wavevector filter is presented.

84-2767

Unsteady Flow Concepts for Dynamic Stall Analysis

L.E. Ericsson and J.P. Reding
Lockheed Missiles & Space Co., Sunnyvale, CA, J. Aircraft, 21 (8), pp 601-606 (Aug 1984) 12 figs, 28 refs

Key Words: Airfoils, Stalling, Aerodynamic loads

It is well established that there is a strong coupling between airfoil motion and boundary-layer separation with attendant vortex shedding. Until now sufficient information has not been available to determine the relative importance of various unsteady flow effects, such as the time-varying inviscid pressure gradient and the unsteady viscous boundary condition at the wall, the moving wall effect. Recent experimental results provide the needed information, revealing how the mode of oscillation for the airfoil determines which unsteady flow effect will dominate.

84-2768

Application of Transonic Codes to Aeroelastic Modeling of Airfoils Including Active Controls

J.T. Batina and T.Y. Yang
Purdue Univ., West Lafayette, IN, J. Aircraft, 21 (8), pp 623-630 (Aug 1984) 12 figs, 3 tables, 25 refs

Key Words: Airfoils, Stability, Active control

A study is performed using aeroelastic modeling to investigate the stability behavior of airfoils in small-disturbance transonic flow. Two conventional airfoils and a supercritical airfoil are considered. Three sets of unsteady aerodynamic data are computed using three different transonic codes for comparison purposes. Stability results obtained using a constant matrix, state-space, aeroelastic model are presented in a root-locus format.

84-2769

Vibrations and Stability of Mechanical Systems: III

K. Huseyin
Univ. of Waterloo, Ontario, Canada N2L 3G1, Shock Vib. Dig., 16 (7), pp 15-22 (July 1984) 92 refs

Key Words: Vibration analysis, Stability, Reviews

This is the third review article concerning general developments in the area of vibrations and stability of mechanical systems. Advances that have been made since 1980 are described. The review covers both linear and nonlinear theories as well as basic methodology developed for holonomic autonomous mechanical (discrete) systems.

MECHANICAL PROPERTIES

DAMPING

84-2770

Constrained Layer Damping with Vitreous Enamel

B. Kumar and M.L. Drake
Univ. of Dayton Res. Inst., Dayton, OH 45469, J. Sound Vib., 93 (3), pp 389-395 (Apr 8, 1984) 6 figs, 2 tables, 5 refs

Key Words: Damping, Layered damping

The concept of constrained layer damping with vitreous enamel is experimentally evaluated. The constraining layer markedly broadens the free layer damping peak. The broadening is explained on the basis of two simultaneous energy dissipation mechanisms and is related to the vitreous enamel's loss factor and viscosity.

84-2771

Nonzero Mean Random Vibration of Hysteretic Systems

T.T. Baber
Univ. of Virginia, Charlottesville, VA 22901, ASCE J. Engrg. Mech., 110 (7), pp 1036-1049 (July 1984) 9 figs, 17 refs

Key Words: Hysteretic damping, Random excitation

A differential equation model for hysteretic systems is analyzed under nonzero mean random excitation. Under

certain conditions, a closed form linearization of the equations of motion is possible. Resulting mean and zero time lag covariance responses agree well with Monte Carlo response simulations. Generalization to degrading systems is straightforward. Skewness coefficients computed from simulation results indicate significantly asymmetric response.

84-2772

Modification Caused by Compliant Layers and Blankets in the Pressure Field Induced on a Boundary

G. Maidanik

David W. Taylor Naval Ship R&D Ctr., Bethesda, MD, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 369-375 (July 1984) 10 figs, 6 refs

Key Words: Structural modification techniques, Cladding, Layered damping

A primitive analytical tool to assess the modification in the response caused by introducing various combinations of flexible layers on panels is proposed and developed. The tool is primitive in the sense that quantities which characterize the dynamic system are expressed in terms of lumped parameters. The formalism is expressed in terms of a matrix that relates the response vector to an external drive vector that induces the response. An element of the matrix identifies the surface on which an external test drive is acting and the surface on which the resulting response is assessed. The general formalism is specialized to the case of a panel that is clad with a composite consisting of a compliant layer and a blanket.

84-2773

Efficient Analysis of Dynamic Response of Linear Systems

A.S. Veletsos and C.E. Ventura

Rice Univ., Houston, TX 77251, Earthquake Engrg. Struc. Dynam., 12 (4), pp 521-536 (July/Aug 1984) 4 figs, 2 tables, 8 refs

Key Words: Transient response, Interaction: soil-structure, Damped structures, Viscous damping

After reviewing briefly a recently proposed procedure for evaluating the dynamic transient response of a classically damped linear system from its corresponding steady-state response, a modified procedure is presented which also appears to be highly efficient for non-classically damped systems of the type encountered in studies of soil-structure

interaction. The concepts involved are developed by reference to viscously damped single-degree-of-freedom systems, and numerical solutions are included to illustrate the accuracy and efficiency of the proposed procedure and its superiority over the classical discrete Fourier transform approach.

FATIGUE

84-2774

Calculation of the Plasma Nitrated Structural Component Samples Taking into Consideration the Hardness Curve and Residual Stress (Berechnung der Dauerschwingfestigkeit von plasmanitrierten bauteilähnlichen Proben unter Berücksichtigung des Härte- und Eigenspannungsverlaufs)

K.H. Kloos and E. Velten

Institut f. Werkstoffkunde der Technischen Hochschule Darmstadt, Fed. Rep. Germany, Konstruktion, 36 (5), pp 181-188 (May 1984) 13 figs, 4 tables, 23 refs

(In German)

Key Words: Fatigue life, Internal stress, Hardness effects

Fatigue strength of boundary layer-stiffened structural components is considerably affected by the boundary hardness and residual stress in the near surface area. For the determination of a quantitative effect of these characteristics a procedure for the calculation of fatigue strength of plasma-nitrated structural component samples using numerous experimental data is derived. The calculated results agree well with the test data in spite of the multiplicity of parameters.

84-2775

Study on Crack Growth Behaviors in Impact Fatigue (Part II, Crack Closure Behaviour under Simple Impact Load)

H. Nakayama, Y. Kanayama, M. Shikida, and T. Tanaka

Osaka Industrial Univ., Nakagaito, Daito-city, Osaka, Japan, Bull. JSME, 27 (227), pp 854-861 (May 1984) 13 figs, 1 table, 23 refs

Key Words: Fatigue tests, Impact excitation, Crack propagation

Fatigue crack growth behavior was investigated under a simple impact stress pattern by using center-notched 0.1% C aluminum killed carbon steel plate specimens, and results obtained were discussed in comparison with those obtained under non-impact fatigue.

84-2776

Study on Characteristics of Fatigue Crack Propagation at Near-threshold Range and Its Affecting Factors

Yan Minggao

Acta Aeron. et Astron. Sinica, 4 (2), pp 13-29 (1983)
CSTA No. 629.1-83.18

Key Words: Fatigue life, Crack propagation

A review of the characteristics and mechanisms of fatigue crack propagation (FCP) at near-threshold range in various metals and alloys is presented. Experimental results from a series of microfractographic analyses of specimens and structures indicated that a type of crystallographic fracture occurs predominantly at near-threshold range. A correlation of the orientation of facets for different metals and alloys with lattice structures, SFS and modes of slip are described. The relation between the fatigue limits of plain- and notched-specimens and fatigue thresholds together with the mechanism of FCP behavior in short cracks is evaluated.

84-2777

Modeling Cyclic Deformation and Fatigue Behavior of Cast Iron under Uniaxial Loading

S.D. Downing

Ph.D. Thesis, Univ. of Illinois at Urbana-Champaign,
117 pp (1983)
DA8409911

Key Words: Fatigue life, Metals, Cyclic loading

A model for estimating cyclic deformation behavior of cast iron under uniaxial loading is described. The model separates total response into components due to symmetrical elastic/plastic response in the matrix/graphite composite and to the nonlinear elastic response of the free graphite phase. Predictions are compared to experimental data for gray cast iron, compacted graphite cast iron and nodular iron. A continuum damage model for fatigue analysis of cast iron is also discussed. The model considers damage to be a global measure of surface crack growth.

