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THE SHOCK AND VIBRATION DIGEST. VOLUME 12, NUMBER 4.(U)
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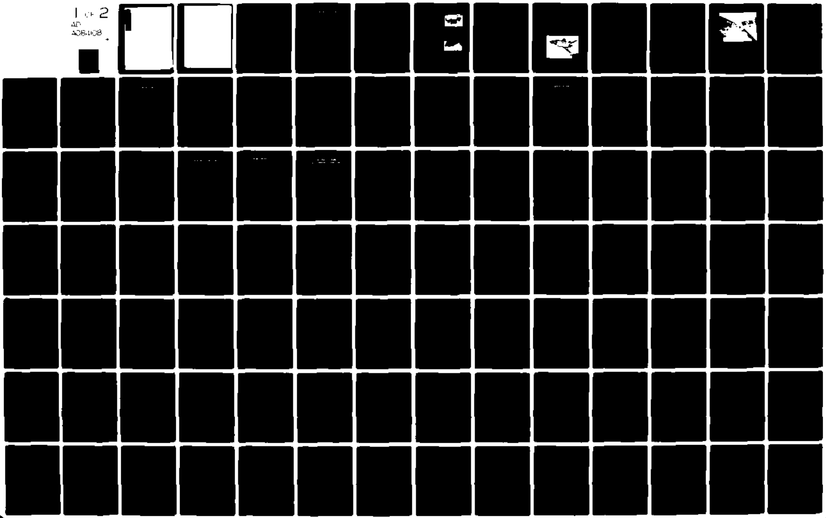

SVIC NOTES

The reader will note that there is a preview of the 26th Annual Technical Meeting of the Institute of Environmental Sciences on page 29 of this issue. I have the honor of being General Chairman for this meeting which I expect to be an outstanding forum on environmental technology. Thanks to Hank Caruso, the technical program offers a number of timely and challenging topics. Even the titles are fascinating. Try "Everybody Doesn't Do Everything Wrong all of the Time" by Colonel Ben Swett or "The Betty Crocker Syndrome in Environmental Testing" by Crill Maples. I am anxious to hear what they have to say.

For my part, Hank has agreed that I should organize a session on "Technical Information Resources." For a long time I have felt that more effort should be made to alert the professional society member to the technical information sources available to him. To be sure, a professional society like IES is a valuable resource in itself, but it is likely not the only source for information in its field. The short session I have organized for the IES will hopefully open the door for other societies to serve their members in a similar fashion, that is to let them know where to look for information applicable to their particular problem. If we do it well at our session, those present may learn the why, where and how of information search. They may learn that their library, although indispensable, is not the only information source available to them. I do not believe that the RDT&E community is separable from the information activities that serve it. Perhaps in Philadelphia I can begin to prove my point.

In the Winter 1980 issue of DAEDALUS* there is an excellent discussion of the connections between Science and Technology by W.O. Baker, Chairman of the Board of Bell Laboratories. He addresses the issue in straight forward terms, speaking to the need for a common systems language to be used for both the creation and application of science and technology. He then proceeds to show by example how we can approach our fundamental needs through systems science involving large and closely interrelated communities for research and development. The importance of communicating and of effective interchange of information is implied throughout the paper. I recommend it as an enlightened discussion of a timely topic.

As you can see from the Calendar, the 51st Shock and Vibration Symposium will be in San Diego this October with the Navy as host. A Call for Papers will appear in the May issue. In the meantime, please feel free to offer suggestions for session or paper topics.

H.C.P.

*Journal of the American Academy of Arts and Sciences

EDITORS RATTLE SPACE

ENGINEERING SOCIETIES

Two of the oldest and most distinguished engineering societies in the U.S. will celebrate important anniversaries this year. The Society of Automotive Engineers (SAE) is 75 years old, and the American Society of Mechanical Engineers (ASME) is celebrating its 100th anniversary. Both societies are a source of the literature abstracted and reviewed in the **Shock and Vibration Digest.** The SAE has been active not only in the automotive field but also in areas involving other vehicles -- spacecraft, ships, construction, and airplanes. Of course the scope of ASME is as broad as mechanical engineering itself. Many vibration and acoustic engineers consider the ASME their primary society.

Both ASME and SAE have made substantial contributions to the advancement of engineering, particularly shock and vibration engineering. In addition, both societies have been actively involved in the development of standards for industry - the ASME boiler code, for example, has provided safe boilers and pressure vessels for both industry and home. And the SAE handbook provides standards and guidelines for many materials use in components of vehicles.

The engineering societies in general have become a focal point for the advancement of engineering practice with their conferences, symposia, seminars, technical committee meetings, and publications. It is worth noting that these activities *are possible only because individuals are willing* to contribute their time and effort. And just as important is the fact that employers are willing to support the activities of their technical people. The result of this dissemination of information is that technology that required millions of dollars to develop is available to everyone at a very low cost. Compare the cost of development of technology to the cost of a technical paper -- can anyone question the money required for editing, printing, and dissemination?

R.L.E.

DYNAMIC ANALYSIS AND DESIGN - CHALLENGE FOR THE FUTURE*

R.W. Hager**

Abstract - A review of the history of dynamic analysis and design through the past 49 sessions of the Shock and Vibration Symposia shows the significant progress made, and the problems and shortcomings being encountered today. Concerns and challenges for the future of dynamic analysis and design are discussed.

The Shock and Vibration Symposia have spanned 32 years, roughly the same period of time that I have been engaged in, or dependent upon, dynamic analysis and design. For the 20 years prior to my program management assignments, I was directly involved in dynamic testing, aeroelastic and dynamic analysis, and structural design. My responsibilities for overall program management for the past ten years have given me a different perspective of the role of dynamic analysis, in that I am responsible for the final product and the cost-effective execution of the effort to get to the final product. I am, therefore, the recipient of good or poor dynamic analysis, interpretation of requirements, and the resulting structural design. I can assure you that the quality and timeliness of the analysis have a significant impact on the cost, schedule, and ultimate capability of the final product.

My involvement with dynamics began with my graduate work in hydrodynamics and research studies of ocean waves and their interactions with structures. The problem in those days was to tie theoretical knowledge to the real world of testing when methods of dynamic measurement were limited. Electronic instruments and oscillographs were just being developed. Dynamic analysis involved laborious, and time-consuming manual calculations using, at best, electric calculators. Electronic digital and analog computers were in their infancy. The approach to design was based on experience and extensive testing of the prototype design.

I looked back at the first few *Shock and Vibration Bulletins* to set the stage for discussing the progress that has been made. The first meeting was in January, 1947; Dr. Klein's greatest concern at that time was for a standardized method for measuring acceleration. The information discussed was predominantly testing -- instrumentation and measurement of the dynamic environment that the equipment would experience during operation.

THE PAST

The first dynamic analysis report was that of J.W. Wrench from David Taylor Model Basin. He compared the measured and calculated response of a single-degree-of-freedom mass plug accelerometer to underwater detonation and the use of shock spectra to describe shock. Such was the limit of dynamic analysis and design capability. Even the more sophisticated field of aircraft flutter was limited to two or three degrees of freedom and time-consuming calculations. Testing was the method for assuring that the design was adequate; full-scale prototypes were exposed to an actual operational environment. Analysis, if it was attempted at all, was used mainly to understand test results.

Obviously tremendous progress has been made in dynamic analysis and design. I hope we have also made the same progress toward understanding system response and optimization of the design.

Progress is attributable to the analytical tools that have been developed and the training and experience of analysts.

But problems remain in fully utilizing digital computer capability and in applying the analysis to the final product design. The future for dynamic analysis

This paper is adapted from a plenary lecture delivered at the 50th Shock and Vibration Symposium in October, 1979, in Colorado Springs

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and design is bright; in ten years I believe we will have the capability and the need to do analysis that is as advanced from what we are doing today as our current analyses are to the one degree of freedom analysis of 1947.

The challenge lies in whether or not we are adequately preparing to use the incredible capacity that will be available. Current problems will have to be solved; both analysis methods and the role that the analysis contributes to the design will change, as will the attitudes and organizational structure required to accomplish the design.

Thirty-two years ago dynamic analysis and design capability consisted of one degree of freedom or at the most two or three degrees of freedom. Figure 1 shows the single-degree-of-freedom analysis presented by Wrench at the 1947 Symposium. Although the limited dynamic analysis capability could provide some guidance to the designer, the design process was, for the most part, a static approach based on experience. The dynamic analysis that was done was carried out in attempts to understand what was happening during testing. The major method for proving a design was extensive testing under simulated or actual operational environment, and when designs failed, they were modified -- a "cut and try" process.

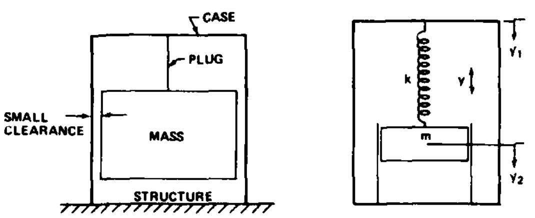

Figure 1. Single-Degree-of-Freedom System

By the early 1960s sophisticated analog computers capable of solving the equations of motion in real time were available, as were computers that directly replace structural elements with electrical ones. Scope and detail of analysis were limited by costs and the limits of individual patience required to set up the analog. Digital computers were in use, and their speed and storage capability were increasing rapidly -- capability for solving dynamic problems was beginning to exceed that of the analog. In fact, the peak of analog capability had been attained: the CEA Direct Structural Analog was the largest (see Figure 2);

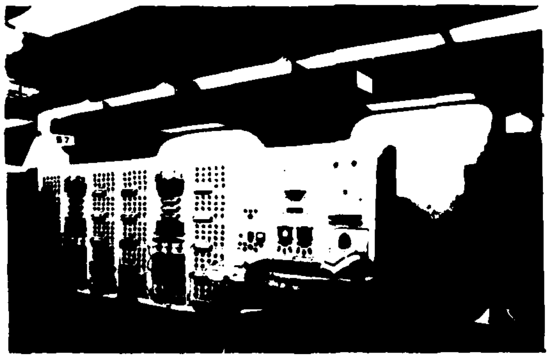

Figure 2. An Analog Computer

it required a room 50 feet by 50 feet and a drawer of equipment for each structural element being simulated. Cost, size, time, and complexity limited the future of this computer for solving larger problems. But it had the capability to solve problems with 20 to 30 degrees of freedom -- an order of magnitude greater than 16 years before.

The dynamic analysis of the Minuteman Missile and its transporter-erector (Figure 3) to road surface roughness was reported in the 33rd Symposium.

Figure 3. Minuteman Missile Transporter Erector

The analysis model, shown in Figure 4, consisted of modeling the tires and axles with the suspension; structural modes of the vehicle and container; the suspension of the missile within the container; and the structural modes of the missile.

The analysis model could be modified to assess the effects of variations in structural stiffness and suspen-

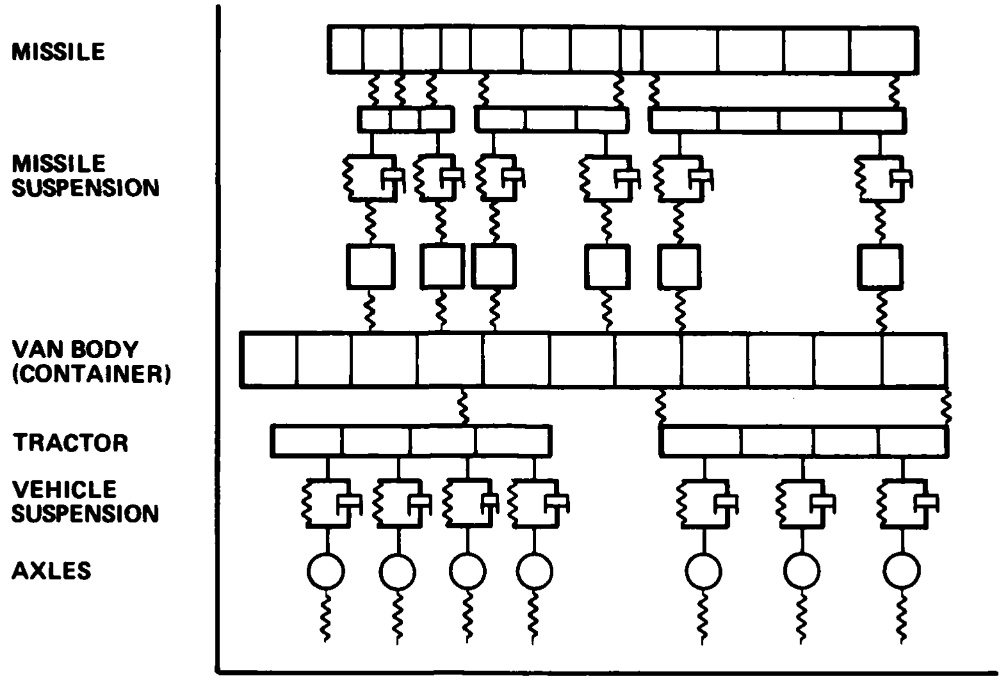

Figure 4. Dynamic Analysis Model of the Minuteman Missile and its Transporter-Erector

sion spring rates, as well as damping characteristics at critical load sites in the missile. Structural response and loads of the missile could quickly and cheaply be determined for a wide variety of road surface conditions and speeds after the model had been set up.

The analysis could set the requirements for the design and eliminate the expensive and time-consuming "cut and"try testing method. Testing could be done on the final design and thus serve to verify the design. Not only had dynamic analysis capability increased but the role of analysis in the final design of the product had also changed.

THE PRESENT

The large structural analogs have disappeared. Digital computer capability has grown by three to five orders of magnitude in speed and capacity. Problems now are the time required to get the data into the machine, understanding the output, and cost-effective usage.

Products have changed. They are more complex: either weight optimization and performance are critical or optimization of the design to reduce cost for large hardware production runs is paramount. Analysis must be relied on because the development tests are too expensive or the real operational environment cannot be simulated.

One example of the complex systems being designed and the degree of dynamic analysis and design interaction required is the Space Shuttle (Figure 5). Full testing under operational conditions is not possible. Some environments and test components can be simulated, but the major structural loadings during launch and landing can be obtained only during actual operation -- and it is not possible at that point to stop for redesign.

The orbiter (Figure 6), external tanks, and solid rocket motor boosters are not the only complex features of the shuttle; the spacecraft and its booster, which are carried in the orbiter cargo bay, are equally complex. The inertial upper stage and the spacecraft in the orbiter must be analyzed both as a part of the total orbiter system for launch and abort launching conditions and as a separate system after it leaves the cargo bay.

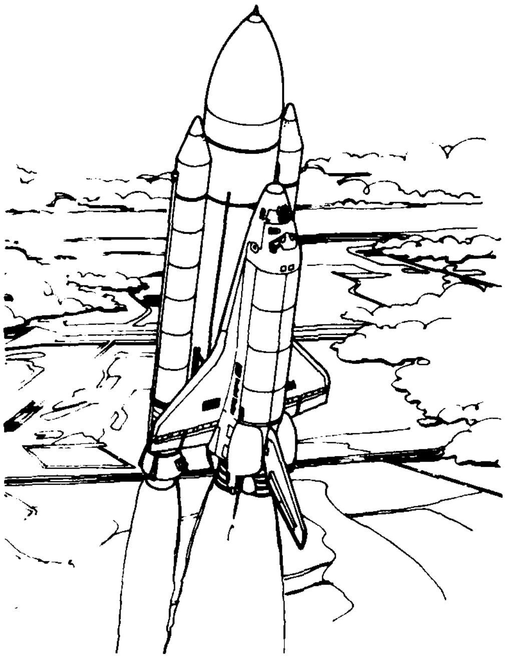

Figure 5. Space Shuttle

The complex analysis requires a large number of degrees of freedom in finite element structural models and a large number of modes in dynamic models (Figure 7). Each system must be modeled and analyzed alone before a somewhat more simple model of the elements is merged to obtain a model of the total system. The results of the dynamic analysis of the complete dynamic model in terms of loads -- accelerations, stresses, and displacements -- are fed back into the finite element structural models to determine stresses in the detail structure. Some structural changes require revision of the dynamic analysis model and loading. The interaction continues until a design compatible with the external forcing functions and system requirements is obtained.

Complicated organizational and contractual arrangements with several companies are also involved in the dynamic analysis and design. Dynamic modeling and input/output information must be passed from one organization to another.

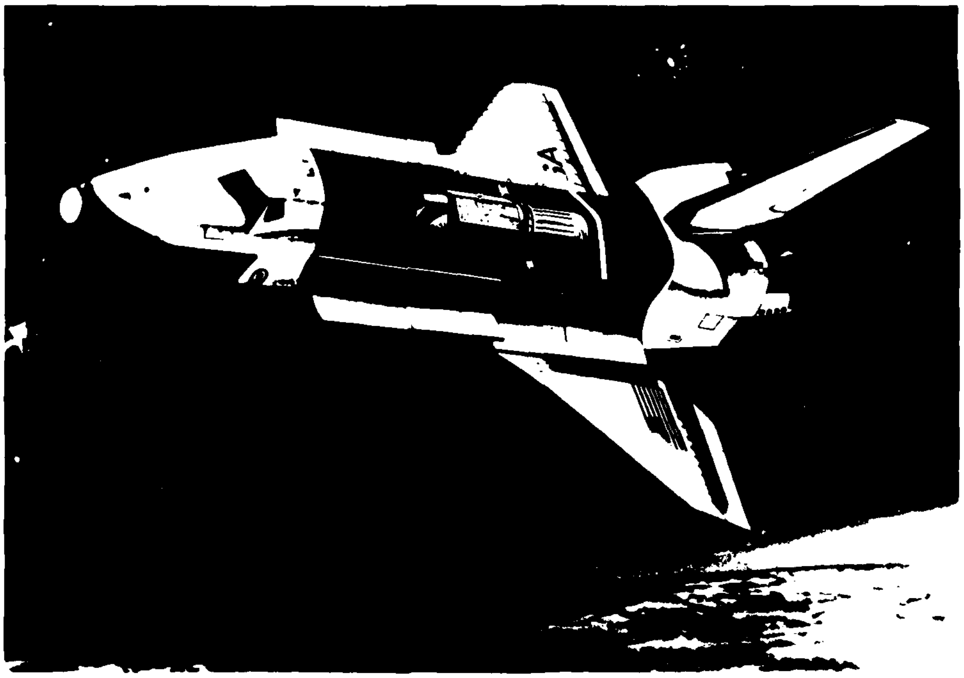

Figure 6. Space Orbiter

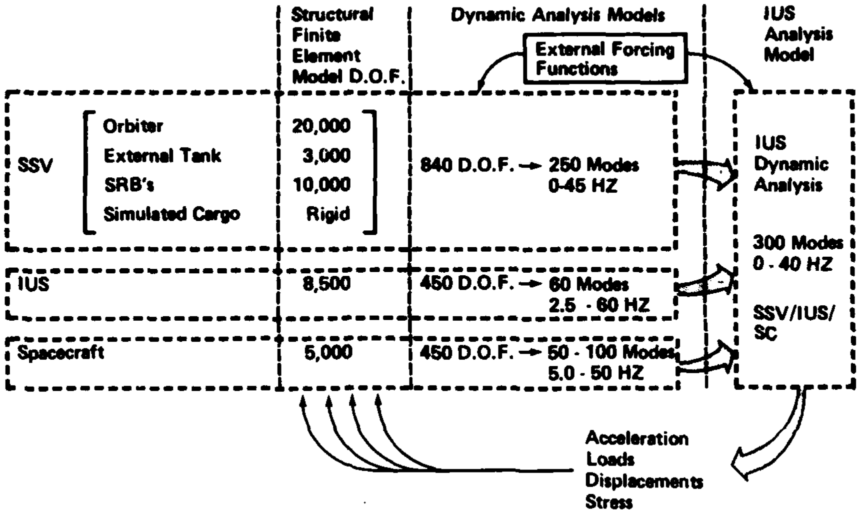

Figure 7. Dynamic Analysis Model of the Space Shuttle

Thus, another order of magnitude in the number of dynamic modes that can be included in the analysis is now possible. Testing is becoming more expensive, and the ability to simulate the environment is limited. Dynamic testing is being used extensively to support dynamic analysis; both dynamic tests of models and full-scale modal tests of flight hardware are used. The role of the analysis has changed again: not only is it providing the design requirements but it is the only method of verifying the design for some operational conditions.