ELASTICITY AND PLASTICITY

84-2778

Mode Conversion and Resonance Scattering of Elastic Waves from a Cylindrical Fluid-Filled Cavity

S.G. Solomon, H. Uberall, and K.B. Yoo

ORI, Inc., 1400 Spring St., Silver Spring, MD 20910,
Acustica, 55 (3), pp 147-159 (June 1984) 16 figs,
1 table, 18 refs

Key Words: Elastic waves, Cavities, Wave scattering

Mode conversion and scattering of compressional and shear waves from cylindrical cavities are studied by performing partial wave expansions of the incident and scattered fields. Analysis, supported by extensive numerical calculations, shows that each partial wave spectrum consists of a smooth background identical to that of an empty cavity and a series of resonance terms associated with the eigenvibrations of the cavity's fluid interior. The scattering matrix for the cavity is defined and its unitary and symmetry properties are discussed. Argand diagrams of the trajectories of the S-matrix elements in the complex plane are shown to have certain easily recognized features which are associated with the cavity resonances.

84-2779

Some Thoughts on the Subject of Dynamic Elastic-Plastic Analyses of Rapid Crack Propagation and Crack Arrest

M.F. Kanninen

Battelle Columbus Labs., OH, 6 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 226-233
AD-P003 116

Key Words: Crack propagation

Despite the fact that the basic assumption of linear elastic fracture mechanics (LEFM) -- contained-yielding -- is violated for a crack that grows, most attempts to characterize rapid crack propagation and arrest are nevertheless rooted in LEFM. Starting from LEFM-based analysis procedures that form the current state-of-the-art, this paper attempts to provide some perspective for this evolutionary trend in dynamic fracture mechanics. Emphasized are some of the potential dilemmas that face the researchers pursuing this subject.

84-2780

Viscoelastic Effect on Dynamic Crack Propagation in Homalite 100

K.S. Kim, K.L. Dickerson, and W.G. Knauss
Illinois Univ. at Urbana-Champaign, IL, 21 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 205-225
AD-P003 115

Key Words: Crack propagation, Viscoelastic media

The optical method of caustics is used to determine the stress intensity factor for a running crack in a viscoelastic material. A formulation of the quasi-static deformation of materials with rheologically simple shadow-optic creep functions is derived for the caustics, solved numerically and applied to the fracture testing of Homalite-100 at various temperatures (40 deg C - 100 deg C). Theoretical and experimental caustics show good agreement in shape even for moderately high crack speeds (150 - 300 m/sec). Results also show that the relation between the stress intensity factor and the crack speed for Homalite 100 is highly sensitive to temperature variations.

84-2781

Dynamic, Steady-State Crack Propagation in Linear Isotropic Viscoelastic Material

J.R. Walton
Texas A&M Univ., College Station, TX, 8 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 197-204
AD-P003 114

Key Words: Crack propagation, Viscoelastic media

This paper is a summary of results of some recent analytical studies of dynamic, steady-state crack propagation in linear viscoelastic material. Closed form solutions are presented for the problems of a semi-infinite, anti-plane shear crack propagating with constant speed in an infinite general linear viscoelastic body and in a layer of finite thickness. For both boundary value problems, and for a general class of shear modulus, the solutions obtained exhibit a universal structure that depends in a simple way upon the time dependent shear modulus and crack speed. The forms for the solutions are convenient for the extraction of qualitative and quantitative information about the dependence of the stress field in the body upon the loading, the crack speed and the shear modulus.

84-2782

Path-Independent Integrals in Dynamic Fracture Mechanics

S.N. Atluri and T. Nishioka
Ctr. for the Advancement of Computational Mechanics, Georgia Inst. of Tech., Atlanta, GA, 13 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 156-168
AD-P003 111

Key Words: Crack propagation

Linear elastodynamic crack propagation under mixed mode non-steady conditions with an arbitrary velocity are considered.

84-2783

Some Theoretical Results on the Dependence of Dynamic Stress Intensity Factor on Crack Tip Speed

L.B. Freund
Brown Univ., Providence, RI, 8 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 129-136
AD-P003 109

Key Words: Crack propagation, Metals, Steel

Two specific topics are discussed under this common heading. The first is concerned with elastic-plastic crack growth and, in particular, with developing theoretical models to explain the dependence of dynamic fracture toughness on crack tip speed observed for 4340 steel and other high strength, low ductility materials which fail in a locally ductile manner. The second topic is concerned with limitations on the use of crack tip singular fields to describe actual stresses in elastic brittle materials during dynamic fracture. The problem discussed is the steady-state growth of a crack in the antiplane shear mode under small scale yielding conditions. Inertial resistance of the material is taken into account explicitly but, for steady state growth, the deformation is time independent as viewed by an observer fixed at the moving crack tip. Results are considered for two material models, elastic-ideally plastic and elastic-viscoplastic. According to the small scale yielding hypothesis, the (possibly non-linear) crack tip stress and deformation fields are controlled by the surrounding elastic field.

84-2784

Dynamic Crack Growth Criteria in Structural Metals

A.J. Rosakis, J. Duffy, and L.B. Freund

California Inst. of Tech., Pasadena, CA, 19 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 100-119
AD-P003 107

Key Words: Crack propagation, Steel

Analytical difficulties associated with the dynamic crack propagation problem have limited the available dynamic solutions to idealized situations. The major limitations introduced by these analytical solutions make both numerical methods and direct experimental observations necessary for the complete understanding of the dynamic fracture process. A principal purpose of experimental studies is to observe directly the instantaneous stress intensity factor as a function of crack speed, and to determine whether or not the observed variation constitutes a material characteristic. The present paper provides a description of dynamic crack propagation experiments on double cantilever beam specimens of a high strength steel. Measurements of the crack tip deformation field and of crack speed during propagation have been made using the optical method of caustics in reflection.

84-2785

Short Pulse Fracture Mechanics

D.A. Shockey, J.F. Kalthoff, H. Homma, and D.C. Erlich

SRI International, Menlo Park, CA, 15 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 57-71
AD-P003 105

Key Words: Crack propagation

A research effort was begun eight years ago at SRI International to analyze the response of a crack struck by a short-lived tensile pulse and to modify static fracture mechanics concepts to allow predictions of dynamic crack instability. The results of this work, which have been presented in a series of papers over the past six years, comprise a unified extension of classical fracture mechanics and are summarized here. Considerations of the stress intensity history experienced by a dynamically loaded crack tip are reviewed, and the instability criterion is considered.

84-2786

Some Current Problems in Experimental Fracture Dynamics

J.F. Kalthoff

Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg im Bressau, Fed. Rep. Germany, Inst. fuer Werstoffmechanik, 25 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 11-35
AD-P003 102

Key Words: Crack propagation

The term fracture dynamics includes both crack tip motion effects and dynamic loading of cracks. Several topics are discussed regarding the subjects crack propagation, arrest of fast running cracks, time dependent loading in general, and loading of cracks by sharp stress pulses of short duration. Following the guidelines of the workshop, previous results are briefly summarized to state the current situation, but special consideration is given to still open questions and problems not yet resolved. Most experimental data reported in this paper have been generated by means of the shadow optical method of caustics. The caustics technique is an optical tool for measuring stress intensifications.

84-2787

Plate Impact Experiment for Studying Crack Initiation at Loading Rates $K(1)$ Approximately $10(8)$ MPa m/s

R.J. Clifton and G. Ravichandran

Brown Univ., Providence, RI, 11 pp (Oct 1983) Workshop on Dynamic Fracture held at Pasadena, CA, Feb 17-18, 1983, pp 36-46
AD-P003 103

Key Words: Crack propagation

A symmetric plate impact technique is being developed for establishing the critical conditions for dynamic fracture initiation at extremely high loading rates. The specimen consists of a circular disc with a midplane, prefatigued, edge crack that has propagated halfway across the diameter. A compressive pulse propagates through the specimen, reflects from the rear surface, and subjects the crack plane to a step tensile pulse. The motion of the rear surface of the specimen is monitored with a laser interferometer system in order to determine the loading time required for crack extension to begin. Using this time in the elastodynamics solution of the stress wave diffraction problem, one can obtain the critical value of the stress intensity factor for dynamic fracture initiation.