Current problems with the dynamic analysis and design processes include time required, failure to take advantage of dynamic analysis capability, and lack of confidence in the results of dynamic analysis.

Perhaps the most critical problem from a hardware design standpoint, is the excessive amount of time necessary to complete the analysis/design cycle. Because of the complex nature of most systems and their interactions, the analysis/design cycle must be an iterative process. Initial requirements based on a concept are translated into a preliminary design for which an initial dynamic analysis can be conducted.

This analysis generates new loads and dynamic requirements for such factors as structural stiffness, damping, and mass distribution. These are introduced back into the design. Depending upon the complexity of the design and the need for optimization of performance or payload, this process can proceed through one or more iterations. After the development hardware has been fabricated and dynamic tests to check the characteristics have been conducted, another iteration is usually required.

In the case of the shuttle, inertial upper stage, spacecraft configuration, this process is even more complex. Several different dynamic analyses models are being done by different companies with different design goals. The dynamic interactions between elements in one analysis must be inputs to another analysis. In the case of the total configuration for launch, the third iteration of the dynamic forcing functions has been completed; more than one year was required. During that time the loads nearly doubled from the initial static load estimates. The impact of this slow iterative process on the cost and schedule of a program with a fixed deadline is substantial.

This example might seem overly complex becuase the system has many elements that cannot be fully tested prior to flight and there must be confidence in the design. However, the shuttle is probably a good indicator of future designs, even of less complex systems, at a time when computing will be much less expensive than it is now and design optimization will be cost-effective.

The analytical capability currently available in design is not being fully utilized. We still rely to a great extent on structural analysis with static load factors. The dynamic analysis is conducted to assure that the loads do not exceed the simplified static loads. Such is the case in the shuttle design. Even though every kilogram of weight reduction and every second of ISP propulsion performance possible are being sought, no one is taking full advantage of the dynamic analysis capability now available. Each element of the structure could be designed to the maximum condition that it will actually experience in the dynamic operation environment rather than to a peak static load factor applied to the total structure.

Not all of the reasons for this failure to take advantage of existing capability are obvious. One reason is historic -- it is traditional to do the design the way it has been done. The procedure has been successful in the past, and there is confidence in the method. Another reason is organizational: the assignment of responsibility. In this case the experience of the managers who are planning and directing the dynamic analysis is important; their experience may be years behind the capability of current tools and analysts. Finally a lack of communication between analysts and management on the real capability of analysis might exist.

The last point is a lack of confidence in reliance on the results of dynamic analysis. More effort must be directed toward verifying analytic results; that is, checking analyses with limited testing, short of full-scale testing. The typical attitude today is that, given enough test data, the analyst can adjust his model and get the right answer after the fact.

The role of the analyst in detail design is going to grow and the time is coming when it will be mandatory to rely on the analyst and not on testing.

THE FUTURE

Predictions for the future are usually difficult. We rely on past experience and knowledge and often fall short of what really happens because we are unable to visualize it. Predictions are sometimes too optimistic: technical limitations, lack of real need, and more recently economic considerations. I shall try to avoid these constraints in my predictions.

Three areas will affect the future of dynamic analysis and design: the types of products, improvements in analytical tools, and changes in the way hardware is designed and manufactured.

Many of the products that will be designed in the next two decades will be similar to those being designed today -- vehicles, equipment, and aircraft. These products will be extended or modified and dynamic analysis and design could be done in the same manner as today. However, more economical design activities will be sought, and effort will be aimed at reducing the cost of analysis and the time required to accomplish the effort. More important, closer ties to manufacturing will be necessary so as to eliminate the input/output stages and drawings now required.

It will not even be possible to assemble and test some hardware because of size or the inability to simulate the dynamic environment exept by actual operational use after the euqipment is built. The hardware that goes into space in the future will be large -- antennas, space stations (Figure 8), even solar power satellites. In many cases these structures will not even be built on Earth. Rather, the materials will be transported and the structural beams will actually be fabricated in orbit.

There will not be any way to test systems. The analysis alone will be used to set requirements and to qualify designs. The process might even require independent verification and validation as is done today in software.

Another area that will affect the future of dynamic analysis and design (Figure 9) is the development of the analytical tools. We are on the threshold of a revolution in the field of computers. Their low cost and availability guarantee an impact on every aspect of our lives. The technology that is producing these changes will create even more profound changes in scientific computing, not only the ability of each designer to have the capacity of the largest computer capability today at his fingertips but also the increased speed and storage capacity.

Figure 10 shows the estimates being made for speed increases in microprocessors in terms of millions of operations per second (MOPS). Microprocessors now in use will be replaced by processors with three orders

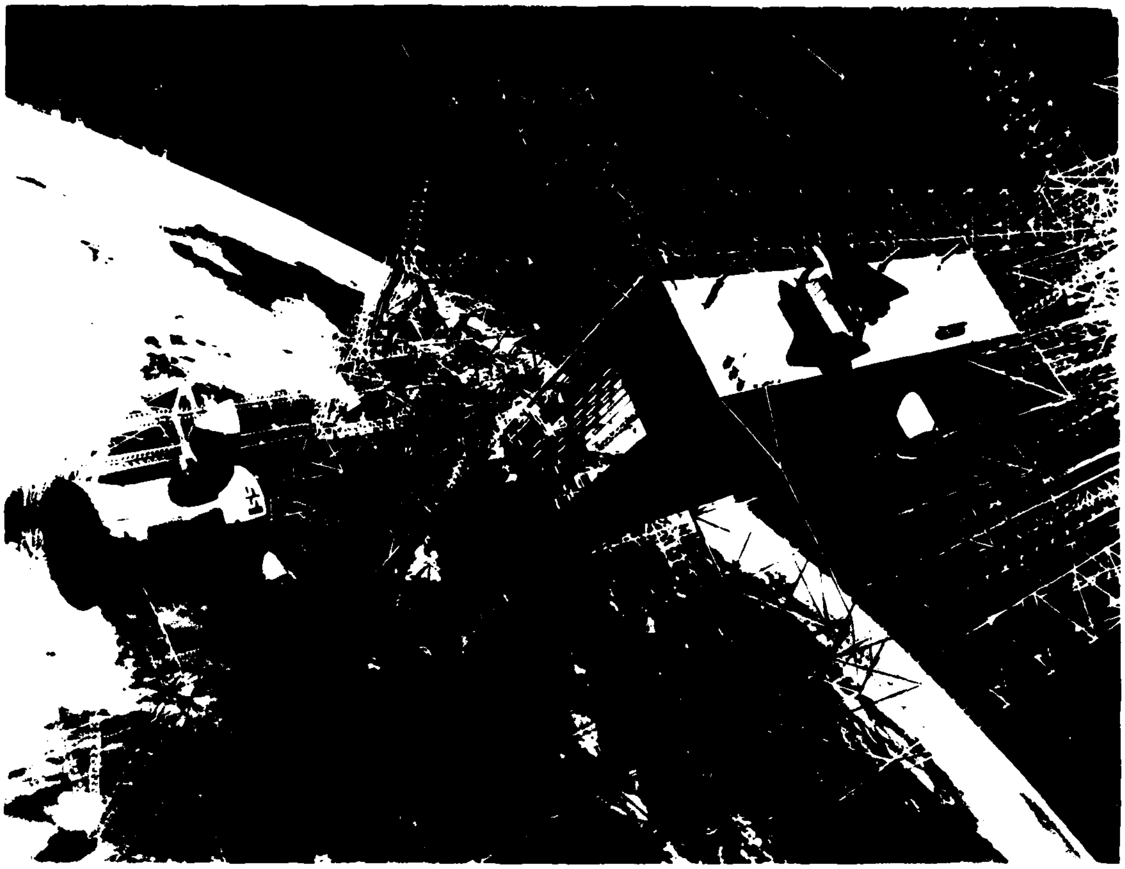

Figure 8. Space Station

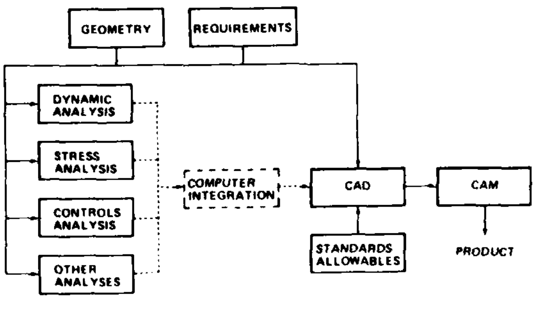

Figure 9. Interactions of Analysis and Design

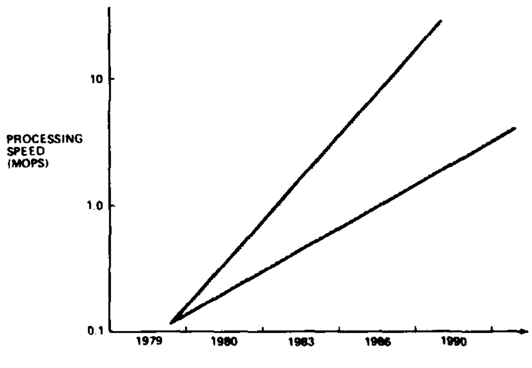

Figure 10. Projected Microprocessor Speeds

of magnitude more capability. Ultimately processors will have potentially one million times greater throughput than current capability. Within the time frame being considered, the next 10 to 20 years will bring three orders of magnitude increase in speed and capacity at a comparable or lower cost than today. Of course, the major concerns will be as they are today: the time and capability to put in information and retrieve analytical results. It will be necessary to minimize data shuffling between computers and design organizations in order to make the operation cost-effective. The low cost of computers will allow a unique computer for each analytical application; today main frame computers are relied on, as is inputting the computational program each time or recalling it from storage.

Computer software or firmware will control function by drawing on massive amounts of stored data and interpreting results necessary for final output parameters. Confidence in the analysis and in the competence and understanding of the analyst and the computer programmer will be an absolute necessity.

The size of computer storage and speed of throughput will be such that there will be no limit to the number of degrees of freedom or the depth of detail to which dynamic loads or stresses can be defined if economic justification or need can be satisfied. It will be possible to look in detail at sections of the design and to tie sections into the total system.

The third area that will affect the future of dynamic analysis is design development. The trend is by necessity toward cost effective design and development as well as cost-effective hardware production. The only way increased analytical capability can be effectively used is to reduce time required and the number of people involved in the design process.

I can visualize analytical capacity such that there will be no need for separating analysis and design functions. The design could be done in one computational process. The input would be the concept and operating constraints; standard design parameters would be stored in the computer. Output could be drawings if needed or, more likely, the manufacturing tapes necessary for automated production. The first stages of this process are occurring today with computer-aided design and computer-aided manufacturing.

Future computer capability is going to make possible the tying of elements into a composite with major reduction in time and cost.

A current problem is a method for retention of knowledge: answers to past analyses, errors made in the past and their corrections. That knowledge now resides primarily in the minds of engineers, analysts, and designers or in some document or loose-leaf notebook that in time will be lost. Future capability will allow the total corporate design knowledge of a company or industry to be stored in a computer or in off-line storage and thus be available for immediate application to any problem at hand.

In all this change and driving for more cost-effective production and utilization of the computer, the most important resource is the people involved. The roles and responsibilities of the analyst, designer, and test engineer will change. Because greater reliance will be placed on the analysis, confidence in the analytical results will have to increase. The design and analysis functions will merge inside the computer. Testing will decrease because of cost and will be done primarily to support the analysis. Final verification and qualification will be mostly by analysis.

Under these conditions the most important individuals will be those who understand the process and can communicate with the program management: the designer of the computer program and the analyst who interprets the results and provides verification. Such changes will mean new organizational concepts and will require training of individuals.

SUMMARY

Figure 11 depicts, for areas of analytical capability, the design process and organizational structure, a view of the past, the present, and my prediction of the future.

The degree of dynamic analysis capability increases from a few degrees of freedom to three to four orders of magnitude improvement today to what I believe will be unlimited capability in the future. I have previously discussed the increases in the analytical capability.

Next is the role of analysis and testing in the design process. In the past testing was an integral part of

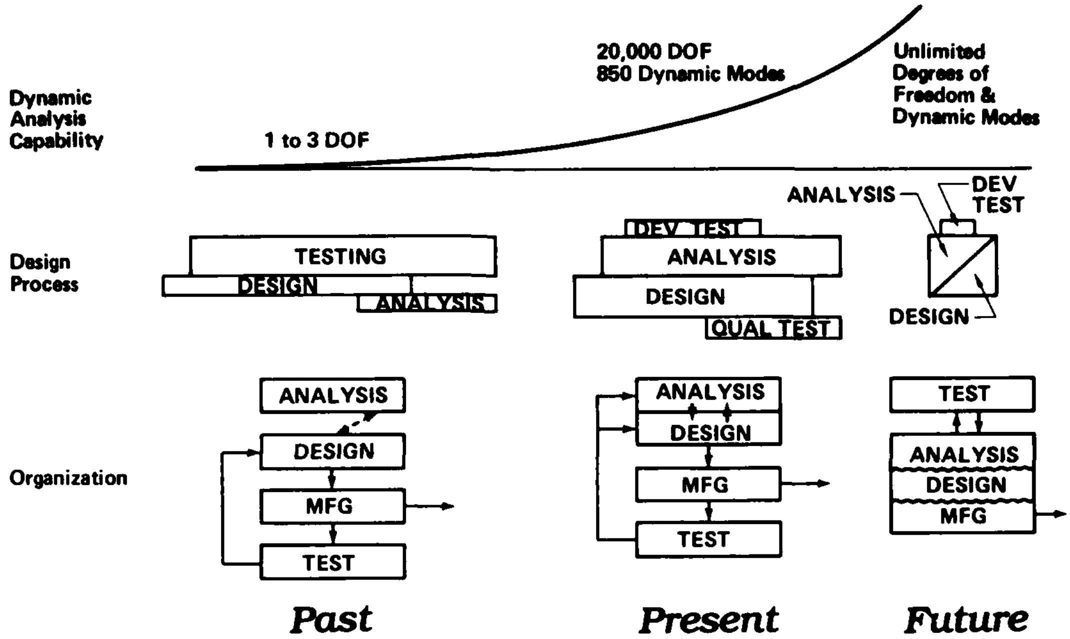

Figure 11. Summary

design; analysis was a way to understand what happened. Today *analysis and design are* done concurrently with testing that supports the analysis and for qualification. In the future, I anticipate that analysis and design will be integrated; the final verification will be analytical, and testing will primarily support the analysis, there is, of course, no clear-cut separation of approaches. Examples of all three exist today. However, most of the more complex designs follow this path because of test costs and increased computer capability.

In the past the organizations to do the design and produce the product were completely separate entities with specific responsibilities. Much data were generated and passed back and forth. Today significant interaction occurs between analysts and designers. In some cases projects go directly from the designer to the manufacturing machine by computer with no need for intermediate drawings.

In the future, computer capability will cause organizations to merge. The roles of analysts and designers as they are known might disappear and be replaced by a team that progresses from the design in the computer to the machines that fabricate the hardware.

I am concerned about our ability to deal with these predictions, and they form the basis for the challenge facing us. First we must understand the tremendous potential that is coming in computational capability. This is the responsibility of analysts and management. Managers must listen to analysts and recognize the capability they are developing.

The tendency is to think years behind current capability because of detail experience. That cannot constrain planning for the future. It will require a radical change in attitude to plan for a level and *method of analysis and design beyond personal* experience and an organization to do the job.

I challenge analysts and designers to think beyond present constraints and to communicate future possibilities to planners and management.

I challenge management to listen to young experts and not be limited by personal experience in analysis and design. If new techniques are needed and are cost-effective, support the necessary investment. Challenge analysts to provide the verification necessary to promote confidence in computer results.

There is an easier path: agreeing that the reasonable limits of dynamic analysis and design have been attained and that it is now time to understand and more effectively use the present level of analysis rather than to strive to increase that level of understanding or to optimize designs.

I am not ready to settle for that path. We must continuously strive for those improvements that will increase productivity across the spectrum in industry or we will stagnate and fall behind.

I have raised some questions and concerns with the hope of challenging you to help with solutions. I assure you that the need for high confidence, cost-effective, rapid dynamic analysis and design is here now and will grow in the future. I believe that computational capability will outstrip our ability to effectively use it unless we begin now to prepare the trained personnel and develop the techniques and organization to use computer capability effectively in the design process.

The future of dynamic analysis and design looks bright, but we are going to have to devote our energy and research funds not only to doing the design and solving present problems but also to preparing and planning for new capabilities. This is the challenge I leave with you.

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 automobile ride quality.

Dr. C.C. Smith of the University of Texas at Austin, Texas has written a paper which presents a brief review of the development of automobile ride quality over the past several years. References that can be examined for further historical insight are given. Recent progress deals with passenger response prediction, vehicle motion prediction, and roadway surface modeling.

LITERATURE REVIEW - AUTOMOBILE RIDE QUALITY

C.C. Smith*

Abstract - A brief review of the development of automobile ride quality over the past several years is presented; references that can be examined for further historical insight are given. Recent progress deals with passenger response prediction, vehicle motion prediction, and roadway surface modeling. Significant progress has been made, but the total automobile ride quality picture remains somewhat blurred. Significant need for continued development exists.

Ride quality has been an important concern of auto manufacturers as they have sought product acceptance in the market place. The current emphasis on vehicle downsizing for increased fuel and material economy has not lessened the importance of ride quality. Although the term ride quality could include such factors as seat spacing, air quality, and humidity and noise levels, it has generally come to refer to the vibration environment to which passengers are exposed. From the point of view of the vehicle designer, a study of automobile ride quality involves three subdivisions:

- prediction or characterization of passenger response to a given vibration environment or vehicular motion
- prediction of vehicle motions for traversal of a given roadway or terrain
- modeling or characterization of typical roadway roughness

Obviously many factors play a role in the passenger comfort rating of ride quality. Weak coupling in one direction allows the common assumption of causality in the inverse order of the three subdivisions; i.e., roadway roughness causes vehicle motion and vehicle motion causes passenger response. Vehicle motion usually has little effect on roadway roughness (at least in the short term); the effect of passenger response on vehicle motion is somewhat less clear, particularly as vehicles get smaller or as concern is directed toward the seat as an integral part of the vehicle and a determinant of ride quality. Nevertheless, it is convenient to assume unidirectional causality to allow independent study of each subdivision. The first is perhaps the most difficult because physiological, psychological, and physical factors are involved. Vehicle motion is of interest to the vehicle designer because it represents the part of the total system over which he has the most control. The roadway is also of interest to the vehicle designer because it represents the environment in which the vehicle must perform. The roadway is of interest to the highway/pavement designer who has some control over the roadway surface.

PASSENGER RESPONSE TO VEHICLE MOTIONS

Humans are relatively insensitive to small changes in vibration level, passenger perception is thus difficult to quantify. This does not reduce the need to know and understand the relationships between passenger perception and vibration levels, however, because vehicle design, construction, and manufacturing costs are often influenced by allowable vibration levels. If permissible vibration levels were too high, ride quality would be unacceptable to many passengers. Human sensitivity to vibration is probably nonlinear: below certain levels, sensitivity is low, but at higher levels small changes will be noticeable and annoying. Much of the early work associated with ride quality focused on the definition of a perception, or discomfort, boundary [1, 2]. Single axis, sinusoidal tests required test subjects to indicate perception level as a function of excitation frequency. Much of this early research has been summarized [3]. The significant variation in many of these studies is presumably attributable to the difficulty of controlling the many possible variables that affect perception -- e.g., posture, psychological mood, expectation. Although not

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universally accepted [4], an international standard for vibration exposure, including vehicle comfort, was adopted by the International Standards Organization [5] after careful review [6] of harmonic motion data available prior to 1975. This standard has provided a focal point for comparison purposes and has been at least one of the criteria considered in most ride quality evaluation conducted since 1975.