WAVE PROPAGATION

84-2788

Frequency-Dependent Elastic Properties of Rubber-like Materials with a Random Distribution of Voids

V.K. Varadan, V.V. Varadan, and Y. Ma

Ohio State Univ., Columbus, OH 43210, *J. Acoust. Soc. Amer.*, **76** (1), pp 296-300 (July 1984) 9 figs, 23 refs

Key Words: Elastomers, Discontinuity-containing media, Frequency dependent parameters, Wave scattering

A self-consistent multiple scattering approach with suitable pair-correlation function has been employed to study the frequency-dependent properties of rubber materials containing a random distribution of voids. Numerical results indicate that for a certain range of concentration of voids, the resonance of the voids controls the frequency-dependent effective properties such that the imaginary part of the effective wavenumber becomes greater than the real part. This indicates that the propagating wave will be damped out over a distance smaller than a wavelength. The so-called "superviscous" propagation seems to occur over a bandwidth controlled by the concentration of voids.

84-2789

Experiments on Guided-Waves Propagation in Heterogeneous Media (Expérimentations sur la propagation d'ondes guidées en milieu hétérogène)

M. Touratier

Ecole Nationale Supérieure d'Arts et Métiers, 151 bd de l'Hôpital, 75640 Paris Cedex 13, *Acustica*, **55** (2), pp 86-100 (May 1984) 15 figs, 14 refs
(In French)

Key Words: Wave propagation, Experimental data

An experimental study has been undertaken on two bi-metallic wave guides of rectangular section: a clad rectangular core and a three-layer. The frequency spectra is presented and the dependence of phase velocity with frequency is determined. For average frequencies, the propagation modes are strongly coupled. The existence of transition velocities and the aspect of distribution of relative acceleration in the final section of guides confirm that the fundamental mode of propagation is guided into a central region (core or central layer) at high frequencies. The comparison between experiments and theory is made on fundamental modes and the higher modes of propagation.

EXPERIMENTATION

MEASUREMENT AND ANALYSIS

84-2790

Finite Element and Experimental Modeling of Three-Dimensional Annular-Like Acoustic Cavities Using the Normal Mode Approach

Chaw-Hua Charles Kung

Ph.D. Thesis, Ohio State Univ., 166 pp (1984)
DA8410394

Key Words: Cavities, Modal analysis, Finite element technique

Since closed form solutions for natural frequencies and modes of cavities are not possible, computational and experimental methods which are the main focuses of this study must be adopted. The scope of the study is limited to a linear system with zero mean flow and negligible temperature gradient; the frequency range of interest is approximately 0 - 2000 Hz for an air medium at room temperature and pressure. Two finite element methods, one using a variational method and the other employing a transient heat conduction analogy, are used for modal analysis of a number of cavities with emphasis on annular-like cavities; example cases studied include an acoustic column, a Helmholtz resonator, an acoustic ring, an acoustic disk, a pure annular cavity, and annular-like cavities. Condensation of the eigenproblems in the solution process is also considered. The results indicate that with carefully chosen meshes, the finite element models predict the first few modes of acoustic cavities accurately with moderate cost.

84-2791

Time-Domain Quasilinear Identification of Nonlinear Dynamic Systems

S.R. Ibrahim

Old Dominion Univ., Norfolk, VA, *AIAA J.*, **22** (6), pp 817-823 (June 1984) 9 figs, 11 tables, 26 refs

Key Words: Modal analysis, System identification, Quasilinearization technique, Time domain method

A time-domain linear modal identification technique is applied to identify some highly nonlinear dynamic systems. The modal concept is used to identify such nonlinear systems

with the understanding that the resulting modes are only a mathematical representation of the series solution of the nonlinear system under consideration. Naturally, these identified modal parameters are not unique for nonlinear systems, since they are functions of the systems' amplitudes and hence referred to as quasilinear. The approach presented in this paper can be useful in predicting signs of nonlinearities when linearity is assumed. It can also be used to analyze and understand the types of nonlinearities in nonlinear systems through successive identifications at different levels of response.

84-2792

Ground Vibration Testing at Boeing

G.D. Carbon

Boeing Commercial Airplane Co., Seattle, WA, S/V, Sound Vib., 18 (6), pp 16-20 (June 1984) 6 figs, 7 refs

Key Words: Modal analysis, Vibration tests, Experimental modal analysis, Random excitation, Aircraft

In the last four years, a number of improvements have been made in the techniques used to perform modal analysis tests on airplanes and other aircraft structures. These improvements are the result of a concentrated effort to reduce test time to a minimum through extensive use of computers and multiplexers in the data gathering and processing operations. The use of multiple shaker random excitation is discussed along with the data processing techniques required for interpreting these data. In addition to data gathering and processing this article discusses techniques used for mounting transducers, and a soft support system designed to separate the flexural modes from the rigid body modes of the airplane.

84-2793

The Modal Equations

A.E. Anuta, Jr.

The Univ. of North Dakota, Grand Forks, ND 58202, Computer Struc., 18 (6), pp 955-962 (1984) 1 fig, 8 refs

Key Words: Modal analysis, Natural frequencies, Mode shapes, Rayleigh method, Iteration

For linear structural dynamics problems, an application of the minimizing properties of calculus to Rayleigh's quotient leads to the model equations of the system. The modal

equations, which are previously undefined in the literature, are a set of simultaneous cubic equations with constant coefficients. They can be solved by means of a converging iteration scheme to obtain all of the mode shapes. Each mode shape can be successively substituted back into Rayleigh's quotient to obtain the corresponding natural frequency. It is therefore possible to determine all of the mode shapes and natural frequencies of a system without developing or solving the characteristic polynomial.

84-2794

Frequency Analysis of Surfaces Machined Using Different Lubricants

L. DeChiffre

AMT, Technical Univ. of Denmark, 2800 Lyngby, Denmark, ASLE, Trans., 27 (3), pp 220-226 (July 1984) 10 figs, 3 tables, 3 refs

Key Words: Frequency analysis, Surface roughness, Lubrication

The paper is concerned with surface roughness analysis as a means of investigating lubricant action in cutting. An experimental setup involving a high-resolution signal analyzer has been used to obtain power spectrum characteristics, as well as conventional surface roughness parameters, of surfaces machined using different work materials and cutting fluids.

84-2795

A Phase Difference Technique for Acoustic Imaging

M. Hayama and K. Toda

The National Defense Academy, Hashirimizu, Yokosuka 239, Japan, J. Acoust. Soc. Amer., 76 (1), pp 184-185 (July 1984) 4 figs, 4 refs

Key Words: Acoustic imaging, Nondestructive tests

A method for obtaining C-scan images is reported by using a Lamb wave device with two arched interdigital transducers, in which the phase difference between an input signal as a reference and a delayed signal reflected at a sample surface or inside a test sample is detected as a function of the position. The transducers are used as a sound beam radiator or a detector at a liquid-solid interface. Acoustic imaging results are satisfactory in measuring the stress fields in ceramic samples.

84-2796

Estimation of Linearized Oil-Film Parameters from the Out-of-Balance Response

M.N. Sahinkaya and C.R. Burrows

Dept. of Dynamics and Control, Univ. of Strathclyde, Glasgow, Scotland, IMechE Proc., 198 (8), pp 131-134 (1984) 1 table, 10 refs

Key Words: Parameter identification technique, Rotors, Synchronous vibration

This paper outlines a simple approach to the identification of linearized oil-film characteristics from the rotor's synchronous response. The method is shown to be effective in filtering signal noise.

84-2797

Laser-Optical Measurement of Surface Distortion with Extreme Dynamic Loads (Laser-optisches Messen von Oberflächenauslenkungen bei extrem-dynamischen Belastungen)

F. Schubert

Laboratorium f. Mess- und Feinwerktechnik an der Hochschule der Bundeswehr Hamburg, Germany, Feinwerktech. u. Messtech., 92 (2), pp 83-84 (1984) 6 figs, 3 refs
(In German)

Key Words: Measurement techniques, Lasers, Optical methods, High frequencies

With extreme dynamic loads, surface movements occur with very small amplitudes and high velocity. The known path measuring methods are not really suited for the determination of such occurrences. The here given diffraction optical measuring procedure operates contact-free, can be easily adjusted and has the necessary resolution. Its critical frequency is only determined by the sensors and the digital storages. The basic usability of the method is proven using an example.

84-2798

Wiegand Effect Position and Velocity Sensors (Wiegand-Sensoren für Weg- und Geschwindigkeitsmessungen)

H.-J. Gevatter and G. Kuers

DODUCO KG Dr. Eugen Dürrwächter, Altgefall 12, D-7530 Pforzheim, Germany, Techn. Messen-TM,

51 (4), pp 123-129 (Apr 1984) 18 figs, 1 table, 3 refs

(In German)

Key Words: Vibration detectors, Measuring instruments, Magnetic fields

Wiegand effect position sensors have inherent insensitiveness against environmental conditions. The sensor device consists of several components optimal matched to the specific case of application. In addition the magnetic field for the Wiegand Effect Sensor can be generated by a permanent magnet or electromagnetically. That allows devices for the measurement of speed, position and angle of rotating and linear movement. The signal transmission is possible without power supply by two-wire circuit, but also wireless or by fiber optic with excellent signal to noise ratio.

84-2799

Incremental Linear Transducer Using Wiegand Sensors (Inkrementaler Lineargeber mit Wiegand-Sensoren)

N. Normann

DODUCO KG Dr. E. Dürrwächter, Bereich Sensoren, Im Altgefall 12, D-7530 Pforzheim, Germany, Techn. Messen-TM, 51 (4), pp 130-132 (Apr 1984) 3 figs, 7 refs
(In German)

Key Words: Transducers, Vibration detectors

Wiegand sensors are suitable for applications under hostile environmental conditions. An incremental linear transducer which uses this sensor type and allows a long system length is described.

84-2800

Strain-Gauge Sensor with Frequency Output (DMS-Sensor mit Frequenzausgang)

B. Heck and D. Meyer-Ebrecht

Philips GmbH, Forschungslaboratorium Hamburg, Vogt-Kolin-Strasse 30, D-2000 Hamburg 54, Fed. Rep. Germany, Techn. Messen-TM, 51 (5), pp 171-175 (May 1984) 7 figs, 4 refs
(In German)

Key Words: Measuring instruments

A novel RC sine-wave oscillator circuit is described which is ideally suited for inexpensive but accurate sensor signal

converters. Its oscillation frequency is controlled by a single attenuator element without effect on the oscillation amplitude. Applications of this oscillator as a converter for strain-gauge sensors have been investigated.

84-2801

Measurement Technology and Signal Processing (Messtechnik und Messsignalverarbeitung)

H.-R. Tränkler

Institut f. Mess- und Regelungstechnik, Hochschule der Bundeswehr München, Werner-Heisenberg-Weg 39, D8014 Neubiberg, Fed. Rep. Germany, Techn. Messen.-TM, 51 (4), p 155 (Apr 1984)
(In German)

Key Words: Measurement techniques, Measuring instruments, Signal processing techniques

The topic of electronic signal processing will be featured in a series of monthly articles to be published over a period of two years. The articles will discuss the important elements of analog and digital measurement technology, its function in measurement systems, and a systematic correction and processing of the data. The series will be roughly subdivided under the following topics: A) An Introduction to Measurement Technology, B) Analog Measurement Techniques, C) Digital Measurement Techniques, D) Measurement Values -- Pick ups, E) Measuring Systems and Digital Data Processing, F) A Supplement to the Measurement Technology.

84-2802

Measurement Technology and Signal Processing. Introduction to Measurement Technology (Messtechnik und Messsignalverarbeitung. Einführung in die Messtechnik)

H.-R. Tränkler

Inst. f. Mess- und Regelungstechnik, Hochschule der Bundeswehr München, Werner-Heisenberg-Weg 39, D8014 Neubiberg, Fed. Rep. Germany, Techn. Messen.-TM, 51 (4), pp 155-158 (Apr 1984) 1 fig
(In German)

Key Words: Measurement techniques, Signal processing techniques

The first article of this series discusses the meaning of measurement and signal processing technology, the field of application and special problems, and the criteria for organizing the subject matter.

84-2803

Measurement Technology and Signal Processing. Analog Measurement Technology and Signal Processing (Messtechnik und Messsignalverarbeitung. Analoge Messtechnik und Messsignalverarbeitung)

H.-R. Tränkler

Inst. f. Mess- und Regelungstechnik, Hochschule der Bundeswehr München, Werner-Heisenberg-Weg 39, D8014 Neubiberg, Fed. Rep. Germany, Techn. Messen.-TM, 51 (5), pp 195-199 (May 1984) 6 figs, 7 refs (continued from April 1984)

(In German)

Key Words: Measuring instruments, Signal processing techniques

The output of analog data by means of a linear moving coil measuring system is discussed in this segment of the series. Because of the importance of analog data presentation and of linear moving coil instruments with external magnets, this type of measuring means is chosen as an example of linearly deforming measuring element. Also, the meaning of analog data is described. The article closes with a discussion of the physical effect, construction and production, the dimensioning of magnetic circuit, and several important static transfer characteristics of the moving coil measuring system.

84-2804

Measurement Technology and Signal Processing. Analog Measurement Technology and Signal Processing (Messtechnik und Messsignalverarbeitung. Analoge Messtechnik und Messsignalverarbeitung)

H.-R. Tränkler

Inst. f. Mess- und Regelungstechnik, Hochschule der Bundeswehr München, Werner-Heisenberg-Weg 39, D8014 Neubiberg, Fed. Rep. Germany, Techn. Messen.-TM, 51 (6), pp 242-246 (June 1984) 7 figs, 2 refs (continued from May 1984)

(In German)

Key Words: Measuring instruments, Signal processing techniques

A number of characteristics are important for the evaluation of a measuring system. They are the static transfer properties (e.g., accuracy), the dynamic transfer properties (e.g., adjustment time), the reliability (e.g., rate of failure), and the cost and maintainability of the instrument. In this section the static transfer characteristics are discussed.

84-2805

**Measurement Technology and Signal Processing.
Analog Measurement Technology and Signal Processing (Messtechnik und Messsignalverarbeitung.
Analoge Messtechnik und Messsignalverarbeitung)**

H.-R. Tränkler

Inst. f. Mess- und Regelungstechnik, Hochschule der Bundeswehr München, Werner-Heisenberg-Weg 39, D8014 Neubiberg, Fed. Rep. Germany, Techn. Messen.-TM, 51 (7/8), pp 285-289 (July-Aug 1984) 5 figs, 8 refs (continued from June 1984) (In German)

Key Words: Measuring instruments, Signal processing techniques

Discrete and continuous data distribution, especially the Gaussian normal distribution, is discussed. The essential characteristics are mean value and standard deviation. The integration of distribution function gives the probability for the occurrence of data within a certain interval. Of particular practical importance is the confidence interval of the mean value in random tests and the graphic evaluation by means of probability system. Examples of application of statistical methods are given, e.g., propagation of random errors.