The application of sinusoidal sensitivity boundaries to the determination of ride quality as represented by a broadband vibration spectrum has long been proposed [7] and frequently utilized. Unfortunately the determinations have often been done without regard to filter bandwidth and the variables associated with the instrumentation used. Comparison of broadband and sinusoidal data on the basis of rms levels is possible only if the bandwidth of the filter used to process the broadband data is specified; results for which the bandwidth was not specified cannot be generalized. The ISO Standard thus specifies a one-third octave bandwidth, stating that the rms acceleration level within that bandwidth must be below the prescribed boundary specified for the center frequency of the band. This method relates broadband random and sinusoidal data, but the extent to which this relationship is valid for predicting passenger perception has not yet been established. It has been suggested [8], for instance, that interaction between frequency bands and/or axes of vibration might be such that each frequency band or axis cannot be considered independently.

It is desirable for the vehicle designer that any ride quality criteria be defined such that a single number ride index is available to serve as an objective function in design tradeoffs. Such a criterion has been proposed [9]: that the power absorbed by the passenger from the vehicle (and hence, dissipated by the passenger) be used as a measure of the ride. In application of this technique, the square of the magnitude of the contact impedance effectively becomes a frequency weighting function for the calculation of a weighted mean square measure of the vibration (absorbed power). A similar frequency weighting method utilizes weighting functions to determine a frequency weighted rms acceleration ride index [10]. In addition, the ISO Standard [5] suggests that an alternate method to independent consideration of individual frequency bands be the use of a frequency weighted rms index using ISO boundaries as weighting curves. This is suggested as a conservative bound when a one-number index is desirable.

Since 1933 various investigators [10-14] have taken field data relating some proposed ride quality measures to subjective passenger response; much of the data are not statistically reliable because of the small numbers of passengers considered. This lack of field data in support of proposed criteria stimulated field experiments to examine statistically the relationships between subjective passenger evaluations of ride quality and objective acceleration measurements.

In one study [15] 78 passengers, 18 roadway sections, and two automobiles were involved; subjective ride ratings were compared with a variety of frequency weighted ride indicators. Cars were driven at constant speed in a straight path on each roadway section; both lateral and vertical accelerations were measured on the automobile floorboard and the man/seat interface. Weighted indicators included rms levels weighted via sinusoidal boundaries defined by ISO [5], Janeway [1], Diekman [2], and the Urban Tracked Air Cushion Vehicle design specifications [4]. In addition, Lee and Pradko's absorbed power [9] (effectively a weighted mean square measure) was used.

Although correlation between the weighted indicators and the subjective passenger responses was good for many of the indicators, simple unweighted rms acceleration provided correlation coefficients as high as or higher than their frequency weighted counterparts. Correlation was best with rms vertical accelerations measured at the floorboard of the vehicle and with rms lateral accelerations measured at the man/seat interface. A magnitude rms acceleration measure, defined as the square root of the sum of the mean square lateral and mean square vertical accelerations measured at either the floorboard or the man/seat interface correlated well with subjective ride ratings. Linear regression equations and residual variances were used to relate measured and subjective indices.

A group at University of Virginia, in conjunction with Dunlap Associates [16] recently conducted studies of a variety of transportation systems including a compact and a subcompact automobile. The cars were driven over such terrain as curves, hills, straight sections, with various roughnesses; data were collected in one-minute segments. Vertical, lateral, and longitudinal accelerations were measured near the vehicle center, as were roll, pitch, and yaw angular velocities. Root mean square values of each objective measure were correlated with subjective ride ratings and with each other. Roll rate, pitch rate, and vertical acceleration were highly (linearly) correlated, as were yaw rate and transverse acceleration. Longitudinal acceleration was also fairly highly correlated with roll rate, pitch rate, and vertical accelerations for the subcompact car. Regression equations relate rms objective measures to a seven point comfort scale. Corresponding correlation coefficients were determined for each objective measure or group of measures and the corresponding regression equation.

An attempt by the author to relate the resulting regression equations using only linear acceleration [16] with corresponding equations [15] resulted in significant apparent differences. It should be remembered, however, that comfort rating scales, type and variation of terrain, and automobile type varied significantly between the studies.

A recent laboratory study at NASA Langley Research Center* [17] examined passenger sensitivity to sinusoidal and random motions in vertical, lateral, longitudinal, roll, and pitch axes. This test provides some indication of sensitivity in each axis, but the regression equations are difficult to relate to those given [15, 16] for passengers exposed to many axes of vibration even when ride ratings correlated strongly with only a single axis measurement. This study indicates some discrepancy with the ISO Standard with regard to scale. The one-minute ISO reduced-comfort boundary was found to represent vibration levels that would be considered uncomfortable by most passengers. Such results agree in general with previous field studies [15, 18]. (It should be mentioned, however, that the intent of the ISO Standard was to provide a bound and a focal point for comparison as opposed to a method for rating comfort or discomfort level and thus was not intended for use as a comfort scale.) The NASA study also suggests a discrepancy between sinusoidal and random vibration comfort levels and suggests that application of sinusoidal criteria to random vibration might be inappropriate.

Thus, although many criteria have been proposed for relating passenger acceptance and vibration characteristics, no general equation has been defined, if indeed such an equation can be defined. Criteria that now exist should therefore be used with care and judgment, especially when they are extrapolated to conditions significantly different from those for which they were derived.

VEHICLE MOTION PREDICTION

Although a general description of passenger perception and response to vehicle vibration characteristics remains elusive, progress has been made in the development of models and simulation capability for predicting vehicle motions and relating vehicle motions to possible design changes. The finite element modeling technique [19, 20] and the computer graphics associated with it are increasingly used in the structural design and testing of new automobile structures. Experimental modal analysis techniques often utilize mini- and microcomputer-based instrumentation systems [21]; these have eased the process of verifying analytical models and provided insight into possible structural design improvements when the system is too complex to develop purely analytical structural models. These advances represent not so much the development of new theory, but rather a significant increase in the usability and availability of existing theory. Significant progress has been made in the development of computer algorithms for these applications, but details of the algorithms have not been widely published.

A fairly detailed study [22-24] considered modeling the vehicle suspension and rigid body motions and the prediction of vertical and lateral acceleration spectra. The developed model neglected structural body modes of vibration and gave good results when compared with experimentally measured spectra up to about 10 Hz for a 1974 Buick Century and a 1975 Ford Maverick. This study focused on tire and suspension system modeling for predicting ride quality spectra. Sensitivity of ride quality spectra to suspension design parameters was examined.

The prediction of lateral motions of an automobile requires a fairly detailed model of tire-roadway interaction. It is expected, therefore, that tire modeling will become more significant in ride quality design studies as models become more sophisticated. In addition, suspension design often requires a trade-off between vehicle handling and ride quality. A study

*This study was conducted using an aircraft style seating arrangement and ride quality simulator, but general results and trends would be presumably generalizable to other modes (automobiles).

that focused on the development of analytical tire models [25] is a useful recent contribution in this important area.

Another vehicle subsystem that may significantly affect overall ride quality is the vehicle seat. It has generally been found that either floorboard or seat vibrations are equally good predictors [15] of ride quality. The relative causal effects are not clear, however; that is to say, the degree to which the perceptions that contribute to overall comfort are transmitted through the seat (and hence could be effected by changing the seat transmissibility) as opposed to floorboard contact, and visual and audible cues has not been established. Some earlier studies attempted models of the passenger-seat system, but most recent studies have examined these effects by experimental identification of seat transmissibility characteristics [26-28]. The seats involved in one study were typical of aircraft and buses; vertical and lateral motions were considered independently using laboratory shaker excitation [26]. In a second study, an automotive split type (single) front seat was considered in a laboratory experiment in which a shaker provided single-degree-of-freedom (linear combination of vertical and pitch motions, vertical dominant) motion of the floorboard [27]. In a third study, a bench-type automotive seat was considered [28]; field data were used, and coupled vertical and lateral motions were considered.

ROADWAY SURFACE MODELING

The final link in the assessment of ride quality is the roadway surface upon which the vehicle travels. Ride quality is based upon vehicle motion statistics; therefore, a statistical description of the roadway surface is usually used. A simple model, originally suggested by Houboult [29], characterizes the auto-spectral density as inversely proportional to the roughness wavelength squared. If more detail is desired, a two-piece linear fit on log-log coordinates of the roughness autospectrum as a function of wavelength has been proposed [30]. In addition, inasmuch as recent work dealing with passenger perceptions indicates that roll motions may significantly affect ride quality, two-dimensional surface models capable of characterization of left and right wheel tracks (and correlation between the two) are desirable. Apparently the best approach to two dimensions at this time is to assume that the road surface is isotropic [31, 32]. Measured data appears to justify use of these models [33], but data are not sufficient to indicate their generally applicability. The advantages of using simplified purely analytical models as opposed to actual measured roughness data are ease of use and possible generality of results. In some cases, however, it might be best to use experimentally measured roughness spectra characteristics of the surfaces to be considered in simulation or design studies.

SUMMARY

Ride quality prediction has been a concern in the automobile industry for several years and is likely to increase in importance as fuel and material economies force designers to modify present designs without losing passenger acceptance. Many studies have contributed to overall understanding, but the total picture remains somewhat blurred. No single criterion has emerged that can be used as a general description of the relationship between vehicle motion and passenger satisfaction. Many criteria have been derived from specific field and laboratory tests, but no general theory yet ties them into a cohesive set. Each criterion should be used with care and judgment when it is extrapolated beyond the conditions from which it was developed.

Significant progress has been made in analytical modeling and design techniques, and designers have new methods for modification of prospective vehicle systems to avoid unwanted vibrations. Improved roadway roughness models, if verified by significant field data, may prove useful in providing a generalized characterization of the environment in which vehicles must operate.

REFERENCES

1. Janeway, R.N., "Vibration Limits to Fit the Passenger," SAE J., 56, pp 48-49 (Aug 1948).

2. Dieckmann, D., "Study of the Influence of Vibration on Man," Ergonomics, 1, pp 345-355 (1958).

3. Hanes, R.M., "Human Sensitivity to Whole-Body Vibration in Urban Transportation Systems: A Literature Review," Rept. No. 004 APL/JHV-TPR 004, Johns Hopkins Univ., Appl. Physics Lab. (May 1970).

4. Janeway, R.N., "Analysis of Proposed Criteria for Human Response to Vibration," Proc. 1975 Ride Quality Symp., NASA TM X-3295, DOT-TSC-OST-75-40, pp 531-563 (Nov 1975).

5. "A Guide for the Evaluation of Human Exposure to Whole-Body Vibration," ISO/DIS 2631, 1974 (E), Intl. Organ. for Standardization, New York, NY.

6. vonGierke, H.E., "The ISO Standard: 'Guide for the Evaluation of Human Exposure to Whole-Body Vibration,' " Proc. 1975 Ride Quality Symp., NASA TM X-3295, DOT-TSC-OST-75-40, pp 565-577 (Nov 1975).

7. Janeway, R.N., "Vertical Vibration Limits for Passenger Comfort," SAE Ride Vib. Manual, SAE J., 6a (1965).

8. Allen, G.R., "Ride Quality and International Standard ISO 2631 (Guide for the Evaluation of Human Exposure to Whole-Body Vibration)," Proc. 1975 Ride Quality Symp., NASA TM X-3295, DOT-TSC-OST-75-40, pp 501-530 (Nov 1975).

9. Lee, R.A. and Pradko, F., "Analytical Analysis of Human Vibration." SAE Trans., No. 680091, pp 346-370 (1968).

10. Butkunas, A.A., "Power Spectral Density and Ride Evaluation," SAE Trans., No. 660138, pp 681-687 (1966).

11. Jacklin, H.M. and Liddle, G.J., "Riding Comfort Analysis," Engr. Bull., V, XVII, Purdue Univ. (May 1933).

12. Van Eldik, Thieme, H.C.A., "Passenger Riding Comfort Criteria and Methods of Analyzing Ride and Vibration Data," SAE Paper No. 29A, SAE Intl. Congr. (1961).

13. Aspinal, D.T., "Vehicle Riding Comfort: A Comparison of Some Subjective and Objective Measurements," Rept. No. 1960/4, Motor Indus. Res. Assoc., Nuneaton, UK (1960).

14. Versace, J., "Measurement of Ride Comfort," SAE Paper No. 638A, SAE Intl. Congr. (1963).

15. Smith, C.C., MeGehee, D.Y., and Healey, A.J., "The Prediction of Passenger Riding Comfort from Acceleration Data," J. Dyn. Syst., Meas. and Control, Trans. ASME, 100 (1), pp 34-41 (Mar 1978).

16. Richards, L.G. and Jacobson, I.D., "Ride Quality Models for Diverse Transportation Systems," Rept. No. UVA/532132/MAE79/101, Res. Lab. Engr. Sci., Univ. Virginia, Charlottesville (June 1979).

17 Dempsey, T.K., Leatherwood, J.D., and Clevenson, S.A., "Discomfort Criteria for Single-Axis Vibrations," NASA Tech. Paper 1422 (May 1979).

18. Smith, C.C., "On Using the ISO Standard to Evaluate the Ride Quality of Broad-Band Vibration Spectra in Transportation Vehicles," J. Dyn. Syst., Meas. and Control, Trans. ASME, 98 (4), p 440 (Dec 1976).

19. McClelland, W.A. and Klosterman, A.L., "Using NASTRAN for Dynamic Analysis of Vehicle Systems," SAE Paper No. 740326.

20. Kamal, M.M. and Wolf, J.A., "Finite Element Models for Automotive Vehicle Vibrations," General Motors Res. Publ. GMR-2461R (Oct 1977).

21. Martz, J.W., Peterson, E.L., Knobeloch, G.W., and Angus, G.D., "Four Steps for Vehicle Ride Improvement," SAE Paper No. 790219.

22. Healey, A.J., Nathman, E., and Smith, C.C., "An Analytical and Experimental Study of Automobile Dynamics with Random Roadway Inputs," J. Dyn. Syst., Meas. and Control, Trans. ASME, 99 (4), pp 284-292.

23. Nathoo, N.S. and Healey, A.J., "Coupled Vertical-Lateral Dynamics of a Pneumatic Tired Vehicle: Part I - A Mathematical Model," J. Dyn. Syst., Meas. and Control, Trans. ASME, 100 (4), pp 311-318.

24. Nathoo, N.S. and Healey, A.J., "Coupled Vertical-Lateral Dynamics of a Pneumatic Tired Vehicle: Part II - Simulated Versus Experimental

Data," J. Dyn. Syst., Meas. and Control, 100 (4), pp 319-325.

25. Captain, K.M., Boghani, A.B., and Wormley, D.N., "Analytical Tire Models for Dynamic Vehicle Simulation," Vehicle Syst. Dyn., 8 (1), p 1 (Mar 1979).

26. Leatherwood, J.D., "Vibrations Transmitted to Human Subjects through Passenger Seats and Consideration of Passenger Comfort," NASA Tech. Note TN-7929 (June 1975).

27. Varterasian, J.H. and Thompson, R.R., "The Dynamic Characteristics of Automobile Seats with Human Occupants," SAE Paper No. 770249 (Mar 1977).

28. Smith, C.C. and Kwak, Y.K., "Identification of the Dynamic Characteristics of a Bench-Type Automotive Seat for the Evaluation of Ride Quality," J. Dyn. Syst., Meas. and Control, Trans. ASME, 100 (1), p 42 (Mar 1978).

29. Houboult, J.C., "Runway Roughness Studies in the Aeronautical Field," ASCE Trans., 127, Pt. IV, p 428 (1962).

30. Dodds, C.J. and Robson, J.D., "The Description of Surface Roughness," J. Sound Vib., 31, Pt. 2, p 175 (1973).

31. Kamash, K.M.A. and Robson, J.D., "The Application of Isotropy in Road Surface Modelling," J. Sound Vib., 57 (1), p 89 (1978).

32. Robson, J.D., "The Role of the Parkhilovskii Model in Road Description," Vehicle Syst. Dyn., 7, p 153 (1978).

33. Healey, A.J. and Stearman, R.O., "Measurement of Roadway Roughness and Automobile Ride Acceleration Spectra," Res. Rept. 13, Council Adv. Transp. Studies, Univ. Texas at Austin (July 1974).

BOOK REVIEWS

MACHINERY NOISE

A.H. Middleton
Oxford University Press, 1977

The author has attempted brief coverage of a broad and complex subject and, on the whole, has succeeded rather well. The material as presented can be applied to machinery noise problems by individuals having general familiarity with the physical concepts of mechanical vibration and sound propagation or by beginners interested in developing an intuitive feeling for and some vocabulary pertinent to machinery noise.

Not enough preliminary development or detailed analysis is given on any type of machinery noise to enable the reader to use the book as a source for a solution method, however. The author should have included a more detailed Bibliography directed to particular machinery noise problems for the serious practitioner. Some practical suggestions are given in the appendices.

The text contains introductory information relating to:

- Definitions and units of air borne noise
- How machines make noise
- Machine design for reduced noise
- Noise generation by individual machine processor
- Combinations of noise sources and the effects of environment
- Identification of noise sources
- Instrumentation for measurement and analysis of machinery noise
- Noise suppression methods

This text is one of an Engineering Design Guides series.

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SIMPLIFIED METHODS IN PRESSURE VESSEL ANALYSIS

R.S. Borsum, Editor
ASME Series PVP-PB-029, ASME; NY, 1978

This publication is a collection of a number of simplified methods in pressure vessel and piping analysis. It deals with various severe loading ranging from thermal shock to creep ratcheting, cyclic plasticity, plastic shakedown, and creep buckling.

The first paper presents a simplified elastic-plastic analysis that permits efficient stress and strain evaluations of structural discontinuities of high temperature components subjected to thermal transients. The method begins with elastic stress analysis using one-dimensional temperature response charts; elastic-plastic stress-strain relationship are used to obtain the maximum stress and strain resulting from a thermal transient. The contributions to strain of both a through-thickness temperature gradient and a longitudinal gradient are considered.

The second paper describes a method of calculating bounds for the accumulated membrane and bending strains due to creep ratcheting in convoluted bellows. The solutions incorporate the effects of internal pressure and cyclic displacement loads. Plots useful in the design of bellows for creep ratcheting are also given.

The third paper presents a new and straightforward method for determining the limit state of stress and strain for a structure made of kinematical hardening material and subjected to periodic loading. The method is shown to be highly efficient in comparison with incremental inelastic analysis and is suited to satisfying prescribed strain limits for structural integrity.

The fourth paper deals with the simplified inelastic analysis methods applied to fast breeder reactor core design where neutron irradiation effects are significant. One of the problems discussed is irradiation-induced creep and its effect on shakedown, ratcheting, and plastic cycling. Another problem is the development of swelling-induced stress, which is an additional loading mechanism.

The fifth paper presents benchmark assessment of a routine procedure for the inelastic analysis of piping systems by simplified methods. The theoretical background is described for a simple routine computer code developed by the authors to analyze the inelastic behavior of piping systems. The code is compared with others.

The last paper gives a simplified approach to the prediction of creep buckling time in structures in which initial geometric imperfections are undergoing elastic-creep deformations. The prediction is based on the elastic-creep constitutive relations of the structural materials and a critical strain, which is estimated with an assumed stress field corresponding to the onset of linear elastic buckling.

This publication should be of interest to practicing engineers involved in designing pressure vessel and piping.

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FLUID TRANSIENTS AND ACOUSTICS IN THE POWER INDUSTRY

C.N. Papadakis and H.A. Scarton, Editors
ASME, New York, 1978

The book contains the papers presented at a symposium, by the same title, held as part of the ASME Winter Annual Meeting in San Francisco, California, December 10-15, 1978. The majority of the papers (31) have to do with fluid transients; the remaining 11 papers concern various aspects of acoustics. Much of the work presented, particularly in fluid transients, is related to the development and design of nuclear power plant components and systems.

Most of the papers in acoustics deal with such aspects of noise as noise generation, radiation, identification of noise sources in machinery, and noise control. Studies pertaining to specific equipment rely strongly on experimental work and concern rotating, reciprocating, and vibrating equipment. An interesting analytic effort is the application of finite element methods to the prediction of noise propagation in ducts.

Acoustic instrumentation and the application of acoustic measurement techniques are the topic of the other papers. The applications are mostly from the nuclear power industry; emphasis is on the acoustic detection of reactor system malfunctions and the identification of structural flaws. One exception is a paper concerned with defining the design parameters for acoustic flow meters for measuring two-phase (fluid-solid-particle) flows in coal conversion applications.