DYNAMIC TESTS

84-2806

Measuring Methods and Facilities in the Development Sector of Automobile Exhaust Mufflers (Messsystem in der Entwicklung von Automobilschalldämpfern)

P. Zacke

Schlierbacher Str. 62, D-7321 Albershausen, Germany, MTZ Motortech. Z., 45 (6), pp 239-243 (June 1984) 5 figs, 3 refs (In German)

Key Words: Exhaust systems, Mufflers, Test facilities, Measuring instruments, Computer-aided techniques

The rather craftman-like construction of exhaust mufflers as practiced in former times has turned to a sophisticated technology due to the growing environmental consciousness and resulting legal standards, the increased demands for comfort by the drivers and the pressure to save fuel on the one hand and to the immense advances in the engine construction sector and the ever increasing range of models offered by the automobile industry on the other hand. Now as before, one cannot dispense with experiments when developing automobile exhaust mufflers. A vehicle test

stand and a computer-controlled measuring system render possible a quick exhaust gas noise analysis, particularly in the case of non-stationary operating conditions.

SCALING AND MODELING

84-2807

Scaling Methods for Earthquake Response Spectra

J.M. Nau and W.J. Hall

North Carolina State Univ., Raleigh, NC 27650, ASCE J. Struc. Engrg., 110 (7), pp 1533-1548 (July 1984) 6 figs, 4 tables, 25 refs

Key Words: Scaling, Seismic response spectra, Seismic design, Earthquake resistant structures

In current practice, design response spectra are normalized by the three peak ground motions. Alternative scaling factors are evaluated to reduce the dispersion encountered in normalized spectral ordinates. The scaling factors comprise two major groups, one based on ground motion data, and the other on response quantities. Within the group based on ground motion values are the integrals of the squared acceleration, velocity, and displacement, and the associated root-square, mean-square, and root-mean-square motions. Included within the group based on response quantities are the spectrum intensity and the mean Fourier amplitude. The scaling parameters are evaluated statistically using response spectra for elastic, elastoplastic, and bilinear hysteretic systems, computed from a set of twelve representative earthquake recordings. The results show that a three parameter system of spectrum intensities, computed within low, medium, and high frequency regions, may provide a better means of scaling earthquake response spectra. Significant reductions in dispersion may be realized if elastic spectra are normalized by the spectrum intensities rather than the peak ground motions. The spectrum intensities also reduce the scatter for normalized inelastic spectra, for low to moderate displacement ductilities.

DIAGNOSTICS

(Also see No. 2814)

84-2808

The Condition Monitoring of Rolling Element Bearings Using Vibration Analysis

J. Mathew and R.J. Alfredson

J. Mathew and Associates, Endeavor Hills, Victoria,

Australia, J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 106 (3), pp 447-453 (July 1984) 8 figs, 39 refs

Key Words: Diagnostic techniques, Bearings, Rolling contact bearings, Vibration analysis

A brief review on techniques of machine condition monitoring is presented followed by a description and results of a study involving the monitoring of vibration signatures of several rolling element bearings with a view to detect incipient failure. The vibration data were analyzed and several parameters were assessed with regard to their effectiveness in the detection of bearing condition. It was found that all the parameters were of some value depending on the type of bearing failure encountered.

84-2809

Troubleshooting In-Plant Equipment with Testing and Analysis

G.F. Mutch and R. Russell

GE-CAE International, Milford, OH, S/V, Sound Vib., 18 (6), pp 26-30 (June 1984) 18 figs

Key Words: Diagnostic techniques, Coal handling equipment

A general approach to solving noise, vibration or failure problems in installed process machinery is reviewed. The techniques are applied to a coal crusher that generated unacceptable levels of vibration. Analyses of the structure and implementation of recommended modification reduced the machinery vibration to satisfactory levels.

BALANCING

84-2810

Some Problems Connected with Balancing of Grinding Wheels

G. Gawlak

The Technical Univ. of Poznan, The Inst. of Mech. Engrg. Poznan, Poland, J. Engrg. Indus., Trans. ASME, 106 (3), pp 233-236 (Aug 1984) 5 figs, 8 refs

Key Words: Balancing techniques, Grinding machinery

In most publications, the unanimous opinion prevails that an increase of grinding machine vibration as well as deterioration

of workpiece quality are observed when the grinding wheel unbalance is on the increase. However, various data on the qualitative influence of wheel unbalance on the realization of the grinding process occur. In this paper a theoretical explanation of the influence of wheel unbalance on the dynamics of grinding, as well as the course and results of investigations proving theoretical considerations, are described.

MONITORING

84-2811

Acoustic Emission Monitoring of Corrosion Fatigue Crack Growth in Offshore Steel

C. Thaulow and T. Berge

Div. of Materials and Processes, Sintef, 7034 Trondheim-NTH, Norway, NDT Intl., 17 (3), pp 147-153 (June 1984) 12 figs

Key Words: Monitoring techniques, Acoustic emission, Corrosion fatigue, Off-shore structures

A research and development program has been carried out to establish relationships between corrosion fatigue crack growth in offshore steel qualities and acoustic emission. Laboratory experiments on small-scale specimens and wide plates have shown that when a certain combination of crack size and crack surface corrosion deposit thickness has been reached, high acoustic emission event rates, in the range of 10-40 events per fatigue cycle, are recorded. The main activity is recorded on rising load, generated from crack surface activity, e.g., secondary emission.

84-2812

Acoustic Emission Transducers for the Vibration Monitoring of Bearings at Low Speeds

P.D. McFadden and J.D. Smith

Univ. Engrg. Dept., Cambridge, UK, IMechE Proc., 198 (8), pp 127-130 (1984) 4 figs, 3 refs

Key Words: Monitoring techniques, Acoustic emission, Rolling contact bearings, Bearings

The use of acoustic emission transducers for the vibration monitoring of rolling element bearings at low speeds is explored. The frequency response and the base strain and bending sensitivities of the transducers are shown to be important.

84-2813

Experimental Observation of the Dynamic Behavior of Noncontacting Coned-Face Mechanical Seals

I. Etsion and I. Constantinescu

Technion, Haifa, Israel, ASLE, Trans., 27 (3), pp 263-270 (July 1984) 11 figs, 2 tables, 5 refs

Key Words: Monitoring techniques, Seals, Alignment

The dynamic behavior of a coned-face noncontacting seal is experimentally observed by means of three proximity probes monitoring the motion of the flexibly mounted stator. The various tilts of the stator are analyzed and the relative misalignment between stator and rotor is found. The effects of both the rotor runout and the flexible support on the relative misalignment are discussed. The tests demonstrate both stable and transition to unstable modes of seal operation. Reasons for failure and other phenomenon during stable seal operation are explained.

teristics, dynamic stress intensity factors, and Rayleigh wave transmission and reflection coefficients, for a range of geometrical parameters.

84-2815

FEM Subelements Conserve Computer Resources

T. Havas

Lockheed Missiles & Space Co., Palo Alto, CA, Mach. Des., pp 83-86 (July 26, 1984) 5 figs

Key Words: Finite element technique

A technique for defining repeating subassemblies of a structure, storing them off-line on computer disk memory, and reusing it over and over in model building, thus reducing the size of the finite element matrix, is described.

ANALYSIS AND DESIGN

ANALYTICAL METHODS

(Also see No. 2773)

84-2814

Diffraction of Elastic Waves by a Sub-Surface Crack (In-Plane Motion)

J.H.M.T. van der Hijden and F.L. Neerhoff

Dept. of Electrical Engrg., Lab. of Electromagnetic Res., Delft Univ. of Tech., P.O. Box 5031, 2600 GA Delft, The Netherlands, J. Acoust. Soc. Amer., 75 (6), pp 1694-1704 (June 1984) 18 figs, 1 table, 18 refs

Key Words: Cracked media, Wave diffraction, Elastic waves, Diagnostic techniques, Crack detection

A rigorous theory of the diffraction of time-harmonic elastic waves by an arbitrarily oriented, cylindrical, stress-free crack of finite width embedded in a semi-infinite elastic medium is presented. The incident wave is taken to be either a P wave, an SV wave, or a Rayleigh wave. The resulting boundary-value problems for the unknown jump in the particle displacement across the crack are solved by employing the integral-equation method in combination with the Galerkin method. Numerical results are presented in the form of scattering cross sections, normalized power scattering charac-

84-2816

The Loading-Frequency Relation of Linear Conservative Systems via a Direct Energetic (Action) Method

J.G. Papastavridis

Georgia Inst. of Tech., Atlanta, GA 30332, J. Sound Vib., 94 (2), pp 223-233 (May 22, 1984) 16 refs

Key Words: Eigenvalue problems, Linear systems

This paper presents alternative proofs of the well-known strict negative monotonicity and convexity properties of the fundamental frequency-load pair curve of the pure eigenproblem of free vibrations/buckling of linear conservative systems subject to a single loading parameter, by studying the first and second order variations of the system's Hamiltonian action (over the fundamental or highest eigenperiod), as one moves along the fundamental eigenpair curve.