Much of the material presented in the book concerns the mathematical and computer modeling of fluid transients in piping systems. One-dimensional analysis by either the method of characteristics, direct finite difference techniques, or control-volume modeling is used. Both fluid-hammer approximations and fully compressible treatments are employed to solve a variety of pressure transient problems that arise in the nuclear industry. As might be expected, many of the examples involve two-phase flows and cavitation phenomena, particularly in the area of reactor accident analysis. Although the techniques employed depend on the application, it appears at times that the choice of method is predicated more on the background of the author than on the appropriateness of the method. In particular the use of the method of characteristics for two-phase (steam/water) transients without a provision for shock formation seems fraught with problems. Two interesting papers from England deal with the measurement and mathematical modeling of the wave speed in two component gas/liquid mixtures: due to the greater accumulation of gas bubbles in a horizontal pipe the wave speed is lower than that in a vertical pipe under similar test conditions.

Among recent developments described for fluid transients are attempts to extend fluid-hammer methods to problems with two or more space dimensions. The formal way for accomplishing this extension is to use bicharacteristics. Some difficulties are encountered at transitions from one- to two-dimensional regions if only part of the fluid system is treated in two dimensions. Another method proposes to replace the multi-dimensional continuum by a discretized lattice work of flow elements. Because this approach relies essentially on superposition, it is limited to linear systems. In addition, an adjustment of the wave speed in the lattice work is required to obtain the proper physical wave propagation. Finally, the fact that all of the validation examples given are essentially one dimensional suggests that some caution should be exercised in applying this method to general multi-dimensional fluid transient problems.

A number of analytic efforts were directed at the problem of fluid-structure interaction. In most efforts, however, uncoupling of the fluid and structure is assumed. For some of the complex systems encountered in nuclear reactors experimental investigations are performed. The most sophisticated is simulation of a loss-of-flow accident by an in-core experiment using an actual fuel bundle. Interesting applications from outside the nuclear industry include the analysis of automotive fuel injection systems, flight control systems, and flow system protection by surge tanks.

On the whole the proceedings are informative and present a good cross section of current work in fluid transients in the power industry. The coverage of acoustic problems is much less complete, however. The volume should therefore be of particular interest to researchers and engineers working in fluid transients.

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SHORT COURSES

APRIL

ASPECTS OF DAMAGE TOLERANCE

Dates: April 7-11, 1980
Place: UCLA
Objective: The concept of damage tolerance can and is being applied to the whole spectrum of engineering materials. The methods of application include the provision of parallel load paths, unloaded standby structures, crack-stopping features and slow crack-growth routes. There are, in the case of metals for example, metallurgical factors which can be exploited to achieve each of these goals and there are micro-structural manipulations which can be used to advantage in ceramic, glass and composite components and structures. These factors and their modifications by environmental attack account for the core lectures in this course.

Contact: Continuing Education in Engineering and Mathematics, P.O. Box 24901, UCLA Extension, Los Angeles, CA 90024 - (213) 825-3344/825-1295.

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

Dates: April 7-11, 1980
Place: Dayton, Ohio
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 St., Santa Barbara, CA 93105 - (815) 682-7171.

MACHINERY VIBRATION ANALYSIS

Dates: April 9-11, 1980
Place: Chicago, Illinois
Dates: June 18-20, 1980
Place: Houston, Texas
Dates: August 26-28, 1980
Place: Las Vegas, Nevada
Dates: December 10-12, 1980
Place: New Orleans, Louisiana
Objective: The course covers causes, effects, detection, and solutions of problems relating to rotating machines. Vibration sources, such as oil and resonant whirl, beats, assembly errors, rotor flexibility, whip, damping, eccentricity, etc. will be discussed. The effect on the overall vibration level due to the interaction of a machine's structure, foundation, and components will be illustrated.

Contact: Bob Kiefer, Spectral Dynamics, P.O. Box 671, San Diego, CA 92112 - (714) 268-7100.

ACOUSTICS AND NOISE CONTROL

Dates: April 14-18, 1980
Place: The University of Tennessee Space Inst.
Objective: This is an indtroductory course dealing with the fundamentals of vibration and noise control. The equations governing the vibrations of continuous systems and sound propagation will be developed and certain elementary solutions derived to illustrate the basic characteristics of the wave motion. Sound propagation in the atmosphere, acoustic filters and resonators, and the attenuation of sound in rooms and ducts by acoustic treatment will be discussed. Fundamental measurement techniques and statistical parameters applicable to the description of noise will be presented.

Contact: Jules Bernard, The Univ. of Tennessee Space Institute, Tullahoma, TN 37388 - (615) 455-0631, Ext. 276.

APPLICATIONS OF TIME SERIES ANALYSIS

Dates: April 14-18, 1980
Place: Institute of Sound and Vibration Research, University of Southampton, UK
Objective: To provide a comprehensive treatment of

time and frequency domain analysis methods for transient and stationary random signals summarizing essential theory and giving engineering applications. To present theories and some applications related to non-stationary processes, system identification and response of non-linear systems to stochastic excitation. To apply the theory to well conceived practical problems utilizing the computers in the Data Analysis Centre enabling participants to experience how new methods may be related to present day industrial requirements.

Contact: Dr. Joseph K. Hammond, Institute of Sound and Vibration Research, University of Southampton, Southampton, Hampshire, England, S09 5NH - 559122, Ext. 467.

THE SIXTH ANNUAL RELIABILITY TESTING INSTITUTE

Dates: April 14-18, 1980
Place: The University of Arizona, Tucson
Objective: To provide reliability engineers, product assurance engineers and managers and all other engineers and teachers with a working knowledge of analyzing component, equipment, and system performance and failure data to determine the distributions of their times to failure, their failure rates, their reliabilities and their confidence limits; small sample size, short duration, low cost tests, and methods of analyzing their results; accelerated testing; test planning; electrical overstress and electrostatic failure protection; Bayesian testing; suspended items testing; sequential testing; and others.

Contact: Dr. Dimitri Kececioglu, Aerospace and Mechanical Engineering Dept., The University of Arizona, Bldg. 16, Tucson, AZ 85721 - (602) 626-2495/626-3901/626-3054/626-1755.

BLASTING AND EXPLOSIVES SAFETY TRAINING

Dates: April 23-25, 1980
Place: Atlanta, Georgia
Dates: May 14-16, 1980
Place: Reno, Nevada
Dates: June 4-6, 1980
Place: St. Louis, Missouri
Dates: June 18-20, 1980
Place: Tucson, Arizona
Dates: September 10-12, 1980
Place: Atlantic City, New Jersey
Dates: September 24-26, 1980
Place: Des Moines, Iowa
Dates: October 8-10, 1980
Place: Nashville, Tennessee
Objective: This course is a basic course that teaches safe methods for handling and using commercial explosives. We approach the problems by getting at the reasons for safety rules and regulations. Helps provide blasters and supervisors with a practical understanding of explosives and their use - stressing importance of safety leadership. Familiarizes risk management and safety personnel with safety considerations of explosives products and blasting methods.

Contact: E.I. du Pont de Nemours & Co. (Inc.), Applied Technology Division, Wilmington, DE 19898 - (302) 772-5982/774-6406.

MAY

MACHINERY VIBRATION ANALYSIS SEMINARS

Dates: May 6-7, 1980
Place: Cherry Hill, New Jersey
Dates: June 17-18, 1980
Place: Oak Brook, Illinois
Dates: July 9-10, 1980
Place: New Orleans, Louisiana
Dates: August 12-13, 1980
Place: Sheraton Inn-Newark Airport, NJ
Dates: October 1-2, 1980
Place: Houston, Texas
Dates: December 9-10, 1980
Place: Atlanta, Georgia
Objective: These two day seminars on machinery vibration analysis will be devoted to the diagnosis and correction of field vibration problems. The material is aimed at field engineers. The sessions will include lectures on the following topics: basic vibrations; critical speeds; resonance; torsional vibrations; instrumentation, including transducers, recorders, analyzers, and plotters; calibration; balancing and vibration control; identification of unbalance, misalignment, bent shafts, looseness, cavitation, and rubs; advanced diagnostic techniques; identification of defects in gears and antifriction bearings by spectrum analysis; and correction of structural foundation problems.

Contact: Dr. Ronald L. Eshleman, Vibration Institute, 101 W. 55th St., Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254/654-2053.

SECOND INTERNATIONAL SEMINAR IN PIPING DESIGN AND PIPE STRESS ANALYSIS

Dates: May 12-16, 1980
Place: Texas A&M University
Objective: This seminar addresses engineers, stress analysts, piping designers and others whose daily functions are related to piping design and stress analysis. The seminar aims to keep participants abreast of rapid changes underway in the petrochemical and power industries with a focus on the latest additions, deletions and modifications of related piping codes. Seminar faculty with recognized expertise will discuss basic philosophy and requirements of piping codes, industry design practice and approximate as well as computer methods of static and dynamic analysis. The seminar places practical emphasis on topics in rotating equipment, piping dynamics, high pressure technology, failure prevention and field troubleshooting.

Contact: Dr. M. Henriksen, Seminar Director, Department of Mechanical Engineering, Texas A&M University, College Station, TX 77843 - (713) 845-3723.

JUNE

FINITE ELEMENTS, A UNIFIED TREATMENT OF STRUCTURAL SYSTEMS - STATICS, DYNAMICS AND STABILITY

Dates: June 2-13, 1980
Place: UCLA
Objective: Designed for structural engineers and analysts in civil, mechanical and aerospace engineering, and university faculty interested in the finite element method of structural analysis for static, dynamic and stability behavior. The presentation constitutes a unified finite element treatment of structural systems that brings together static, dynamic and stability analysis, both in terms of problem formulation and solution. Techniques are explored that are most suitable for solution by a digital computer. Modern computer programs are also discussed.

Contact: Continuing Education in Engineering and Mathematics, P.O. Box 24901, UCLA Extension, Los Angeles, CA 90024 - (213) 825-3344/825-1295.

FINITE ELEMENT ANALYSIS

Dates: June 3-6, 1980
Place: Charlottesville, Virginia
Objective: This course is intended to combine an introduction to engineering finite element analysis with a survey of advanced applications. Topics to be covered include solid mechanics, fluid dynamics, and heat transfer. Many engineering examples will be given throughout the course to assist in understanding the material.

Contact: VIBCO Research Inc., P.O. Box 3307, University of Virginia Station, Charlottesville, VA 22903 - (804) 924-3982.

VIBRATION AND STRESS ANALYSIS USING EXPERIMENTAL TECHNIQUES

Dates: June 4-5, 1980
Place: Cincinnati, Ohio
Objective: This seminar will discuss/demonstrate the use of experimental testing methods to identify and solve complex vibration and stress problems. Recent advancements in the test area have provided test engineers and technicians with increased capabilities to acquire, store, and process experimentally obtained data to successfully map the performance and dynamic load data; to determine the dynamic characteristics; and to integrate with analytical modeling techniques for correlation and direction in model development. Both data acquisition and data analysis techniques will be thoroughly discussed and actually demonstrated.

Contact: Mrs. Gayle Lyons, SDRC Seminar Coordinator, Structural Dynamics Research Corporation, 2000 Eastman Drive, Milford, OH 45150 - (513) 576-2594.

DYNAMICS OF STRUCTURAL AND MECHANICAL SYSTEMS

Dates: June 23-27, 1980
Place: UCLA
Objective: For engineers interested in the presentation of the area of structural dynamics at an inter-

mediate level with application to aerospace, civil and mechanical engineering. The course presents the area of structural dynamics at an intermediate to advanced level. The subject is treated in a unified manner so as to be equally applicable to aerospace, civil and mechanical engineering problems. The course emphasizes discrete methods, numerical methods and structural modeling for computer-oriented solution of various structural dynamic problems. Some recent developments in the structural dynamic analysis of parametrically excited systems, rotating systems and systems in which fluid-structure dynamic interactions occur are also considered.

Contact: Continuing Education in Engineering and Mathematics, P.O. Box 24901, UCLA Extension, Los Angeles, CA 90024 - (213) 825-3344/825-1295.

MACHINERY VIBRATIONS SEMINAR

Dates: June 24-26, 1980

Place: Mechanical Technology, Inc.
Latham, New York

Objective: To cover the basic aspects of rotor-bearing system dynamics. The course will provide a fundamental understanding of rotating machinery vibrations; an awareness of available tools and techniques for the analysis and diagnosis of rotor vibration problems; and an appreciation of how these techniques are applied to correct vibration problems. Technical personnel who will benefit most from this course are those concerned with the rotor dynamics evaluation of motors, pumps, turbines, compressors, gearing, shafting, couplings, and similar mechanical equipment. The attendee should possess an engineering degree with some understanding of mechanics of materials and vibration theory. Appropriate job functions include machinery designers; and plant, manufacturing, or service engineers.

Contact: Mr. Paul Babson, MTI, 968 Albany-Shaker Rd., Latham, NY 12110 - (518) 785-2371.

ADVANCED DYNAMIC ANALYSIS FOR MODAL TESTING USERS

Dates: June 25-26, 1980

Place: San Diego, California

Dates: July 9-10, 1980

Place: Cincinnati, Ohio

Objective: This seminar has been organized to provide the serious user (advanced and beginner alike) with a complete knowledge of the capabilities and applications of the SDRC Testing Software Package (MODAL, MODAL-PLUS, SABBA and FATIGUE). The emphasis will, therefore, be on advanced software capabilities and their use to solve dynamics problems. Applications will come from the vehicle, construction and mining equipment, and rotating equipment areas; but, will be of general interest to any engineer working in the area of experimental dynamics.

Contact: Mrs. Gayle Lyons, SDRC Seminar Coordinator, Structural Dynamics Research Corp., 2000 Eastman Drive, Milford, OH 45150 - (513) 576-2594.

JULY

INTRODUCTION TO THE VIBRATION AND STRESS ANALYSIS OF PRESSURE ACTUATED VALVES FOR GAS COMPRESSORS USING FINITE ELEMENT METHODS

Dates: July 21-22, 1980

Place: Purdue University

Objective: The course content is general to many fluid machinery systems utilizing pressure actuated flexible valves, however, class examples will emphasize small, high-speed, refrigerant compressors. Interest is directed to the development of suitable mathematical models for the prediction of the dynamic motion of the flexible valve during the compressor cycle and the resultant stress field in the valve. Participants should be familiar with the mathematical simulation philosophy for compressors. Extension of the valve modeling to more detailed descriptions compatible with the general compressor simulation will be presented.

Contact: James. F. Hamilton, Ray W. Herrick Laboratories, School of Mech. Engrg., Purdue University, West Lafayette, IN 47907.

AUGUST

NOISE ANALYSIS

Dates: August 6-7, 1980

Place: Cincinnati, Ohio

Objective: This seminar will provide engineers concerned with noise analysis and control an introduction to the most current technology in this area. The session will be dedicated to presenting the latest noise analysis procedures, and the various noise control measures which can be employed, primarily related to product noise. Topics discussed will include: physical acoustics, psycho-acoustics, time series analysis, source identification, structural frequency response, noise control, absorption, barriers, isolation, stiffening, and damping.

Contact: Mrs. Gayle Lyons, SDRC Seminar Coordinator, Structural Dynamics Research Corp., 2000 Eastman Drive, Milford, OH 45150 - (513) 576-2594.

FATIGUE ANALYSIS

Dates: August 13-14, 1980
Place: San Diego, California
Dates: September 10-11, 1980
Place: Cincinnati, Ohio
Objective: The growing understanding of the important factors in the fatigue failure process coupled with the accumulation of new, correctly obtained, fatigue test data and material property and behavior data, has led to the practical application of fatigue analysis methods. The vast improvements in stress analysis, both computerized design analysis (finite element methods, etc.) and experimental testing techniques (digital Fourier analysis, cycle counting methods, etc.) have enabled engineers and designers to get a more fundamental understanding of fatigue. The seminar will address the topics of cyclic stress-strain behavior of metals, fatigue properties of metals and cumulative damage procedures.

Contact: Mrs. Gayle Lyons, SDRC Seminar Coordinator, Structural Dynamics Research Corp., 2000 Eastman Drive, Milford, OH 45150 - (513) 576-2594.

SEPTEMBER

9TH ADVANCED NOISE AND VIBRATION COURSE

Dates: September 15-19, 1980
Place: Institute of Sound and Vibration Research, University of Southampton, UK
Objective: The course is aimed at researchers and development engineers in industry and research establishments, and people in other spheres who are associated with noise and vibration problems. The course, which is designed to refresh and cover the latest theories and techniques, initially deals with fundamentals and common ground and then offers a choice of specialist topics. The course comprises over thirty lectures, including the basic subjects of acoustics, random processes, vibration theory, subjective response and aerodynamic noise, which form the central core of the course. In addition, several specialist applied topics are offered, including aircraft noise, road traffic noise, industrial machinery noise, diesel engine noise, process plant noise, and environmental noise and planning.

Contact: Mrs. O.G. Hyde, ISVR Conference Secretary, The University, Southampton, S09 5NH UK-Southampton (0703) 559122, Ext. 2310 or 752, Telex: 47661.

MODAL ANALYSIS

Dates: September 17-19, 1980
Place: Cleveland, Ohio
Objective: This seminar will provide information on new techniques for identifying dynamic structural weaknesses. The sessions include the use of state-of-the-art instrumentation and software for creating a dynamic structural model in the computer. Techniques will be demonstrated for mode shape calculation and animated displays, computation of mass, stiffness and damping values and modal manipulation methods.

Contact: Bob Kiefer, Spectral Dynamics, P.O. Box 671, San Diego, CA 92112 - (714) 268-7100.

OCTOBER

VIBRATION TESTING

Dates: October 6-9, 1980
Place: San Diego, California
Objective: Topics to be covered are: exciters, fixtures, transducers, test specifications and the latest computerized techniques for equalization, control, and protection. Subjects covered include dynamics and dynamic measurements of mechanical systems, vibration and shock specifications and data generation. Demonstrations are given of sine random and shock testing and of how test specifications are met.

Contact: Bob Kiefer, Spectral Dynamics, P.O. Box 671, San Diego, CA 92112 - (714) 268-7100.

PREVIEWS OF MEETINGS

26th ANNUAL TECHNICAL MEETING OF INSTITUTE OF ENVIRONMENTAL SCIENCES MAY 11-14, 1980

The Institute of Environmental Sciences (IES) will conduct its 26th Annual Technical Meeting at the Marriott Hotel, Philadelphia, Pennsylvania on May 11-14, 1980. The General Chairman, Mr. Henry Pusey of the Shock and Vibration Information Center, announced that the theme of the meeting will be "Life Cycle Problems and Environmental Technology." The technical program, planned by Mr. Henry Caruso of Westinghouse Electric Co., is scheduled as a series of interdisciplinary technical seminars. The Keynote Speaker will be Joseph G. Gavin, Jr., President of the Grumman Corporation. An equipment exposition will be held in conjunction with the meeting.

This year's theme, "Life Cycle Problems and Environmental Technology," has significance for a diverse variety of technical disciplines. But regardless of which life cycle problems are considered, they can be solved only by the carefully coordinated integration of many individual technical disciplines. No one technical discipline can stand alone. Each is but one piece in the complex puzzle of technology interrelationships that surround the current issues and controversies in the environmental sciences.

The technical seminars of interest to the sound, shock and vibration engineer follow.

Seminar I

THE CRITICAL NEED FOR ENVIRONMENTAL INTEGRATION: SPECIFICATION, DESIGN AND TEST

Monday, May 12

- Myths and Sacred Cows in Environmental Design and Test
- Technical Information Resources

Tuesday, May 13

- Environmental Integration: Design and Test
- Specifications and Standards

Wednesday, May 14

- Environmental Stress Screening - What's Going On Now?
- Environmental Stress Screening - How Much is Enough?
- Utility of Combined Environment Testing

Seminar II

THE CHALLENGE OF ENVIRONMENTAL TEST TAILORING FOR ELECTRONIC HARDWARE

Monday, May 12

- Keynote Address
- Test Tailoring

Tuesday, May 13

- Equipment Exposition
- Practical Environmental Reliability Modeling
- Low-Cost Vibration Alternatives

Seminar III

EMERGING TECHNOLOGY IN ENVIRONMENTAL TESTING AND MEASUREMENT

Tuesday, May 13

- New Directions in Acoustic Test Facilities
- Industrial Noise Control
- High-G Shock and Vibration
- Shock/Vibration Fixture Problems

Wednesday, May 14

- Instrumentation, Digital Control and Processing

Proceedings of the 26th Annual Technical Meeting will be published and distributed as part of the registration fee (except to students). The **1980 PROCEEDINGS ($25.00 prepaid)** may be ordered as indicated on the registration form elsewhere in this Advance Program. Proceedings of all past IES conferences are available from the National Office of the **Institute of Environmental Sciences, 940 East Northwest Hwy., Mt. Prospect, IL 60056, 312/255-1561.**

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

An International Conference on Recent Advances in Structural Dynamics

An International Conference on Recent Advances in Structural Dynamics will be held July 7-11, 1980 at the Institute of Sound and Vibration Research, University of Southampton, Southampton, England.

INTRODUCTION

In recent years considerable advances have been made in both theoretical and experimental techniques for solving problems in structural dynamics. In addition, a great deal of experience has been gained in applying these techniques to practical situations. This Conference aims to bring together researchers and practicing engineers, from the different branches of engineering, so that these techniques should receive the wildest dissemination.

PROPOSED TOPICS

Developments in Theoretical Structural Dynamics
Finite element methods, boundary element methods, approximate design methods. Solution methods for transient and random excitations, and representation of damping.

Developments in Testing Techniques
Acquisition and analysis of vibration data, system identification, interpretation of experimental data for vibration control.

Application of Theory and Correlation with Experiment
Vibration of transport vehicles, bridges, buildings, nuclear reactors, off-shore structures. Methods of vibration reduction and control.

Structure-Fluid Interaction
Vibration of ship structures, off-shore structures, piping systems, acoustic cavities with flexible walls.

Vibration of Composite Structures
Fibre reinforced materials, laminated composite and sandwich panels. Dynamic stiffness and damping properties, response, fatigue and optimal design.

Wave Propagation
Wave propagation due to transient loads, wave propagation in structural elements (structure-borne sound), propagation in periodic structures, propagation of ground vibration.

Machinery Vibration
Vibration of blade and bladed-disc assemblies, vibration of machine tools, vibration of engine structures.

Dynamic Stability
Non-linear vibration, parametric vibration, rotating machinery, self-excited oscillations.

INVITED LECTURES

1. Developments in theoretical structural dynamics
L. Meirovitch, USA
2. Dynamic analysis of off-shore steel structures - measurement and prediction of fatigue life
M.G. Hallam, UK
3. Acoustoelasticity
E.H. Dowell, USA
4. Vibration of composite structures
C.W. Bert, USA
5. Structure-borne sound
M. Heckl, West Germany
6. Bladed disc assemblies
D.J. Ewins, UK
7. Some development in parametric stability and non-linear vibration
A.D.S. Barr, UK

For further information please contact:

Mrs. O.G. Hyde
ISVR Conference Secretary
The University
Southampton, S09 5 NH
England
(0703) 559122, Ext. 2310/2297
Telex: 47661

ABSTRACTS FROM THE CURRENT LITERATURE

Copies of articles abstracted in the DIGEST are not available from the SVIC or the Vibration Institute (except those generated by either organization). Inquiries should be directed to library resources. Government reports can be obtained from the National Technical Information Service, Springfield, VA 22151, by citing the AD-, PB-, or N- number. Doctoral dissertations are available from University Microfilms (UM), 313 N. Fir St., Ann Arbor, MI; U.S. Patents from the Commissioner of Patents, Washington, D.C. 20231. Addresses following the authors' names in the citation refer only to the first author. The list of periodicals scanned by this journal is printed in issues 1, 6, and 12.

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MECHANICAL SYSTEMS

ROTATING MACHINES

(Also see Nos. 694, 784, 788, 797, 806, 891, 904, 906, 930)

80-663

Torque Control: Stop Damage Before It Starts

R.S. Bhise
Winsmith Div., UMC Industries, Inc., Springville, NY,
Power Transm. Des., pp 45-47 (Nov 1979) 4 figs

Key Words: Rotating structures, Torque

This article illustrates some of the torque control devices most often used with speed reducers.

80-664

On the Motion of a Variable-Mass Rotor in a Particular Transient

P.G. Molari
Istituto di Meccanica Applicata alle Macchine dell'-Universita di Bologna, Meccanica, 13 (1), pp 56-61 (Mar 1978) 4 figs, 4 refs

Key Words: Rotors, Variable cross section, Variable material properties, Runge-Kutta method, Bessel functions

This paper considers a variable mass and diameter rotor having constant peripheral speed. Such rotor sketches a bobbin on which tape or wire are wound. Two methods of solution are being compared: the first one performs the integration of the movement equations following the Runge-Kutta method; the second, using the Bessel functions, reduces the integration itself to the solution of four differential equations of the first order independent from each other. A numerical example is given.

80-665

Vibration and Buckling of Rotating Flexible Rods at Transitional Parameter Values

W.D. Lakin and A. Nachman
Dept. of Mathematical and Computing Sciences, Old Dominion Univ., Norfolk, VA 23508, J. Engr. Math., 13 (4), pp 339-346 (Oct 1979) 7 refs

Key Words: Rods, Rotating structures, Rotors, Boundary value problems

The connection between vibration and buckling problems for a uniform flexible rod which is clamped at one end and rotates in a plane perpendicular to the axis of rotation is considered. The rod is assumed off-clamped, i.e. the axis of rotation does not pass through the rod's clamped end. The resulting fourth-order boundary value problem with a turning point for the free vibrations is solved using uniform approximations in a transitional parameter range where high rotation rates balance small off-clampings. Second approximations to the vibration eigenvalues are used to determine critical buckling rotation rates for the slightly off-clamped rods.

80-666

Investigation of Load-Induced Non-Synchronous Whirl Instabilities in Rotating Machinery

J.M. Vance, G.N. Sandor, K.E. Ard, and F.J. Laudadio
Rotordynamics Lab., Florida Univ., Gainesville, FL,
Rept. No. ARO-15041.2-E, 126 pp (Mar 1979)
AD-A071 716/5GA

Key Words: Rotors (machine elements), Shafts (machine elements), Flexible shafts, Stiffness, Whirling

Seven tasks are described which were designed to reach the objectives. At the time of termination of the grant, these tasks were in various stages of completion, as described in this report: tasks 1 and 2: experimental verification of 'torquewhirl'; task 3: measurement of the alford force; task 4: comparison of test data with theory; task 5: inclusion of a more general shaft flexibility in the 'torquewhirl' theory; task 6: derivation of the linearized stiffness damping, and cross-coupling for use in a computer stability analysis; and task 7: load-dependent stability predictions for a machine of realistic complexity.

80-667

Calculation of Propeller-Excited Whirling Critical Speeds

R. Woytowich
Machinery Tech. Staff, American Bureau of Shipping, New York, NY, J. Ship Res., 23 (4), pp 235-241 (Dec 1979), 2 figs, 4 refs

Key Words: Shafts, Propeller-induced excitation, Whirling, Critical speeds

This paper presents a calculation method, suitable for manual calculation or use with a small, desk-top calculator, for estimating the propeller-excited whirling critical speed of a shafting system. The proposed calculation method includes propeller gyroscopic and inertia effects, as well as shaft mass effects. Comparisons between the results of the proposed hand calculation and the results of other well-known methods of whirling analysis are presented for a typical vessel shafting system. Extensions of the proposed calculation to include the effects of the line shafting and the sterntube bearing stiffness are also presented.

80-668

Prevention of Torsional Vibration in Fan Motor Shaft Systems with Multiblade Fans (2nd Report: Effect of Making the Shaft System Symmetrical on Vibration Reduction)

F. Fujisawa, Y. Segawa, and M. Shiga

Mech. Engrg. Research Lab., Hitachi Ltd., Hitachi, Japan, Bull. JSME 22 (171), pp 1299-1306 (Sept 1979) 7 figs, 8 tables, 4 refs

Key Words: Shafts (machine elements), Fans, Torsional vibration, Resonant frequencies, Vibration control

A thyristor-controlled multiblade fan motor generates noise from fans when torsional vibrations in its shaft system resonate with the pulsation torque of the fan motor. The conditions necessary to avoid torsional resonance in a shaft system with multiblade fans at both ends of the shaft are analyzed. The effect of making a shaft system symmetrical on vibration reduction is examined.

80-669

The Influence of Piston Slap and Crankshaft Torsional Vibration on Engine Structure Noise in High Speed Diesel Engines

H. Okamura

Dept. of Mech. Engrg., Faculty of Science and Tech., Sophia Univ., 7 Kioicho, Chiyoda-ku, Tokyo, Japan 102, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 255-260, 5 figs, 1 table, 7 refs; Avail: see 80-931

Key Words: Crankshafts, Pistons, Diesel engines, Torsional vibration, Noise generation

The influence of piston slap and crankshaft torsional vibration on engine structure noise in high speed diesel engines is examined.

80-670

Vibrations of Impellers (Part 3. An Analysis of Coupled Vibrations between a Disk and Blades Using a Reduced Impedance Method)

S. Michimura, A. Nagamatsu, and K. Asazuma

Tokyo Inst. of Technology, Meguro-ku, Tokyo, Japan, Bull. JSME, 22 (171), pp 1293-1298 (Sept 1979) 10 figs, 4 refs

Key Words: Impellers, Disks (shapes), Blades, Impedance technique

A reduced impedance method is proposed in order to analyze vibrations of complex mechanical structures. Natural frequencies and modes of coupled vibrations between a disk and blades of an impeller are analyzed using this method. In this method a total structure is considered as an assembly of some sub-structures, and reduced impedance matrices on combined regions in each sub-structure are calculated; they are composed together to make dynamic equations of the total system. The results of the theoretical analysis are in good agreement with the experimental ones.

80-671

Fatigue Failures of Compressor Impellers and Resonance Excitation Testing

F.L. Van Laningham and D.E. Wood

Union Carbide Corp., Houston, TX, Proc., 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 1-9, 14 figs

Key Words: Impellers, Compressor impellers, Fatigue life, Fluid-induced excitation

The similarity of failures of impellers in centrifugal compressors soon after initial start up and failures of impellers in other compressors after about seven years of successful operation and the test programs to define the problems are described. Both the shop and field testing, including corrective action, are discussed.

80-672

Design and Full Load Testing of a High Pressure Centrifugal Natural Gas Injection Compressor

V.K. Sood
Elliott Co., Jeannette, PA, Proc., 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 35-42, 19 figs, 2 tables, 6 refs

Key Words: Compressors, Dynamic tests, Design techniques

This paper discusses the design of a high pressure reinjection centrifugal compressor. This compressor was tested in the manufacturer's shop under full load to simulate the field operating conditions in terms of inlet/discharge pressures, flows, horsepower, gas density, etc. The pressure transducer data verified that the pressure pulsations at the inlet and discharge of a centrifugal compressor are very small even at high operating pressures. Reliable centrifugal compressors can be manufactured with the use of state of the art technology.

80-673
On the Dynamics of Compressor Surge
A. Tondl
National Res. Inst. for Machine Design, 250 97 Praha 9, Bechovice, Czechoslovakia, Intl. J. Nonlin. Mech., 14 (4), pp 259-266 (1979) 9 figs, 5 refs

Key Words: Pumps, Compressors, Self-excited vibrations, Surges

Investigations concerned with the stability of stationary states and the possibility of self-excited oscillation (surge) occurring in systems with a centrifugal compressor (or a centrifugal pump) lead, for a simplified model, to an analysis of a set of two first-order differential equations. The paper presents such an analysis for the case when the machine characteristic can be expressed by a continuous unique curve as well as for that when the characteristic is neither a unique nor even a smooth curve.

80-674
Effects of Fluid-Filled Clearance Spaces on Centrifugal Pump and Submerged Motor Vibrations
H.F. Black
Heriot-Watt Univ., Edinburgh, UK, Proc., 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 29-34, 7 figs, 8 refs

Key Words: Pumps, Clearance effects

The paper explains the effects of fluid-filled clearance spaces on centrifugal pumps and submerged motor vibrations.

80-675
Fan Drives on Construction Equipment?
M.E. Rumbaugh, Jr. and J.J. Pisarski
NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 25-32, 1 fig, 3 tables, Avail: see 80-931

Key Words: Fans, Cooling systems, Construction equipment, Noise reduction

The object of this paper is to present the results of one developmental effort and test project undertaken in the past year to further reduce the noise level of construction equipment cooling systems. The project was undertaken to evaluate the application of fan drives and/or fan clutches to construction equipment and to measure the effectiveness of such units. Prior to presenting the test results, some basic cooling system noise abatement principles are briefly presented, followed by a description of the various types of fan drives that are currently available on the market. Next, the equipment and test procedures used in this project are described, followed by the results achieved to date on the project.

80-676
Noise Characteristics and Outlet Flow Field of Axial Flow Fans
H. Fujita
Mechanical Engrg. Res. Lab., Hitachi, Ltd., Tsuchiura, 300 Japan, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 79-85, 3 figs, 4 refs; Avail: see 80-931

Key Words: Fans, Cooling systems, Aerodynamic characteristics, Noise generation

In this work, noise and aerodynamic characteristics are studied on low speed axial flow fans in order to determine the effect of various parameters such as shape and number of blades, blade load and flow inlet conditions. In addition to the usual performance tests, detailed measurements of the outlet flow fields were carried out with hot-wire anemometers. The technique of ensemble averaging was used to extract periodic components of the signals phase locked with the impeller rotation. All three components of the velocity and the streamwise vorticity were measured by an "X" type hot-wire probe rotated axially.

80-677
The Acoustics of Turbo-Superchargers (Akustische Untersuchungen an Abgasturboladern)

P. Költzsch, J. Plundrich, and K. Biehn
Zentralinstitut f. Arbeitsschutz, Dresden, Germany, Maschinenbautechnik, 28 (3), pp 124-126 (Mar 1979) 8 figs, 1 table, 5 refs
(In German)

Key Words: Turbomachinery, Noise reduction

The acoustic characteristics of turbosuperchargers are described and several test results of intake silencers are presented. The sound pressure and the acoustic response spectra contain narrowband and broadband components. The emitted sound power is directly proportional to the compressor power. An optimal acoustical design for the intake silencer is presented. Good agreement is found between the calculated and measured values of noise reduction. The effect of operating parameters on the effectiveness of the intake silencer is also investigated.

80-678

Turbomachines: How to Avoid Operating Problems

C. Jackson and M.E. Leader
Monsanto Chemical Intermediates Co., Texas City, TX, Hydrocarbon Processing, 50 (11), pp 281-284 (Nov 1979) 14 figs, 1 ref

Key Words: Turbomachinery, Vibration monitoring

Engineers have several options to avoid operating turbomachines near critical speeds: speeds where serious rotor damage can occur from resonant vibrations: check bearing stiffness, shaft stiffness, span between bearings, and critical speeds.

80-679

A New Vibration Criteria for High Speed Large Capacity Turbomachinery

K. Shiraki and H. Kanki
Takasago Tech. Inst., Mitsubishi Heavy Industries, Ltd., Takasago, Japan, Proc., 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 59-70, 24 figs, 4 tables, 6 refs

Key Words: Critical speed, Turbomachinery, Modal analysis

This paper presents the development and analysis of new critical speed criteria. The critical speed has been defined as the resonant speed of the rotor bearing system at which large response amplitudes can occur. This new critical speed criteria, considering damping, Q-factor criteria, and modal mass consideration, is developed based on operating experience, analysis and physical considerations. The procedure that is followed in the analysis is shown and the approximate modal analysis used is introduced. Typical low sensitive rotors are used as examples to illustrate the application of the analysis.

80-680

Exciter and Attenuation Forces by Lattice Flow in Axial-Flow Compressors (Erreger- und Dämpfungskräfte durch die Gitterströmung in Axialverdichtern)

H. Sauer
VEB Bergmann-Borsig/Gorlitzer Maschinenbau, Werk Berlin, Maschinenbautechnik, 28 (2), pp 80-84 (Feb 1979) 8 figs, 7 refs
(In German)

Key Words: Turbomachinery, Compressors, Fluid-induced excitation, Damping

The excitation forces in upstream lattices, caused by wake nonuniformity, are derived from the flow conditions through the lattices. The introduction of the frequency-dependent influence function and the derivative of lift coefficient of the single profile provides the basis for a theoretical calculation of excitation and damping force. Measurements taken by an axial flow compressor and in a wind tunnel confirm the theoretical results.

RECIPROCATING MACHINES

(Also see Nos. 791, 793, 903)

80-681

Isolation of Engine Components

W.G. Halvorsen and R.G. Smiley
Anatrol Corp., Cincinnati, OH, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 215-224, 10 figs, 1 table, 2 refs; Avail: see 80-931

Key Words: Engines, Noise reduction, Vibration isolation

Covers and attachments of engines are often major radiators of sound. The major source of excitation for such components is usually the basic engine structure, with structure-borne excitation generally much more significant than air-borne excitation. In some cases the sound radiated by engine components can be reduced by controlling the frequency response of the components, such as by increasing structural damping through the use of damped laminated sheet metal.

80-682

Noise Control of Diesel-Powered Underground Mining Equipment

J.A. Burks and R. Madden

U.S. Bureau of Mines, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 275-282, 5 figs; Avail: see 80-931

Key Words: Mining equipment, Noise reduction, Diesel engines

Since passage of the Coal Mine Health and Safety Act of 1969, the Bureau of Mines has sponsored extensive research to determine the noise levels associated with mining equipment; the noise exposure of miners; and how principal noise-makers can be quieted. Diesel-powered machinery used in mines can be divided into two broad categories: loading/hauling equipment and service vehicles.

80-683

Dynamic Behaviour of Driving Systems at Starting with Asynchronous Motors (Zum dynamischen Verhalten von Antriebssystemen beim Anfahren mit Asynchronmotoren)

D. Pawandenat, B. Matthes, and R. Leonhardt

Dresden, Germany, Maschinenbautechnik, 28 (2), pp 59-61 (Feb 1979) 8 figs, 8 refs

(In German)

Key Words: Drive line vibrations, Asynchronous motors

The torques created by the airgap moment in a driving system during the start-up with an asynchronous motor are greater than it is usually assumed in the calculations. A calculation which would closely approximate actual conditions should include all system parameters, i.e. those of the electric drive, as well as, mechanical components. In the paper the measurement results and the corresponding theoretical calculations are discussed.

80-684

The Effect of Asynchronous Motor on the Torsional Vibrations of Machine Tool Drives (Einfluss des Asynchronmotors auf das Drehschwingungsverhalten der Werkzeugmaschinenantriebe)

G. Gebhardt

Institut f. Werkzeugmaschinen der Universität, Stuttgart, Germany, Konstruktion, 31 (11), pp 439-445 (Nov 1979) 8 figs, 4 refs

(In German)

Key Words: Machine tools, Asynchronous motors

Low frequency vibrations of machine tool drive components are strongly affected by the properties of the asynchronous motors. A mathematical model is presented for the calculation of these vibrations. It describes the properties of the motor and a multimass torsional vibrator with side chains, and the additional shaft deflections. The frequency characteristic of a machine tool drive with asynchronous motor is measured and compared with the calculated values. A parameter investigation shows which electric characteristics have the greatest effect.

METAL WORKING AND FORMING

(Also see No. 789)

80-685

Time Response of Cutting Force Components of the Hobbing Machine Hobs. Part I: Computer Program FRDYN (Ermittlung des zeitlichen Verlaufs der Zerspankraftkomponenten beim Walzfrasen. Teil I: Digitalrechnerprogramm FRDYN)

K. Bouzakis

Lab. f. Werkzeugmaschinen und Betriebslehre der Rheinisch-Westfalischen Technischen Hochschule, Aachen, West Germany, VDI Z., 121 (19), pp 943-950 (Oct 1979) 9 figs, 1 table, 22 refs

(In German)

Key Words: Machine tools, Cutting, Computer programs

For an optimum design of a hobbing machine, as well as for maintaining its static and dynamic capacity limits, the time response of the expected forces is required. Until now, cutting force components have not been numerically calculated. For that purpose a computer program FRDYN was developed. It accurately determines the characteristics of cutting force components at all operating conditions and hobbing procedures. In this first part of the paper the computer program FRYDN is presented and its validity tested by a comparison with cutting force measurements.