84-2817

Dynamic Analysis of Structures Using Lanczos Coordinates

B. Nour-Omid and R.W. Clough

Center for Pure and Applied Mathematics, Univ. of California, Berkeley, CA 94720, Earthquake Engrg.

Struc. Dynam., 12 (4), pp 565-577 (July/Aug 1984)
4 figs, 1 table, 12 refs

Key Words: Lanczos method

A procedure for deriving the Lanczos vectors is explained and their use in structural dynamics analysis as an alternative to modal co-ordinates is discussed. The vectors are obtained by an inverse iteration procedure in which orthogonality is imposed between the vectors resulting from successive iteration cycles. Using these Lanczos vectors the equations of motion are transformed to tridiagonal form, which provides for a very efficient time-stepping solution. The effectiveness of the method is demonstrated by a numerical example.

84-2818

Dynamic Response Analysis of Linear Structural Systems Subject to Component Changes

A.R. Kukreti and C.C. Feng

Univ. of Oklahoma, Norman, OK 73069, Computer Struc., 18 (6), pp 963-976 (1984) 9 figs, 1 table, 21 refs

Key Words: Substructuring methods, Transient response, Linear systems, Buildings, Multistory buildings

A method of analysis is developed for determining transient responses of large multiply-connected structural systems subjected to changes of structural components. A dynamic system is divided into two subsystems: the support which remains unaltered and the branch which is liable to change. The response characteristics of an original system are used as a basis for evaluating the new response of the altered system. The responses of the support interface coordinates due to external excitations on it are called base motion. The method is applied to a 16-story building rigid frame model. The methods give response results comparable with the conventional integrated system analysis. Approximations due to modal truncation are the same as component mode substitution method.

84-2819

The Gate Function Response Method in Analysis of Linear Systems

Du Qingxuan

J. of China Railway Society, 5 (4), pp 22-29 (1983)
CSTA No. 625.1-83.25

Key Words: Linear systems, Time domain method

In this paper, the unit gate function is defined and the gate function response method in the time-domain analysis

of linear systems is introduced with the result that the convolution integral can be converted into ordinary integrals.

84-2820

A New Numerical Procedure for Symmetric Eigenvalue Problems

I. Levit

Tel-Aviv Univ., Ramat-Aviv, Israel, Computer Struc., 18 (6), pp 977-988 (1984) 3 figs, 7 tables, 15 refs

Key Words: Numerical analysis, Eigenvalue problem

A numerical solution procedure for solving standard symmetric eigenvalue problems is presented. The solution is based on a sequence of one dimensional minmax stages and is capable of extracting eigenpairs in either decreasing or increasing orders. Generalized symmetric eigenvalue problems are transferred to standard form and solved using the same algorithm.

84-2821

A Method for Reducing the Order of Nonlinear Dynamic Systems

S.F. Masri, R.K. Miller, H. Sassi, and T.K. Caughey
Univ. of Southern California, Los Angeles, CA 90089-0242, J. Appl. Mech., Trans. ASME, 51 (2), pp 391-398 (June 1984) 11 figs, 26 refs

Key Words: Reduction methods, Multidegree of freedom systems, Nonlinear systems, Condensation method, Non-parametric identification technique

An approximate method that uses conventional condensation techniques for linear systems together with the non-parametric identification of the reduced-order model generalized nonlinear restoring forces is presented for reducing the order of discrete multidegree-of-freedom dynamic systems that possess arbitrary nonlinear characteristics. The utility of the proposed method is demonstrated by considering a redundant three-dimensional finite-element model half of whose elements incorporate hysteretic properties. A nonlinear reduced-order model, of one-third the order of the original model, is developed on the basis of wideband stationary random excitation and the validity of the reduced-order model is subsequently demonstrated by its ability to predict with adequate accuracy the transient response of the original nonlinear model under a different nonstationary random excitation.

84-2822

The Origin of Stability Indeterminacy in a Symmetric Hamiltonian

M.R. Hyams and L.A. Month

Dept. of Mech. Engrg., Univ. of California, Berkeley, CA 94720, J. Appl. Mech., Trans. ASME, 51 (2), pp 399-405 (June 1984) 4 figs, 5 refs

Key Words: Stability, Hamiltonian principle

The stability and bifurcation of periodic motions in a symmetric two-degree-of-freedom Hamiltonian system is studied by a reduction to a two-dimensional action-angle phase plane, via canonical perturbation theory. The results are used to explain why linear stability analysis will always be indeterminate for the in-phase mode in a class of coupled nonlinear oscillators.

Key Words: Stochastic processes, Load coincidence method

The problem of evaluating the probability that a structure becomes unsafe under a combination of loads over a given time period is addressed. The loads and load effects are modeled as either pulse (static problem) or intermittent continuous (dynamic problem) processes. The load coincidence method is extended to problems with both nonlinear limit states and dynamic responses. Results are compared with other methods, namely, methods based on upcrossing rate, simpler combination rules and Monte Carlo simulation. It is found that the load coincidence method is a versatile method for load combination of many types. It generally gives conservative results with good accuracy.

DESIGN TECHNIQUES

84-2823

Dynamics of Gyroelastic Continua

G.M.T. D Eleuterio and P.C. Hughes

Univ. of Toronto, 4925 Dufferin St., Downsview, Ontario, Canada M3H 5T6, J. Appl. Mech., Trans. ASME, 51 (2), pp 415-422 (June 1984) 6 figs, 7 refs

Key Words: Gyroelastic properties, Continuum mechanics

This paper introduces the idea of distributed gyrocity, in which each volume element of a continuum possesses an infinitesimal quantity of stored angular momentum. The continuum is also assumed to be linear-elastic. Using operator notation, a partial differential equation is derived that governs the small displacements of this gyroelastic continuum. Gyroelastic vibration modes are derived and used as basis functions in terms of which the general motion can be expressed. A discretized approximation is also developed using the method of Rayleigh-Ritz. The paper concludes with a numerical example of gyroelastic modes.

84-2825

Computer-Aided Design of Control Systems Dynamic Compensation

He Xungui and Chen Xianwei

Acta Automatic Sinica, 9 (4), pp 253-259 (1983) CSTA No. 629.8-83.40

Key Words: Design techniques, Computer-aided techniques, Frequency domain method

This paper presents a computer-aided design method for linear time-invariant system compensation in frequency domain. It can be applied to the compensation for control systems containing different origin poles, real zeros, real poles, and complex poles. Lead, lag, and lead-lag compensations under given performance requirement can be achieved. The design result of the compensated parameters can be printed by the computer. It can also print the time response curves and performance for both the original systems and the compensated systems through computerized analysis, if necessary. Satisfactory results were obtained in many practical cases.

STATISTICAL METHODS

84-2824

Stochastic Combination of Load Effects

H.T. Pearce and Y.K. Wen

Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801, ASCE J. Struc. Engrg., 110 (7), pp 1613-1629 (July 1984) 11 figs, 30 refs

COMPUTER PROGRAMS

84-2826

Development of a Simplified Procedure for Cyclic Structural Analysis

A. Kaufman

NASA Lewis Res. Ctr., Cleveland, OH, Rept. No. E-1855, NASA-TP-2243, 20 pp (Mar 1984)
N84-20878

Key Words: Computer programs, Cyclic loading

Development was extended of a simplified inelastic analysis computer program for predicting the stress-strain history at the critical location of a thermomechanically cycled structure from an elastic solution. The program uses an iterative and incremental procedure to estimate the plastic strains from the material stress-strain properties and a plasticity hardening model. Creep effects can be calculated on the basis of stress relaxation at constant strain, creep at constant stress, or a combination of stress relaxation and creep accumulation. Good agreement was found between these analytical results and nonlinear finite-element solutions for these problems. The simplified analysis program used less than 1 percent of the CPU time required for a nonlinear finite-element analysis.

84-2827

Analytical and Experimental Investigation of Bird Impact on Fan and Compressor Blading

A.F. Storace, R.P. Minner, and R. Ravenhall
General Electric Co., Cincinnati, OH, J. Aircraft, 21 (7), pp 520-527 (July 1984) 19 figs, 14 refs

Key Words: Blades, Fan blades, Fans, Bird strikes, Computer programs

An analytical design tool and structural design criteria have been developed to assess and improve the foreign object damage tolerance of turbine engine fan and compressor blading. The analytical method is based on a three-dimensional finite element computer code that incorporates an interactive bird-loading model. The computer code and design criteria provide a systematic transient-structural analysis approach that will aid in the design of structurally efficient, impact damage-resistant blading.

84-2828

Pascal Packages for ASCII File I/O and CDC and Dynamic Strings

W.J. Vandeneersteren

Physics Lab. RVO-TNO, The Hague, The Netherlands, Rept. No. PHL-1983-18, TDCK-77992, 47 pp (May 1983)
N84-22285

Key Words: Computer programs

Three packages, written in PASCAL, that implement dynamic strings and ASCII file I/O in a structured way on CDC Cyber computers are described.

84-2829

AUTDYN -- A Digital Simulation Computer Program for the Handling Dynamics of Passenger Cars -- Part 2 (AUTDYN -- ein digitales Simulationsrechenprogramm für die Fahrdynamik von Personenkraftwagen -- Teil 2)

F. Uffelmann

Kammuhlweg 9, 8074 Gaimersheim, Germany, Automobiltech. Z., 86 (5), pp 243-246 (May 1984) 11 figs
(In German)

Key Words: Computer programs, Automobiles, Ride dynamics

This paper reports on the new AUTDYN vehicle model. The paper reports on steering system, tires, braking system, engine/transmission drive train, road surface and aerodynamics. The initial results of computation and comparisons with test measurements are presented in conclusion to show the applicability and validity of the model.

GENERAL TOPICS

TUTORIALS AND REVIEWS

84-2830

Some Dynamical Aspects of Army Missile Systems

J.J. Richardson

U.S. Army Missile Command, Redstone Arsenal, AL, Shock Vib. Bull., No. 54, Pt. 1, pp 43-53 (June 1984) 17 figs (Proc. Shock Vib. Symp., Oct 18-20, 1983, Jet Propulsion Lab., Pasadena, CA. Spons. SVIC, Naval Res. Lab., Washington, D.C.)

Key Words: Missiles

The great diversity of size, employment, and flight parameters of army missile systems yield an accordingly diverse

set of dynamics problems. It is the aim of this paper to provide some indication of the range of these problems. A few general remarks are followed by examples taken from recent experiences.

BIBLIOGRAPHIES

84-2831

Vibrational Analysis in Aerodynamics. 1972 - April, 1984 (Citations from the International Aerospace Abstracts Data Base)

NTIS, Springfield, VA, 136 pp (May 1984)
PB84-865633

Key Words: Aerodynamic loads, Flutter, Blades, Bibliographies

This bibliography contains citations concerned with design and performance relative to aerodynamic vibration. Among the topics discussed are torsion blade flutter; vibration generated by rudders, rotor blades, panels and air foils; vortex shedding; load control; and helicopter gust response flutter. Aircraft vibrational analyses by means of analog computer simulation, auto-flight control systems, and structural dynamics of aircraft are included with consideration for flight vehicle vibration control and reduction. (This updated bibliography contains 157 citations, 13 of which are new entries to the previous edition).

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Natke, H.G., Einführung in Theorie und Praxis der Zeitreihen und Modalanalyse (Introduction to the Theory and Practice of Time Series and Modal Analysis), Friedrich Vieweg-Verlagsgesellschaft, Braunschweig/Wiesbaden, 1983 (in German); Reviewed by R. Nordmann, SVD, 16 (9), pp 23-24 (Sept 1984).

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Orr, W.G., Handbook for Industrial Noise Control, National Technical Information Service, Springfield, VA, 1981; Reviewed by V.R. Miller, SVD, 16 (7), p 23 (July 1984).

Palm, W.J., III, Modeling, Analysis, and Control of Dynamic Systems, John Wiley & Sons, New York, NY, 1983; Reviewed by S.M. Holzer, SVD, 16 (10), pp 19-20 (Oct 1984).

Pandit, S.M. and Wu, S.M., Time Series and System Analysis with Applications, John Wiley & Sons, New York, NY, 1983; Reviewed by H. Saunders, SVD, 16 (12), pp 15-16 (Dec 1984).

Rao, S.S., The Finite Element Method in Engineering, Pergamon Press, Elmsford, NY, 1982; Reviewed by H. Saunders, SVD, 16 (5), pp 24-25 (May 1984).

Ross, C.R.T., Computational Methods in Structural and Continuum Mechanics, John Wiley & Sons, New York, NY, 1982; Reviewed by R.A. Ibrahim, SVD, 16 (2), pp 28-29 (Feb 1984).

Rutherford, S.H., Meaningful Engineering Science, Mechanical Engineering Publications, Ltd., London, 1980; Reviewed by K.E. Hofer, SVD, 16 (5), p 27 (May 1984).

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Stanomir, D., The Physical Theory of Electromechanical Systems, Romanian Academy of Sciences, Bucharest, 1982 (in Romanian); Reviewed by M. Rades, SVD, 16 (2), pp 24-25 (Feb 1984).

Szymkowiak, E., Optimized Vibration Testing and Analysis, Institute of Environmental Sciences, Mt. Prospect, IL, 1983; Reviewed by H.C. Pusey, SVD, 16 (11), pp 33-34 (Nov 1984).

Valid, R., Mechanics of Continuous Media and Analysis of Structures, Series in Applied Mathematics and Mechanics, Vol. 26, North-Holland Publishing Co., Amsterdam, 1981; Reviewed by R.A. Ibrahim, SVD, 16 (2), pp 25-27 (Feb 1984).

Van Stijgeren, E., ed., Recent Advances in Pipe Support Design, ASME, New York, NY, 1982; Reviewed by H. Saunders, SVD, 16 (2), p 27 (Feb 1984).

Van Stijgeren, E., ed., Special Applications in Piping Dynamic Analysis, ASME, New York, NY, 1982; Reviewed by H. Saunders, SVD, 16 (2), pp 27-28 (Feb 1984).

Wempner, G., Mechanics of Solids with Applications to Thin Bodies, Martinus Nijhoff, The Hague, The Netherlands, 1982; Reviewed by L.Y. Bahar, SVD, 16 (6), pp 23-24 (June 1984).

Wetzel, R.M., ed., Fatigue under Complex Loading, Society of Automotive Engineers, Inc., Warrendale, PA, 1977; Reviewed by K.E. Hofer, SVD, 16 (6), pp 24-26 (June 1984).