80-686

Determination of Time Response of Cutting Force Components in the Hobbing Machine Hobs. Part II. The Effects of Technical Parameters of the Machine Tool and Wheel Geometry (Ermittlung des zeitlichen Verlaufs der Zerspankraftkomponenten beim Walzfrasen. Teil 2: Einflusse technologischer Parameter, der Werkzeuggeometrie und der Werkradgeometrie)

K. Bouzakis

Lab. f. Werkzeugmaschinen und Betriebslehre der Rheinisch-Westfalischen Technischen Hochschule, Aachen, Germany, VDI-Z., 121 (20), pp 1016-1026 (Oct 1979) 27 figs, 28 refs

Key Words: Machine tools, Cutting

Using the computer program FRDYN, described in the first part of this paper, the effects of technological parameters, such as the axial displacement, the depth of immersion and the effect of the hobbing process on the cutting force components may be determined. In addition, the cutting force components are determined independently of the geometry of the machine tool, for example the number of gears, number of supports, and the outer diameter of hobs. Finally, the effect of wheel geometry on time response of the cutting force components is investigated.

80-687

The Efficiency and Clash Load of Impact Forming Machines to the Second Order of Approximation

S. Vajpayee, M.N. Sadek, and S.A. Tobias

Dept. of Mech. Engrg., Univ. of Birmingham, UK, Intl. J. Mach. Tool Des. Res., 19 (4), pp 237-252 (1979) 10 figs, 8 refs

Key Words: Machine tools, Machining, Metal working

A theoretical analysis is given of the dynamics of a single-acting impact forming machine with the aim of establishing the relationship between the efficiency of energy transfer and that of the clash load and the machine/process parameters. The machine is assumed to be represented by an equivalent single-degree-of-freedom system excited by a time-dependent pulse which simulates the forming load arising in the cold upsetting of billets.

80-688

Noise Reduction and Increased Productivity in Forging: A Progress Report

H.A. Evensen, A.A. Hendrickson, H.W. Lord, N.I. Dreiman, S. Dabrowski, T.C. Meier, and M.W. Trethewey

Michigan Tech. Univ., Houghton, MI, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 101-110, 1 table, 15 refs; Avail: see 80-931

Key Words: Forging machinery, Noise reduction

Forging works metals and alloys into useful shapes by hammering or pressing. It is the oldest of the metalworking arts with origins in the goldsmith, coppersmith and ironsmith of Biblical times. The forging industry's major environmental problem is control of noise, both within the plant and in the plant neighborhood. Effective noise control in forging is a uniquely difficult problem. Many of the basic elements of the forging process such as hammering, heating, blowing, cooling and cleaning are inherently noisy. Impulsive sound from the forge hammer, the tool which is the foundation of the forging industry's livelihood (2/3 of forging production is from hammers), presents the single most important and technically difficult noise problem for the forging industry.

80-689

Rotary Scrap Chopper Noise

D.B. Mortimer

Reynolds Metals Co., 6601 W. Broad St., Richmond, VA 23261, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 171-175, 3 figs; Avail: see 80-931

Key Words: Metal working, Noise generation

Edge trimming of coiled aluminum sheet products is one operation that can contribute to high noise levels in manufacturing plants. The main noise problem is not the trimming operation itself but the subsequent chopping operation that cuts the trimmed scrap into more easily handled lengths for returning to the production cycle. Other methods of handling trimmed scrap such as scrap winding or scrap balling are available, but these operations have drawbacks of their own. The majority of edge trimming operations presently incorporate some type of rotary scrap chopper.

80-690

Quieter Metal Cutting Methods and Machinery

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Kaiser Aluminum & Chemical Corp., 300 Lakeside

Dr., Oakland, CA 94643, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 163-169, 4 figs, 10 refs; Avail: see 80-931

Key Words: Metal working, Noise generation

Metal sawing generates one of the most common and difficult noise problems in industry today. This complex problem involves aerodynamic and structureborne sources that radiate from the saw blade and/or the work piece. New methods and machinery are presented which can reduce these sources up to 20 dBA.

80-691

Noise Generation Mechanisms for Machines Employing Circular Saw Blades

J.S. Stewart

Noise Control Services, Inc., P.O. Box 5670, Greensboro, NC, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 53-61, 8 figs, 7 refs; Avail: see 80-931

Key Words: Saws, Noise generation

In this paper, only the additive sources resulting from saw blade-workpiece interaction are considered in detail; however, it should be recognized that the various other sources should be analyzed carefully prior to attempting noise control.

80-692

Solutions for Noise Reduction on Circular Saws

M. Zockel, D.A. Bies, and S.G. Page

Mechanical Engrg. Dept., Univ. of Adelaide, Adelaide, South Australia 5000, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 373-383, 5 figs, 2 tables, 8 refs; Avail: see 80-931

Key Words: Saws, Noise reduction

In a program to help reduce saw noise in South Australia's woodworking and metal industries, an experimental program was set up to investigate the parameters affecting the idle and cutting noise sources. The work concentrated on existing saw blades and did not consider the possibility of modifying the tooth geometry.

80-693

The Use of Elastomers in Rolling Contact Surfaces

J.G. Bollinger, R.H. Chan, and J.F. Yerges

Dept. of Mech. Engrg., Univ. of Wisconsin, 1513 University Ave., Madison, WI 53706, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 63-70, 6 figs; Avail: see 80-931

Key Words: Wire stranding machinery, Rolling friction, Noise reduction, Elastomers

The idler rolls used to support the long steel tubular rotors of wire stranding machines provide a severe example of rolling contact noise generation. This paper outlines design considerations for elastomer covered rolls. A specific load-speed range is considered which represents a wide selection of industrial wire stranders. A roll test stand is discussed which is being used to generate design data for roll application. Data on roll temperature rise and power consumption for a typical design are presented.

ELECTROMECHANICAL SYSTEMS

80-694

Application of Multivariable Frequency Response Methods to Control of Turbogenerators

S.I. Ahson and B.W. Hogg

Dept. of Electrical Engrg. & Electronics, The Univ. of Liverpool, Liverpool L69 3BX, UK, Intl. J. Control, 30 (4), pp 533-548 (Oct 1979) 10 figs,18 refs

Key Words: Turbomachinery, Control equipment, Frequency response methods

This paper deals with the design, evaluation and testing of an integrated control scheme for a turbogenerator equipped with a high-gain thyristor exciter and an electro-hydraulic governing system. Multivariable frequency response methods are used.

STRUCTURAL SYSTEMS

BRIDGES

(Also see Nos. 778, 868)

80-695

Motion of Suspension Bridges in Turbulent Winds

Y.K. Lin

Univ. of Illinois at Urbana-Champaign, IL, ASCE J. Engr. Mech. Div., 105 (EM6), pp 921-932 (Dec 1979) 2 figs, 18 refs

Key Words: Bridges, Suspension bridges, Wind-induced excitation

The first and second stochastic moments of the motion of a suspension bridge under the excitation of a natural wind are evaluated theoretically on the assumptions that typical scale of turbulence in the wind flow is much larger than the lateral dimensions of the bridge, and that the turbulence field is convected at a high velocity relative to the bridge.

80-696

Dynamic Response of Single Span Highway Bridges

S.G. Hutton and Y.K. Cheung

Dept. of Mech. Engrg., Univ. of British Columbia, Canada, Intl. J. Earthquake Engr. Struc. Dynam., 7 (6), pp 543-553 (Nov/Dec 1979) 11 figs, 10 refs

Key Words: Bridges, Ground vehicles, Moving loads, Modal analysis, Interaction: vehicle-structure

The dynamic response of single span simply supported bridge decks subjected to the passage of vehicles is examined. A modal analysis approach is adopted that is based upon a finite strip idealization of the deck. The vehicle is modelled as a rigid body supported at two points by a suspension idealization that accounts for the effect of tire stiffness and the frictional nature of real suspension systems. Results are presented for an orthotropic slab deck and a box girder deck that illustrate the effects of the initial precompression of the suspension system as the vehicle enters the span; the ratio of the vehicle's natural frequency to that of the bridge deck; and a bridge deck surface profile that is not perfectly horizontal.

80-697

Natural Frequency of Curved Box Girder Bridges

C.P. Heins and M.A. Sahin

Univ. of Maryland, College Park, MD, ASCE J. Struc. Div., 105 (ST12), pp 2591-2600 (Dec 1979) 1 fig, 8 tables, 8 refs

Key Words: Bridges, Box type structures, Girders, Natural frequencies

This paper presents the results of a comprehensive study which has permitted the development of a series of empirical equations used for direct evaluation of the natural frequency of straight and curved box girders. The natural frequency of curved box girders has been obtained by utilizing a computer oriented finite difference scheme. The natural frequency results obtained from the computer program were compared to measured frequencies of a series of test bridges. Excellent correlation was observed. A parametric study was then performed on a series of simple, two and three span continuous curved bridges.

80-698

The Three-Dimensional Response of Structures Subjected to Traveling Rayleigh Wave Excitation

S.D. Werner and L.C. Lee

Agbabian Associates, Engineers and Consultants, El Segundo, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 693-702, 9 figs, 10 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Bridges, Seismic response, Rayleigh waves

This paper examines how spatially varying excitations associated with Rayleigh waves influence the three-dimensional response of a simple bridge structure.

80-699

Damage to Highway Bridges and Other Lifeline Systems from the Miyagi-Ken-Oki, Japan Earthquake of June 12, 1978

K. Kuribayashi, Y. Shioi, T. Tazaki, and K. Kawashima

Public Works Res. Inst., Ministry of Construction, Japan, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg.,

Auq 22-24, 1979, Stanford Univ., Stanford, CA, pp 353-362, 2 tables, 10 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Bridges, Lifeline systems, Earthquake damage

The Miyagiken-oki Earthquake of June 12, 1978 with 7.4 of Magnitude brought many disasters to Sendai City. After the earthquake, various facts concerned with earthquake disaster prevention measures were investigated in cooperation with various organizations. The survey aims at a successful analysis on structural damage and repair to highway structures, especially bridges, and functional damage and rehabilitation of lifeline systems.

BUILDINGS

(Also see Nos. 776, 777, 840, 841, 871, 893, 901)

80-700

Design Considerations for Plywood Diaphragms in Seismic Zone 4

J.R. Rissell

Appl. Research Dept., American Plywood Assn., Tacoma, WA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 953-958, 1 table, 9 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Roofs, Floors, Seismic design, Earthquake resistant structures

The advent of Seismic Zone 4, as well as the trend to increased building size, has resulted in a requirement for higher design shears. All of the widely accepted model building codes allow the calculation of diaphragm strength by the principles of mechanics, using the values for fastener strength and plywood shear values as specified by the code. The research reported and discussed in this paper is conducted primarily to determine if the presently accepted design method, based on the principles of mechanics, will accurately predict the performance of diaphragms designed for much higher loads.

80-701

Study on Aseismic Capacity of a HiRC (Highrise Reinforced Concrete) Building Referenced to Newly Proposed Codes in Japan and U.S.A.

K. Muto, T. Sugano, and N. Inoue

Univ. of Tokyo, Japan, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 959-968, 14 figs, 3 tables, 4 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Multi-story buildings, Reinforced concrete, Seismic response, Standards and codes

This paper presents the re-evaluation of the aseismic capacity of the "G Tower" designed by the dynamic design procedure as referenced to the newly proposed codes of Japan and USA.

80-702

On Instrumental Versus Effective Acceleration, and Design Coefficients

J.A. Blume

URS/John A. Blume & Associates, Engineers, San Francisco, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 868-882, 4 figs, 3 tables, 17 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Measurement techniques, Seismic response spectra, Seismic design

The purposes of this paper are to attempt to clarify the situation, identify the most significant parameters and considerations inherent in the problem, and - to the extent feasible - reconcile or revise the great variations between recorded peak accelerations, dynamic design peak accelerations, spectral response accelerations, and code base shear coefficients. Acceleration, rather than velocity or displacement, will be used for convenience in comparisons.

80-703

An Overview of the State-of-the-Art in Earthquake-Resistant Reinforced Concrete Building Construction

V.V. Bertero

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 838-852, 6 figs, 25 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Reinforced concrete, Seismic design, Earthquake resistant structures

The main objectives of this paper are to: review the presently accepted philosophy of seismic-resistant construction and factors that should be considered in applying this philosophy; emphasize the importance of construction and maintenance aspects (alterations, repair, retrofitting, etc.); discuss problems involved in the design of future buildings and current knowledge for solving these problems; and formulate recommendations for research and development to improve present design, construction, and maintenance of reinforced concrete buildings.

80-704

Statistical Studies of Low-Rise Japanese Building Damage: The Miyagiken-Oki Earthquake of June 12, 1978

C. Scawthorn, Y. Yamada, and H. Iemura

Earthquake Engrg. Lab., Kyoto Univ., Kyoto, Japan, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 373-382, 5 figs, 3 tables, 24 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Seismic response, Earthquake damage, Statistical analysis

Damage data for Sendai City, Japan, due to the Miyagiken-oki earthquake of June 12, 1978 was collected and processed to provide damage ratios for buildings damaged, and monetary estimates of the damage. The data is for damage to low-rise Japanese residential structures, mostly of wood construction. Spectral accelerations in Sendai were determined using a "virtual epicenter", moved towards Sendai from the epicenter of record, together with existing spectral acceleration regressions. Combining correlations determined herein, a relation between spectral acceleration and damage cost was obtained.

80-705

Explicit Inelastic Dynamic Analysis and Proportioning of Earthquake-Resistant Reinforced Concrete Buildings

M. Fintel and S.K. Ghosh

Portland Cement Assn., Skokie, IL, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 393-402, 3 figs, 6 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Seismic design, Earthquake resistant structures

This paper proposes an alternative seismic design approach which represents a significant departure from the empirical Code approach. The suggested procedure uses earthquake accelerograms as loading, dynamic inelastic response history analysis to determine member forces and deformations, and resistances from tests for proportioning the members.

80-706

Nonlinear Overturning Effects in a Core-Stiffened Building

A.A. Huckelbridge, Jr. and R.A. Christ

Case Western Reserve Univ., Cleveland, OH, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 403-412, 5 figs, 9 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Multi-story buildings, Buildings, Earthquake damage, Seismic design, Standards and codes

At the current time there are no completely satisfactory building code provisions which consider, in a rational manner, the extreme overturning effects associated with severe seismic excitation. Model building codes generally prescribe lateral load magnitudes which are unrealistically low for linear response to a severe seismic event. Special detailing requirements, however, intended to insure adeouate available ductility for a structure's survival in case of an extreme event, are prescribed. Model codes usually require that overturning effects associated with the prescribed loading be resisted by the structural system.

80-707

A Practical Approach to Damage Mitigation in Existing Structures Exposed to Earthquakes

O. Kustu

URS/John A. Blume & Associates, Engineers, San Francisco, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 487-494, 4 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Damage prediction, Earthquake damage

In this paper, a method of comparing alternative structural strengthening schemes for existing buildings is presented. The method is intended to be used by owners or managers of existing buildings as a decision-making tool in the selection of the most economically feasible structural strengthening scheme in order to minimize their expected financial losses from future earthquakes.

80-708

Design Seismic Accelerations in Buildings

R. Smilowitz and N.M. Newmark

Weidlinger Assoc., Consulting Engrs., New York, NY, ASCE J. Struc. Div., 105 (ST12), pp 2487-2496 (Dec 1979) 2 figs, 4 tables, 6 refs

Key Words: Buildings, Seismic design, Earthquake resistant structures

A procedure is presented for determining the design distribution of story shears and overturning moments in buildings subjected to strong ground motions, with particular emphasis on tall buildings. A parameter study is conducted and modal analyses are performed to determine the influence of the following variables on the most probable response to earthquake excitation at various levels in a building: The type of structural behavior, ranging from that of a purely flexural beam to that of a purely shear beam; the fundamental frequency relative to the intersection of the linear branches of the response spectrum; the degree of structural setback, ranging from uniform to setback over 80% of the height; and the degree of foundation compliance.

80-709

Inelastic Behavior of Steel Braces Under Cyclic Loading

E.P. Popov

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 923-932, 10 figs, 1 table, 5 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Framed structures, Steel, Seismic response, Dynamic tests, Cyclic loading

In this paper some findings based on the results of 24 experiments on cyclically loaded members into the inelastic range are described and evaluated. The specimens employed were larger than those used by previous investigators. This permitted a direct use of structural rolled shapes employed in practice, and a simulation of the geometries of larger members.

80-710

Component Analysis - Will it Lead to Safer, More Economical Structures?

R.E. Englekirk

Ruthroff & Englekirk, Consulting Structural Engineers, Los Angeles, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 913-922, 1 fig, 2 tables, 4 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Seismic design, Earthquake resistant structures

Force levels required by current building codes for seismic resisting elements have increased dramatically over the past decade. Current force levels are assumed to be consistant with forces anticipated during a major earthquake if material factors of safety are included in the force resistance equation. The use of realistic force levels has brought about a more cost effective and reliable design for building materials with predictable yield levels and ultimate strengths.

80-711

Earthquake Response of Three Dimensional Steel Frames Stiffened by Open Tubular Concrete Shear Walls

C.N. Kostem and D.T. Heckman

Fritz Engrg. Lab., Lehigh Univ., Bethlehem, PA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 969-977, 2 figs, 2 tables, 13 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Framed structures, Walls, Stiffness, Seismic response

Medium-to-high rise steel building frames require substantial stiffening to withstand lateral loadings, if they are to be built in areas where seismic activities are of major concern. The employment of reinforced concrete shear walls as the lateral stiffening structural element has greatly enhanced the performance of the buildings.

80-712

Seismic Behavior of Diagonal Steel Wind Bracing

R.W. Clough and Y. Ghanaat

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 313-322, 14 figs, 6 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Seismic response, Parameter identification technique

The purpose of this study was to obtain experimental data on the seismic performance of a building frame with diagonal wind bracing, and to correlate these results with computer analyses. The tests were performed using the 20 ft square earthquake simulator facility at the Earthquake Engineering Research Center, University of California, Berkeley. The basic test structure was a three story steel building frame. In addition to the original rod bracing system, welded pipe X-bracing also was studied in this investigation. Results of these specific tests, and correlation of each with analytical predictions are described in this paper.

80-713

Criteria for Seismic Design of Low-Rise Brittle Buildings in Developing Countries

R. Razani

Pahlavi Univ., Shiraz, Iran, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 813-822, 1 fig, 8 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Seismic design

The main characteristics of a suitable earthquake protection policy for low-rise, low-cost housing of a brittle type in seismically active LDCs are described. This policy gives priority to designs of collapse resistant buildings. On the basis of the proposed policy a suitable criteria for the protection of buildings against earthquake damage and collapse in terms of maximum safe earthquake intensities are developed. A simple quantitative relationship between earthquake intensity and peak ground acceleration is obtained, and for each level of earthquake intensity a ground motion spectrum is proposed, and a corresponding structural response spectrum is determined. Simple design spectra for various classes of low-rise brittle buildings, such as unreinforced masonry and adobe low-cost housing, are proposed, and minimum required design lateral loads and base-shear coefficients for protection against earthquake damage and collapse are obtained.

80-714

A Documented Vertical Acceleration Failure

L.A. Wyllie, Jr. and C.D. Poland

H.J. Degenkolb & Associates, San Francisco, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1066-1075, 8 figs, 3 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Beams, Seismic response

The structure discussed in this paper is a concrete service station which contained relatively slender post-tensioned concrete beams supporting concrete canopies over the service islands. The structure was shown to one of the authors several months after the December 23, 1972, earthquake by a Nicaraguan structural engineer who had noted with interest the structural distress sustained by the building, possibly caused by vertical acceleration. This led to the analytical program described in this paper which shows that the post-tensioned concrete beams developed hinges within their span that can be attributed to the vertical component of ground motion, or vertical accelerations.

80-715

Dynamic Behavior of a Pedestal Base Multistory Building

R.M. Stephen and E.L. Wilson

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1076-1084, 7 figs, 1 table, 5 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Multistory buildings, Seismic response, Dynamic tests

Dynamic tests using forced and ambient methods were performed on the Rainier Tower Building in Seattle, Washington. Because of the potential advantages of the ambient vibration method in dynamic testing of full-scale structures, it was desirable to compare both methods in order to assess the accuracy of each method in evaluating the dynamic properties of the structural systems.