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JANUARY 1985

22-24 Annual Reliability and Maintainability Symposium [IES] Philadelphia, PA (*IES Hqs.*)

28-31 3rd International Modal Analysis Conference [Union College] Orlando, FL (*Ms. Rae D'Amelio, Union College, Wells House, 1 Union Ave., Schenectady, NY 12308 - (518) 370-6288*)

29-Feb 1 International Conference on Nondestructive Evaluation in Nuclear Industry, Grenoble, France (*J.P. Launay, COFREND, 32 Boulevard de la Chapelle, 75880 Paris Cedex 18, France*)

FEBRUARY 1985

25-Mar 1 International Congress and Exposition [SAE] Detroit, MI (*SAE Hqs.*)

MARCH 1985

18-21 30th International Gas Turbine Conference and Exhibit [ASME] Houston, TX (*Intl. Gas Turbine Ctr., Gas Turbine Div., ASME, 4250 Perimeter Park South, Suite 108, Atlanta, GA 30341 - (404) 451-1905*)

APRIL 1985

1-3 2nd International Symposium on Aeroelasticity and Structural Dynamics [Deutsche Gesellschaft für Luft- und Raumfahrt e.V.] Technical University of Aachen, Germany (*Symposium Organizing Secretariate, Deutsche Gesellschaft für Luft- und Raumfahrt, Godesberger Allee 70, D-5300 Bonn 2, W. Germany*)

8-12 Acoustical Society of America, Spring Meeting [ASA] Austin, TX (*ASA Hqs.*)

15-17 Institute of Acoustics Spring Conference [IOA] York University, UK (*IOA, 25 Chambers St., Edinburgh EH1 1HU, UK*)

15-19 2nd Symp. on Interaction of Non-Nuclear Munitions with Structures [Tyndall AFB, FL; Eglin AFB, FL; Kirtland AFB, NM] Panama City Beach, FL (*Ms. L.C. Clouston, Registrar, P.O. Box 1918, Eglin AFB, FL 32542 - (904) 882-5614*)

22-26 International Symposium on Acoustical Imaging, The Hague, The Netherlands (*J. Ridder, P.O. Box 5046, 2600 GA Delft, The Netherlands*)

29-May 3 31st Annual Technical Meeting and Equipment Exposition [IES] Las Vegas, NV (*IES Hqs.*)

MAY 1985

6-8 4th International Symposium on Hand-Arm Vibration [Finnish Inst. of Occupational Health] Helsinki, Finland (*I. Pyykko, Inst. of Occupational Health, Laajaniityntie 1, 01620, Vantaa 62, Finland*)

6-9 American Society of Lubrication Engineers, 40th Annual Meeting [ASLE] Las Vegas, NV (*ASLE Hqs.*)

22-24 Machinery Vibration Monitoring and Analysis Meeting [Vibration Institute] New Orleans, LA (*Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 W. 55th St., Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254*)

JUNE 1985

3-5 NOISE-CON 85 [Institute of Noise Control Engineering and Ohio State University] Columbus, OH (*NOISE-CON 85, Dept. of Mech. Engrg., Ohio State Univ., 206 W. 18th Ave., Columbus, OH 43210 - (614) 422-1910*)

24-26 2nd National Conference and Workshop on Tailoring Environmental Standards to Control Contract Requirements [IES] Leesburg, VA (*IES Hqs.*)

JULY 1985

2-4 Ultrasonics International '85, Kings College, London (*Z. Novak, Ultrasonics, P.O. Box 63, Westbury House, Bury St., Guildford, Surrey GU2 5BH, England*)

11-13 International Compressor Engineering Conference, Lafayette, IN (*Purdue University, W. Lafayette, IN - (317) 494-2132*)

AUGUST 1985

5-10 SAE West Coast International Meeting [SAE] Portland, OR (*SAE Hqs.*)

CALENDAR ACRONYM DEFINITIONS AND ADDRESSES OF SOCIETY HEADQUARTERS

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AIAA:	American Institute of Aeronautics and Astronautics 1633 Broadway New York, NY 10019	IFTOMM:	International Federation for Theory of Machines and Mechanisms U.S. Council for TMM c/o Univ. Mass., Dept. ME Amherst, MA 01002
ASA:	Acoustical Society of America 335 E. 45th St. New York, NY 10017	INCE:	Institute of Noise Control Engineering P.O. Box 3206, Arlington Branch Poughkeepsie, NY 12603
ASCE:	American Society of Civil Engineers United Engineering Center 345 E. 47th St. New York, NY 10017	ISA:	Instrument Society of America 67 Alexander Dr. Research Triangle Park, NC 27709
ASLE:	American Society of Lubrication Engineers 838 Busse Highway Park Ridge, IL 60068	SAE:	Society of Automotive Engineers 400 Commonwealth Dr. Warrendale, PA 15096
ASME:	American Society of Mechanical Engineers United Engineering Center 345 E. 47th St. New York, NY 10017	SEE:	Society of Environmental Engineers Owles Hall, Buntingford, Hertz. SG9 9PL, England
ASTM:	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103	SESA:	Society for Experimental Stress Analysis 14 Fairfield Dr. Brookfield Center, CT 06805
ICF:	International Congress on Fracture Tohoku University Sendai, Japan	SNAME:	Society of Naval Architects and Marine Engineers 74 Trinity Pl. New York, NY 10006
IEEE:	Institute of Electrical and Electronics Engineers United Engineering Center 345 E. 47th St. New York, NY 10017	SPE:	Society of Petroleum Engineers 6200 N. Central Expressway Dallas, TX 75206
IES:	Institute of Environmental Sciences 940 E. Northwest Highway Mt. Prospect, IL 60056	SVIC:	Shock and Vibration Information Center Naval Research Laboratory Code 5804 Washington, D.C. 20375

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Unsolicited articles are accepted for publication in the **Shock and Vibration Digest**. Feature articles should be tutorials and/or reviews of areas of interest to shock and vibration engineers. Literature review articles should provide a subjective critique/summary of papers, patents, proceedings and reports of a pertinent topic in the shock and vibration field. A literature review should stress important recent technology. Only pertinent literature should be cited. Illustrations are encouraged. Detailed mathematical derivations are discouraged; rather, simple formulas representing results should be used. When complex formulas cannot be avoided, a functional form should be used so that readers will understand the interaction between parameters and variables.

Manuscripts must be typed (double-spaced) and figures attached. It is strongly recommended that line figures be rendered in ink or heavy pencil and neatly labeled. Photographs must be unscreened glossy black and white prints. The format for references shown in DIGEST articles is to be followed.

Manuscripts must begin with a brief abstract, or summary. Only material referred to in the text should be included in the list of References at the end of the article. References should be cited in text by consecutive numbers in brackets, as in the example below.

Unfortunately, such information is often unreliable, particularly statistical data pertinent to a reliability assessment, as has been previously noted [1].

Critical and certain related excitations were first applied to the problem of assessing system reliability almost a decade ago [2]. Since then, the variations that have been developed and the practical applications that have been explored [3-7] indicate that . . .

The format and style for the list of References at the end of the article are as follows:

- each citation number as it appears in text (not in alphabetical order)
- last name of author/editor followed by initials or first name
- titles of articles within quotations, titles of books underlined

- abbreviated title of journal in which article was published (see Periodicals Scanned list in January, June, and December issues)
- volume, issue number, and pages for journals; publisher for books
- year of publication in parentheses

A sample reference list is given below.

1. Platzer, M.F., "Transonic Blade Flutter - A Survey," Shock Vib. Dig., 7 (7), pp 97-106 (July 1975).
2. Bisplinghoff, R.L., Ashley, H., and Halfman, R.L., Aeroelasticity, Addison-Wesley (1955).
3. Jones, W.P., (Ed.), "Manual on Aeroelasticity," Part II, Aerodynamic Aspects, Advisory Group Aeronaut. Res. Dev. (1962).
4. Lin, C.C., Reissner, E., and Tsien, H., "On Two-Dimensional Nonsteady Motion of a Slender Body in a Compressible Fluid," J. Math. Phys., 27 (3), pp 220-231 (1948).
5. Landahl, M., Unsteady Transonic Flow, Pergamon Press (1961).
6. Miles, J.W., "The Compressible Flow Past an Oscillating Airfoil in a Wind Tunnel," J. Aeronaut. Sci., 23 (7), pp 671-678 (1956).
7. Lane, F., "Supersonic Flow Past an Oscillating Cascade with Supersonic Leading Edge Locus," J. Aeronaut. Sci., 24 (1), pp 65-66 (1957).

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