80-716

Seismic Response of Equipment in Multi-Story Structures: Response Evaluation and Test Simulation

J.C. Wilson and A.C. Heidebrecht

Dept. of Civil Engrg. and Engrg. Mechanics, McMaster Univ., Hamilton, Ontario, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 543-552, 2 figs, 2 tables, 6 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Multi-story buildings, Equipment response, Seismic response, Testing techniques

This paper concentrates on two aspects of the problem of earthquake sensitive equipment in multi-story structures: examining characteristics of the seismic environment at equipment mounting locations in the buildings; and utilization of shake table tests as a means of examining the seismic adequacy of equipment test specimens.

80-717

Reliability of Seismic-Resistant Frames Designed by Inelastic Spectra

F. Casciati, L. Faravelli, and A. Gobetti
Univ. of Pavia, Italy, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 553-562, 7 figs, 2 tables, 14 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Multi-story buildings, Framed structures, Seismic design

The aim of this paper is to investigate the reliability level corresponding to structures designed by using inelastic spectra at different values of the load factor. The considered limit-state is defined by excessive inelastic deformations. This study is performed with reference to a specified multi-story frame in a given seismic region. The parameters that describe the variability in time of the ground acceleration are random variables. The parameters of this distribution function are calculated through a simulation procedure. For this purpose the structural response to each artificially yielded accelerogram is determined via a step-by-step integration technique on a simplified model of the actual frame.

80-718

Ground-Borne Noise and Vibration From Underground Rail Systems

L.G. Kurzweil
U.S. Dept. of Transportation, Transportation Systems Ctr., Environmental Tech. Branch, Kendall Square, Cambridge, MA 02142, J. Sound Vib., 66 (3) pp 363-370 (Oct 8, 1979) 6 figs, 1 table, 24 refs

Key Words: Buildings, Vibration excitation, Rail transportation, Interaction: rail-wheel, Ground motion

Ground-borne noise is one of the main causes of environmental impact from urban rail transit systems. The vibration resulting from track-train interaction is transmitted through the tunnel structure and the surrounding ground to adjacent buildings. The resulting vibrations of the walls and floors of these buildings cause secondary radiation of noise. This paper presents a method for estimating A-weighted sound levels as well as noise and vibration spectra due to ground-transmitted vibration in buildings near subways.

80-719

Ground Vibrations from Passing Trains

T.M. Dawn and C.G. Stanworth
British Railways Board, Railway Technical Centre, London Road, Derby DE2 8UP, UK, J. Sound Vib., 66 (3), pp 355-362 (Oct 8, 1979) 6 figs, 7 refs

Key Words: Buildings, Vibration excitation, Rail transportation, Interaction: rail-wheel, Ground motion

This paper examined the residual problems of ground-borne vibration, the vehicle and track features which might be responsible for generation, how it is propagated, and how it might affect wayside buildings. Experimental work has suggested various significant features of railway design which might merit attention.

80-720

General Approach to Active Structural Control

M. Abdel-Rohman and H.H.E. Leipholz
Univ. of Waterloo, Waterloo, Ontario, Canada, ASCE J. Engr. Mech. Div., 105 (EM6), pp 1007-1023 (Dec 1979) 11 figs, 1 table, 20 refs

Key Words: Buildings, Wind-induced excitation, Active control

A general approach is proposed to be used in the active control of civil engineering structures. The approach aims at satisfying, simultaneously, the safety of the structure, the desired human comfort, and the feasibility of control. The problem is formulated as an optimal control problem subjected to equality and inequality constraints. These constraints represent, respectively, the structure's model and the requirements on the controlled response. A method is offered to make the order of the system as small as desired. Also, an algorithm is offered that enables one to obtain a closed-loop control in the presence of the inequality constraints. The approach is applied to the active tendon control of a two-story building frame.

80-721

Deterministic Torsional Building Response to Winds

C.P. Patrickson and P.P. Friedmann

Nucleotech, Montreal, Canada, ASCE J. Struc. Div., 105 (ST12), pp 2621-2637 (Dec 1979) 7 figs, 1 table, 16 refs

Key Words: Buildings, Wind-induced excitation, Torsional response

The dynamic response of tall buildings to wind loads, including the torsional degree-of-freedom, is investigated using a sinusoidal pseudo-turbulent representation of atmospheric gusts superimposed on a mean wind velocity. Torsional effects are due to the offsets between a hypothetical aerodynamic center and the cross-sectional center of mass relative to the elastic axis or both.

TOWERS

(Also see No. 933)

80-722

Seismic Response of Elevated Liquid Storage Tanks

S.C. Lee and D.V. Reddy

Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 193-202, 4 figs, 3 tables, 12 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Storage tanks, Seismic response, Water towers

As many elevated water tanks of today are much larger in dimensions than those previously constructed, more sophisticated methods of analysis are required to determine their seismic behavior. The considerable need for predicting the response of the larger liquid storage tower structures, incorporating detailed shell behavior of the tank, has prompted the studies described in this paper. The work is restricted to the formulation of a procedure for seismic analysis of axisymmetric water towers on the seismic response analysis of ground-supported liquid storage tanks.

80-723

Seismic Analysis of Oil Refinery Structures

C.A. Kircher, R.M. Czarnecki, R.E. Scholl, and J.M. Gere

Jack R. Benjamin & Associates, Inc., Palo Alto, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 127-136, 5 figs, 6 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Columns, Towers, Seismic design, Seismic response, Oil refineries, Industrial facilities, Experimental results, Mathematical models

This paper presents the results of experimental and analytical studies of the dynamic characteristics of oil refinery structures (i.e., tall columns). The objectives of the project are to obtain improved knowledge of the dynamic properties of tall columns through combined field measurements and analytical models, to reconcile these results, and to use these results in the evaluation of the seismic design criteria for oil refinery structures.

FOUNDATIONS

(Also see No. 835)

80-724

Dynamic Stiffness and Seismic Input Motion of a Group of Battered Piles

J.P. Wolf

Electrowatt Engrg. Services LTD., Bellerivestr. 36, 8022, Zurich, Switzerland, Nucl. Engr. Des., 54 (3), pp 325-335 (Nov 1979) 9 figs, 12 refs

Key Words: Pile structures, Interaction: soil-structure, Seismic excitation, Dynamic stiffness, Hysteretic damping

The dynamic stiffness (impedance function) and the corresponding seismic input motion of a group of battered piles, which can be end-bearing and floating, situated in any desired configuration in horizontally stratified soil, are determined. The soil and the piles consist of (frequency-dependent) visco-elastic material with hysteretic damping. The base mat can be rigid or flexible. Any seismic excitation, for which the free-field motion can be calculated, can be specified (body waves, propagating at an arbitrary angle, generalized surface waves). The soil is discretized by toroidal finite elements in conjunction with a Fourier expansion in the circumferential direction. Radiation and hysteretic damping are accounted for. The dynamic-flexibility matrix of the soil is generated, superimposing the basic dynamic-flexibility coefficients calculated by applying sequentially a horizontal and a vertical force at all nodes located on the axis of symmetry. The influence of the soil which is subsequently replaced by piles is taken into consideration. Pile-soil-pile interaction is accounted for in this method. The formulation can also be applied to embedded foundations and buried structures such as tunnels and pipe systems.

80-725

On the Seismic Behavior of Loess Soil Foundations

M. Minkov and D. Evstatiev

Bulgarian Academy of Sciences, Sofia, Bulgaria, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 988-996, 2 figs, 5 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Foundations, Seismic response, Earthquake damage

The earthquake on March 4, 1977, of a magnitude of 7.4 and with epicentre in the Vrancea Mountain in Roumania, in the boundaries of 200 to 300 km from the region analyzed here in North Bulgaria, did considerable damage to many buildings and engineering structures in the towns and villages close to the Danube River, built mostly on subsidental loess soils. Reliable conclusions about the effect of the loess base conditions on the seismic performance of the engineering structures is obtained.

80-726

Vibration Survey on the NASA White Sands Steam Ejector

W.R. Davis

Lincoln Lab., Massachusetts Inst. of Tech., Lexington, MA, Rept. No. NLP-13, ESD-TR-79-34, 22 pp (Mar 5, 1979)

AD-A072 017/7GA

Key Words: Exhaust systems, Test facilities, Foundations, Ground vibration

Vibration and dynamic pressure measurements were made on a large steam ejector at the NASA White Sands Test Facility. Acceleration measurements were made on the ejector foundation to determine how much vibration was transmitted to the ground, and dynamic pressure measurements were made in the ejector tube to provide a basis for future scaling of the vibration data to a larger size ejector. Spectral analyses are presented for both the accelerations and pressures.

80-727

Vertical Vibration of Machine Foundations

G. Gazetas and J.M. Roesset

Case Western Reserve Univ., Cleveland, OH, ASCE J. Geotech. Engr. Div., 105 (GT12), pp 1435-1454 (Dec 1979) 13 figs, 28 refs

Key Words: Foundations, Machine foundations, Vibrating foundations

The paper presents the results of an analytical study of vertical vibrations of massive strip foundations excited by constant-force or rotating-mass type oscillators and placed on the surface of a linearly hysteretic soil layer on rock. A semianalytical method based on a direct solution of the wave equations in terms of displacements and accounting for the exact physical conditions at the rough layer interfaces and the soil surface is briefly presented.

80-728

Dynamic Response of Strip Footings on Elastic Halfspace

S.P. Dasgupta and N.S.V.K. Rao

Dept. of Civil Engrg., I.I.T., Kharagpur, India, Intl. J. Vehicle Des., 14 (11), pp 1597-1612 (1979) 11 figs, 24 refs

Key Words: Footings, Dynamic response, Halfspace, Finite element technique, Interaction: soil-foundation

Dynamic response of strip footings resting on a soil medium, idealized as an elastic halfspace, is obtained using the finite element discretization technique with constant strain rectangular elements consisting of 4CST elements. Boundary stresses have been computed using a combination of Rayleigh wave absorbing boundaries (RAB) and standard viscous boundaries (SVB). The influences of contact pressure distributions at the footing-soil interface, mass and frequency ratios on the dynamic response of a strip footing are studied. Effects of embedment, static surcharge, nonhomogeneity and nonlinear constitutive relations are shown. Results are compared with the existing solutions and are presented graphically.

UNDERGROUND STRUCTURES

(Also see Nos. 724, 872)

80-729

Consideration of Dynamic Stress Concentration in the Seismic Analysis of Buried Structures

P.C. Chen, D.Z.F. Deng, and A.J. Birkmyer
Frederiksen Engineering Co., Inc., Oakland, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 165-174, 8 figs, 2 tables, 10 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Underground structures, Pipes (tubes), Tunnels, Seismic response

The seismic analysis of buried structures such as pipes, conduits, tunnels etc., has been customarily performed using the one dimensional wave propagation theory. Another approach to the seismic analysis of buried structures is to include the soil-structure interaction using either the continuum or the finite-element method. Both of these methods consider the soil as an elastic, homogeneous, and isotropic medium. They do not consider the layered soil medium and the possible effect of stress concentrations due to the existence of voids inside the buried structures, nor do these two approaches include the effects of diffraction and scattering of seismic waves on these structures. The significance of these effects can be assessed once the dynamic stress concentration factors on these structures are determined.

HARBORS AND DAMS

(Also see No. 828)

80-730

Shear Moduli and Damping Factors of Earth Dam

A.M. Abdel-Ghaffar and R.F. Scott
Princeton Univ., Princeton, NJ, ASCE J. Geotech. Engr. Div., 105 (GT12), pp 1405-1426 (Dec 1979) 12 figs, 1 table, 8 refs

Key Words: Dams, Earthquake response, Damping effects

In this study of an earth dam, a rational procedure is developed to estimate its dynamic soil properties, such as the shear moduli and damping factors, from its measured response to real earthquakes; the measured response includes strong-motion records from the crest and the base of the dam. The procedure permits study of nonlinear behavior by using the variation of stiffness and damping properties with strain levels. The Santa Felicia Dam, located in Southern California, was chosen for the analysis. The investigation is limited to the upstream-downstream response since existing analytical techniques for earth dams are restricted to horizontal shear deformation in that direction.

80-731

Analysis of Earth Dam Response to Earthquakes

A.M. Abdel-Ghaffar and R.F. Scott
Princeton Univ., Princeton, NJ, ASCE J. Geotech. Engr. Div., 105 (GT12), pp 1379-1404 (Dec 1979) 13 figs, 5 tables, 8 refs

Key Words: Dams, Earthquake response

An investigation has been made of the effect of two earthquakes with Richter local magnitudes M_L of 6.3 and 4.7 on a modern rolled-fill earth dam in Southern California. The dam was equipped with motion sensors that yielded data on the structural response as well as the ground input motion at the site. Amplification spectra of the dam were computed for the two earthquakes to indicate the natural frequencies of the dam, to estimate the shear-wave velocity of its materials, and to estimate the relative contribution of different modes of vibrations. In addition, field wave-velocity measurements were carried out as a further check as well as to study the variation of shear-wave velocity (or shear modulus) at various depths below the crest of the dam.

80-732

Experimental Investigation of the Dynamic Response Characteristics of an Earth Dam

A.M. Abdel-Ghaffar and R.F. Scott
Univ. of Illinois at Chicago, Chicago, IL, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1026-1035, 12 figs, 1 table, 4 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Dams, Earth structures, Earthquake response, Dynamic tests

Full-scale dynamic tests, including forced and ambient vibration as well as popper tests, were carried out on Santa Felicia Dam in Southern California subsequent to the study of the dam's earthquake response characteristics. The dam, which is instrumented with motion sensors which indicate its structural response as well as the input ground motion at the site, had been subjected to strong shaking during two earthquakes: the strong, 6.3 local Richter magnitude San Fernando earthquake of 1971, and a 1976 earthquake of magnitude 4.7. This paper briefly presents a description of the dynamic field test program and a discussion of some of the results, including a comparison between the dynamic properties determined from the full-scale tests and those estimated from the measured responses to the two earthquakes.

80-733

Earthquake Induced Deformations in Earth Dams

R.C. Chaney

Fugro, Inc., Long Beach, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 633-642, 5 figs, 11 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Dams, Earthquake damage

In earth dams the behavior of soils located in various zones of the dam structure may behave differently under seismic induced loads due to individual soil characteristics and degree of saturation, hence leading to problems in evaluating overall dam performance. In addition, the distinction between liquefaction and progressive cyclic deformation is not always easy to define for a particular part of the dam structure. These problems have led to two distinct ways of quantifying the seismic stability of an earth dam. The two methods both utilize finite element calculations in which the dam structure is modeled as a series of individual elements. The first method uses a calculated seismic factor of safety for each element. The second method is based on an evaluation of the potential strain experienced by each element.

80-734

Earth Pressures During Earthquakes

S. Prakash and P. Nandakumaran

Univ. of Missouri-Rolla, Rolla, MO, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 613-622, 7 figs, 3 tables, 16 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Dams, Earth structures, Retaining walls, Model testing, Earthquake response

A brief description of model test set ups and salient results are presented along with a case of performance of a retaining wall in Koyna earthquake of December 11, 1967.

80-735

Determination of Design Earthquake for the Dynamic Analysis of Fort Peck Dam

W.F. Marcuson, III and E.L. Krinitzsky

Waterways Experiment Station, Vicksburg, MS, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 978-987, 3 figs, 5 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Dams, Seismic design, Earthquake resistant structures

Because of the slide in the Lower San Fernando Dam during the San Fernando Earthquake, the U.S. Army Corps of Engineers initiated earthquake studies of its hydraulic-fill structures located in seismically active areas. Fort Peck Dam is a large hydraulic-fill dam in northeast central Montana, on the Missouri River, built during the period from 1933-1940. This paper describes the investigations performed to determine the so-called "design" earthquake used in the dynamic analysis of Fort Peck Dam.

80-736

Response and Stability of Earth Dams During Strong Earthquakes

S.K. Sarma

Dept. of Civil Engrg., Imperial College of Science and Technology, London, UK, Rept. No. WES-MP-GL-79-13, 278 pp (June 1979)

AD-A073 010/1GA

Key Words: Dams, Earthquake response

This earth dam study considers the response of an earth dam resting on a layer underlain by a rigid base and subjected to a strong ground motion. The dam and the layer are assumed to be elastic, homogeneous, and of simple geometric form. Several combinations of the properties of the dam and the layer, as well as several ratios of the height of the dam to the depth of the layer, are studied.

The results of individual cases and their envelopes are presented in the spectral form for design purposes. Methods of stability analysis for static and pseudostatic conditions are examined, and two new methods are presented.

80-737

Prediction Feasibility of Induced Seismicity Following Impounding of Reservoirs

S. K. Guha, J.G. Padale, P.D. Gosavi, and U.A. Kulkarni

Central Water and Power Res. Station, Khadakwasla, Pune 411 024, India, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1160-1168, 5 figs, 2 tables, 15 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Dams, Seismic response, Earthquake damage

An attempt to identify parameters closely related to qualitative as well as quantitative prediction of post impounding seismic behaviour of the reservoir area has been made here.

80-738

Fatigue Analysis of Offshore Structures

J.R. Wallis, Y.O. Bayazitoglu, A. Mangiavacchi, and F.M. Chapman, Jr.

Brown & Root, Inc., Houston, TX 77001, J. Energy Resources Tech., Trans. ASME, 101 (4), pp 218-224 (Dec 1979) 5 figs, 2 tables, 10 refs

Key Words: Off-shore structures, Fatigue life, Water waves

This paper presents a procedure for fatigue analysis where the dynamic response of the structure is analyzed through a spectral approach. The sea waves which constitute the forcing function acting on the structure are represented as energy spectra; the response is obtained in spectral terms and is subsequently interpreted according to probabilistic concepts. The characteristics of the distribution of the response are considered.

CONSTRUCTION EQUIPMENT

(Also see Nos. 675, 783, 790, 792)

80-739

Exhaust Noise Control for Construction Equipment

D.E. Winnes and S.D. Schmeichel

Donaldson Co., Inc., P.O. Box 1299, Minneapolis, MN 55440, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 33-43, 3 figs; Avail: see 80-931

Key Words: Construction equipment, Exhaust systems, Noise reduction, Noise source identification

The paper specifically addresses exhaust noise control for in-use construction equipment. Specific background data on the relationships between exhaust noise, other machine noise sources, and overall construction equipment noise levels is obtained. To provide this type of background data, a study was undertaken to: determine those types of construction equipment having high environmental noise impact; identify the major noise sources of these machines; and study the effects of different exhaust systems on these machines.

80-740

Noise Abatement Techniques for Construction Equipment

W.J. Toth

Society of Automotive Engineers, Inc., Warrendale, PA, Rept. No. DOT/TSC/NHTSA-79/45, DOT-HS-803 293, 187 pp (Aug 1979)

PB-300 948/7GA

Key Words: Construction equipment, Trucks, Noise reduction

The primary objective of this work is to transfer technology developed in the area of truck noise reduction to that of construction equipment. Included is information gathered from previous contracts, surveys of manufacturers, a noise impact ranking by equipment type, engine and equipment test results, specific information to enable equipment owners to reduce noise from their equipment, and recommendations dealing with reasonable noise level goals for used equipment.

80-741

Noise Abatement of Vibration-Stimulated Material Handling Equipment

E.I. Rivin

Ford Motor Co., Dearborn, MI 48239, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 87-89, 1 fig; Avail: see 80-931

Key Words: Materials handling equipment, Noise reduction

The paper shows ways to drastically (25 dBA and more) reduce noise with simultaneous substantial boost in performance.

80-742

Attack on Agricultural Tractor Operator Noise

A.A. Amberg

Tractor Control Center Dept., International Harvester Co., Hinsdale, IL 60521, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 19-24, 2 figs, 24 refs; Avail: see 80-931

Key Words: Agricultural machinery, Tractors, Noise reduction

This report discusses a major research study performed on a tractor cab being purchased for factory installation on large agricultural tractors. The object was to determine the potential sound level reduction of an experimental tractor by making major and minor modifications to the cab.

80-743

Demonstration of Bulldozer Noise Control

M.N. Rubin, R. Madden, J.A. Burks, and J.H. Daniel

Bolt, Beranek & Newman, Inc., NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 45-49, 2 tables; Avail: see 80-931

Key Words: Tractors, Mines (excavations), Construction equipment, Noise reduction, Regulations

This paper presents the results of a noise control demonstration program, sponsored by the U.S. Bureau of Mines, on two large crawler tractors. The purpose of the program was to illustrate that there are practical cost-effective retrofit noise control treatments which can assist in obtaining compliance with the noise exposure criteria established under the Federal Mine Safety and Health Act of 1977.

80-744

Mobile Equipment Noise Control in Surface Mining

H.J. Browning

Alpha Portland Cement Co., P.O. 191, Easton, PA 18042, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 283-289; Avail: see 80-931

Key Words: Mining equipment, Noise reduction

During the past two days a wealth of knowledge necessary for noise reduction work has been made available for us. Noise - what is it? How does it work? What does it do to us, etc., has been covered. Personnel of the United States Environmental Protection Agency, United States Department of Labor, and others, have stated the problem of which we are all a part. Specific areas of cabs, fans, drive trains, vibration, attenuation of glass, mufflers, and all other inroads of the noise spectrum have also been covered. Effective noise reduction of any sort will necessarily encompass every aspect of subjects discussed thus far.

POWER PLANTS

(Also see Nos. 780, 823, 828, 939)

80-745

Seismic Analyses of Fossil-Fuel Boiler Structures

T.Y. Yang and M.I. Baig

Purdue Univ., West Lafayette, IN, ASCE J. Struc. Div., 105 (ST12), pp 2511-2528 (Dec 1979) 12 figs, 5 tables, 14 refs

Key Words: Electric power plants, Boilers, Seismic response, Earthquake response, Seismic design

Seismic analysis has been performed for a 600-MW and a 1200-MW steam generators and their supporting structures in this paper using realistic three-dimensional finite element models. Each suspended boiler is analyzed by an analytic model as well as by a finite element model with four hanger rods. For each plant, twelve natural frequencies and associated mode shapes of the combined boiler and structure finite element model have been obtained.

80-746

A Methodology for the Determination of Seismic Resistant Design Criteria

B. Kacyra and J.M. Vallenas

Earthquake Engineering Systems, Inc., 141 Battery St., San Francisco, CA 94111, Proc. 2nd U.S. Natl.

Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 37-51, 8 figs, 10 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Nuclear power plants, Seismic design

This paper describes a methodology for the development of optimum structural performance criteria for thermal electric generation and transmission systems subjected to earthquake excitations. The systems are optimized in the sense that the sum of the cost of upgrading the network plus the expected cost of earthquake induced outage is minimized.

80-747

Dynamic Analysis of Storage Racks for Spent Fuel Assemblies

G. Habedank, L.M. Habip, and H. Swelim
Kraftwerk Union AG, Reaktortechnik, Postfach 70 06 49, 6000 Frankfurt 70, Federal Rep. Germany, Nucl. Engr. Des., 54 (3), pp 379-383 (Nov 1979) 7 figs, 6 refs

Key Words: Racks, Seismic excitation, *Nuclear fuel elements*

The dynamic response of storage racks for spent fuel assemblies subjected to base excitation is calculated. Several nonlinear dynamic analyses have been performed for different types of storage racks with uplift capability. With the help of the numerical results, the rocking behavior of storage racks and their structural integrity has been examined.

VEHICLE SYSTEMS

GROUND VEHICLES

(Also see Nos. 696, 718, 719, 740, 770, 771, 772, 773, 787, 795, 896, 927, 928)

80-748

Recent Developments in Wheel/Rail Noise Research

B. Hemsworth
Res. & Dev. Div., British Railways Board, Railway Technical Centre, London Road, Derby DE2 8UP, UK, J. Sound Vib., 66 (3), pp 297-310 (Oct 8, 1979) 17 figs, 22 refs

Key Words: Interaction: rail-wheel, Noise generation, Mathematical models

A review is presented of wheel/rail noise research studies, published since 1976. Further work is needed on the parameters governing the magnitudes of the forces in the wheel/rail contact zone, however, before a complete understanding of noise generation can be achieved, and hence control at source.

80-749

On the Sources of Wayside Noise Generated by High-Speed Trains

W.F. King, III and D. Bechert
Institut f. Turbulenzforschung, Deutsche Forschungs- und Versuchsanstalt f. Luft- und Raumfahrt e.V., 1 Berlin 12, Germany, J. Sound Vib., 66 (3), pp 311-332 (Oct 8, 1979) 13 figs, 5 tables, 37 refs

Key Words: Railroad trains, High-speed transportation, Noise source identification, Interaction: rail-wheel, Experimental data

A linear array of 14 microphones is used to measure radiated noise generated by a four-carriage electric train traveling at speeds between 160 and 250 km/h. Most of the results given in this paper pertain to apparent source locations of wheel/rail interaction noise, although preliminary data collected in a concurrent study of railway aerodynamic noise are briefly mentioned.

80-750

Noise Generation by Railroad Coaches

H.M. Fischer
Institut f. Technische Akustik, Technische Universität Berlin, Germany, J. Sound Vib., 66 (3), pp 333-349 (Oct 8, 1979) 22 figs, 14 refs

Key Words: Railroad cars, Rail transportation, Noise generation, Noise source identification, Interaction: rail-wheel

A systematic analysis is carried out on the acoustic behavior of railroad coaches. Radiation of air-borne sound as well as structure-borne sound transmission from the wheel/rail contact area to the car body is investigated in laboratory and stationary tests and during test runs at high speeds (160-250 km/h). The aim of the experiments is to find out how much the individual components of the trailing bogie contribute to the transmission of structure-borne sound and the radiation of air-borne sound. A rank ordering of the individual transmission paths from the axle bearing to the bogie frame is set up.

80-751

Prediction of the Propagation of Train-Induced Ground Vibration

H.P. Verhas

Welvaartstraat 98, B-9300 Aalst, Belgium, J. Sound Vib., 66 (3), pp 371-376 (Oct 8, 1979) 1 fig, 5 tables, 3 refs

Key Words: Rail transportation, Ground vibration, Mathematical models

This paper presents models for prediction of the propagation of train-induced ground vibration. Three models are presented: the line source model, the point source model and the superposed model, and each of these models is discussed in regard to available measurement data.

80-752

Comparative Values of Structure-Borne Sound Levels in Track Tunnels

H.W. Koch

Curt-Risch-Institut f. Schwingungs- und Messtechnik, Universität Hannover, Hannover, Germany, J. Sound Vib., 66 (3), pp 377-380 (Oct 8, 1979) 3 figs, 2 tables, 4 refs

Key Words: Structure-born noise, Rail transportation, Tunnels, Experimental data

Investigations concerning the structure-borne sound resulting from the passage of vehicles through track tunnels (underground trains, main line trains, trams) involve the use of vibration measuring instruments such as vibration velocity detectors, usually in the form of moving coil instruments, and accelerometers, these instruments being located in the tunnel itself and at ground level in the vicinity of the tunnel. The vibration velocity level of the structure-borne sound is derived from the results of measurements made with these instruments, the values for the different locations being compared with one another. Comparative figures for the structure-borne sound levels in underground train tunnels are given by the results of measurements made by the Curt-Risch-Institut as published in a series of internal reports.

80-753

Propagation of Noise from Rail Lines

L.G. Kurzweil, W.N. Cobb, and R.P. Kendig

U.S. Dept. of Transportation, Transportation System Ctr., Kendall Square, Cambridge, MA 02142, J. Sound Vib., 66 (3), pp 389-405 (Oct 8, 1979) 20 figs, 30 refs

Key Words: Railroad transportation, Noise transmission

This paper presents models for predicting the effects of geometric attenuation, air absorption, ground attenuation, and barrier insertion loss on the propagation of noise from railcars and locomotives. Predictions based on these models are compared with available field data.

80-754

Pilot Study on Railway Noise Attenuation by Belts of Trees

J. Kragh

Acoustical Lab., The Danish Academy of Tech. Sciences, DK-2800 Lyngby, Denmark, J. Sound Vib., 66 (3), pp 407-415 (Oct 8, 1979) 2 tables, 1 ref

Key Words: Railroad transportation, Noise reduction, Trees (plants)

Sound levels from passing trains were recorded. At each site attenuation over level, grass-covered ground and through shelter belts was measured 1·5 m above ground. Attenuation differences at each site were due to both minor variations in terrain configuration (track above/below adjacent terrain) and to attenuation in vegetation.

80-755

MVMA Two-Dimensional Crash Victim Simulation, Version 4. Volume 1

B.M. Bowman, R.O. Bennet, and D.H. Robbins

Highway Safety Research Inst., Michigan Univ., Ann Arbor, MI, Rept. No. UM-HSRI-79-5-1, 232 pp (June 29, 1979)

PB-299 305/3GA

Key Words: Collision research (automotive), Mathematical models

Volume one is intended primarily for the analyst who is interested in the theoretical bases of the MVMA Two-Dimensional Crash Victim Simulation. This volume contains the detailed formulation of the equations of planar motion of a vehicle occupant in a crash environment. The features of the analytical model are described.

80-756

Retrofit Noise Control of Rapid Transit Cars

P.J. Remington and L.E. Wittig

Bolt Beranek and Newman, Inc., Cambridge, MA 02138, J. Sound Vib., 66 (3), pp 419-441 (Oct 8, 1979) 19 figs, 6 tables, 18 refs

Key Words: Ground vehicles, Internal noise, Noise reduction

This paper describes a retrofit noise control study for existing, electric-powered transit cars currently operated by the New York City Transit Authority. The study focuses on a test car considered to be representative of the fleet, that is outfitted with monitoring equipment and operates through a series of experiments. The dominant noise-producing components are determined and the important noise and vibration transmission paths located. Simple, easy-to-implement treatments that would reduce the noise levels to acceptable levels are recommended.

80-757

The TRRL Quiet Heavy Vehicle Project

J.W. Tyler

Noise Control Vib. Isolation, 10 (8), pp 315-317 (Oct 1979) 3 tables, 3 refs

Key Words: Ground vehicles, Motor vehicle noise, Diesel engines, Noise reduction

As a result of the investigations carried out by the Working Group on Research into Traffic Noise, the Quiet Heavy Vehicle (QHV) Project was initiated by TRRL in 1971. This class of vehicle was chosen as the first to be considered because it was thought to be the most difficult to quieten - having the most powerful and noisiest engines.

80-758

Analysis of Vehicle Vibration Problems Using a Digital Modal Analysis System

C. Winckless

GenRad AVA Div., Noise Control Vib. Isolation, 10 (8), pp 324-331 (Oct 1979) 22 figs

Key Words: Ground vehicles, Modal analysis, Computer programs

This article is an illustration of modern methods of structural analysis showing the use of modal analysis techniques applied to a vibration problem in a motor vehicle. The trouble shooting role of modal analysis in identifying the possible cause of vibration problems is one use of the technique. An equally important use of modal methods is in the integration of modal analysis and design data to produce an integrated computer model of the behavior of a structure.

80-759

Dynamic Testing - Reliability

T. Black

Product Engr. (NY), pp 51-53 (Nov 1979) 5 figs

Key Words: Off-highway vehicles, Dynamic structural analysis, Dynamic tests

Structural reliability of off-the-road vehicles by dynamic analysis, dynamic laboratory testing and powerful worst-condition feedback from the field is described.

80-760

Preliminary Target Description Data for the Calculation of the Response of a Truck-Shelter-Rack System Exposed to a Blast Wave and Proposed Test Procedures for Obtaining Such Data

P.P. Radkowski, P.P.F. Radkowski, III, J.R. Opperman, and M.R. Williams

R-Associates, Riverside, CA, Rept. No. ARBRL-CR-00399, AD-E430 271, 86 pp (May 1979)
AD-A072 788/3GA

Key Words: Trucks, Protective shelters, Blast response, Testing techniques, Mathematical models

This report is divided into three parts. Part I: Preliminary target description data for the development of a matrix equation of motion of a dynamic model for the total truck-shelter-rack system in response to a blast wave under various ground conditions are presented. Also presented are recommendations for the development of the model as well as constraints on some of the data-input. Part II: Issues and needs are listed for analysis and to obtain input data. Part III: Preliminary test plans are presented for obtaining the input data required.

80-761

Indoor Simulation of SAE Recommended Practice J366b for Heavy Trucks

R.K. Witwer and J.W. Sullivan
Cummins Engine Co., Inc., 1900 McKinley Ave., MC 71400, Columbus, IN, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 187-192, 4 figs, 2 tables, 4 refs; Avail: see 80-931

Key Words: Trucks, Noise measurement, Measurement techniques

There are a number of potential errors in this investigation which could not be controlled, including the errors inherent in the J366b measurement itself. However, the most serious was the inability to simulate more closely the transient test using the water brake dynamometer. An inertial dynamometer would be more appropriate. The simulated method shows promise; however the small sample size indicates more testing should be performed before drawing firm conclusions.

SHIPS

80-762

Lateral Forces on a Ship Approaching a Vertical Wall: A Theoretical Model

F. Hess
The Univ. of Adelaide, Adelaide, South Australia, J. Ship Res., 23 (4), pp 284-296 (Dec 1979) 8 figs, 14 refs

Key Words: Ships, Lateral vibration, Mathematical models

This paper deals with the unsteady hydrodynamic problem of a ship approaching a vertical wall on an oblique course. The ship is considered as a slender body with a trailing edge. The sway force and yaw moment acting on the ship are computed for various water depths and heading angles.

AIRCRAFT

(Also see Nos. 774, 935, 937, 947)

80-763

Active Controls for Civil Aircraft

H.P.Y. Hitch
Weybridge-Bristol Div., British Aerospace Aircraft Group, Aeronaut. J., 83 (826), pp 389-398 (Oct 1979) 29 figs, 7 refs

Key Words: Aircraft, Active control, Wind-induced excitation

The paper is concerned with maneuver and gust load alleviation. This paper concentrates on the technical issues and assumes that the benefits from the deployment of ACT (Active Control Technology) are worthwhile.

80-764

Large Amplitude Response of Complex Structures due to High Intensity Noise

C. Mei
Ohio State Univ. Res. Foundation, Columbus, OH, Rept. No. AFFDL-TR-79-3028, 42 pp (Apr 1979)
AD-A071 401/4GA

Key Words: Aircraft, Acoustic fatigue

This report presents a review of existing analytical and numerical methods on random excitation on nonlinear multi-degree-of-freedom systems, and an evaluation of these methods based on some realistic considerations from the point of view of their application to complex panel configurations of aircraft structure.

80-765

Angular Vibration of Aircraft. Volume 1. Executive Summary

C.D. Johnson, W.C. Gibson, D.A. Kienholz, and E.B. Paxson
Applied Mech. Div., Anamet Labs., Inc., San Carlos, CA, Rept. No. AFFDL-TR-79-3045-VOL-1, 52 pp (Apr 1979)
AD-A071 895/7GA

Key Words: Aircraft vibration, Angular vibration, Computer programs, NASTRAN (Computer program), Finite element technique, Statistical energy methods

This report describes development work in several distinct areas, all related to prediction of angular vibration of aircraft structures. Angular vibration in this context refers to dynamic rotations or changes in slope at specific points on a vibrating structure. It is of interest primarily in connection with high resolution optical and electro-optical systems. Efforts were directed at both low frequency vibration, where individual normal modes are known, as well as high frequency vibration where they are not.

80-766

Angular Vibration of Aircraft. Volume II. Prediction Methods for Angular Vibration

C.D. Johnson, W.C. Gibson, D. Kienholz, and E.B. Paxson

Applied Mech. Div., Anamet Labs., Inc., San Carlos, CA, Rept. No. AFFDL-TR-3045-VOL-2, 459 pp (Apr 1979)

AD-A071 749/6GA

Key Words: Aircraft vibration, Angular vibration, Finite element technique, Statistical energy methods

This report describes development work in several distinct areas, all related to prediction of angular vibration of aircraft structures. Angular vibration in this context refers to dynamic rotations or changes in slope at specific points on a vibrating structure. It is of interest primarily in connection with high resolution optical and electro-optical systems. Efforts were directed at both low frequency vibration, where individual normal modes are known, as well as high frequency vibration where they are not.

80-767

Transonic Wind Tunnel Tests on an Oscillating Wing with External Stores. Part II. The Clean Wing

H. Tijdeman, J.W.G. van Nunen, A.N. Kraan, A.J. Persoon, and R. Poestkoke

National Aerospace Lab., Amsterdam, The Netherlands, Rept. No. NLR-TR-78106-U-PT-2, AFFDL-TR-78-194-PT-2, 128 pp (Mar 1979)

AD-A071 420/4GA

Key Words: Aircraft wings, Wing stores, Wind tunnel tests

A wind-tunnel investigation is carried out on an oscillating model of the F-5 wing with and without an external store (AIM-9J missile). The store is mounted at the wing tip as well as at a pylon underneath the wing. Detailed steady and unsteady pressure distributions are measured over the wing, while on the store aerodynamic loads are obtained. In addition, wind-tunnel wall pressures are recorded.

MISSILES AND SPACECRAFT

80-768

A Shock Tube Investigation of Silo-Launched Vehicle Aerodynamic Flow Asymmetries

R.L. Varwig, D.H. Ross, and J.M. Lyons

Aerophysics Lab., Aerospace Corp., El Segundo, CA, Rept. No. TR-0079(4550-83)-1, SAMSO-TR-79-48, 59 pp (July 5, 1979)

AD-A071 811/4GA

Key Words: Rocket launching, Shock tube tests

A shock tube is used to simulate the initial transient flow from a rocket launching silo when the rocket motor was ignited. The object is to investigate the relationship between lateral loads observed on the missile being launched during the early transient flow and the silo exit geometry. The pressures measured on the missile model are presented together with a correlation technique that was developed to display the effect of the silo exit geometries on the model pressure difference force. Also included are results from the application of this correlation technique to full-scale flight data.

BIOLOGICAL SYSTEMS

HUMAN

80-769

The Effects of Site Selected Variables on Human Responses to Traffic Noise. Part I: Type of Housing by Traffic Noise Level

J.S. Bradley and B.A. Jonah

The Univ. Western Ontario, London, Canada, J. Sound Vib., 66 (4), pp 589-604 (Oct 22, 1979) 7 figs, 4 tables, 17 refs

Key Words: Traffic noise, Human response

The results of the first part of a field study of human response to traffic noise are reported, along with the general methodology of the entire study. The research is carried out by selecting subjects at sites that had the desired values of selected site variables. Human response measurements are obtained from interviewer administered structured questionnaires, and are as spatially and temporally coincident as possible with the noise measurements. Noise measurements are obtained from six days of rapidly sampled recordings. In this first part the effects of traffic noise level and housing type are considered.

80-770

The Importance of Railway Noise in France

M. Maurin

Institut de Recherche des Transports, Centre d'Evaluation et de Recherche des Nuisances, Bron Cedex 69672, France, J. Sound Vib., 66 (3), pp 493-496 (Oct 8, 1979) 3 tables

Key Words: Traffic noise, Railroad transportation, Human response

A national survey on environmental nuisances due to all forms of transport was made in France during 1977. From among the data gathered, it is possible to extract results concerning the impact of nuisance due to railways, partly from results of questionnaires and partly from results of acoustical measurements. Interviews and measurements were made in several towns, at randomly selected dwellings.

80-771

A Dutch Study on Railroad Traffic Noise

R.G. De Jong

TNO Research Inst. for Environmental Hygiene, Delft, The Netherlands, J. Sound Vib., 66 (3), pp 497-502 (Oct 8, 1979) 3 tables, 2 refs

Key Words: Traffic noise, Railroad transportation, Noise measurement, Human response

This paper is about a Dutch study on the community response to noise. The set-up of the study is described broadly. Some details are given about the comprehensive sound level measurement program. Some preliminary results from the social survey are given.

80-772

Overall Railway Noise Impact in the U.K.

D.M. Waters

Dept. of Transport Technology, Univ. of Tech., Loughborough LE11, 3TU, UK, J. Sound Vib., 66 (3), pp 477-481 (Oct 8, 1979) 1 fig, 5 tables, 8 refs

Key Words: Railroad transportation, Traffic noise, Human response

As part of a British Rail (BR) "Environmental and Social Impact" study in 1975, an attempt at assessing the relative noise impact of rail and road transport was made. Five train types were defined, two classes of line, three regions of population density and three standard topographies.

80-773

Railway Noise and Vibration Annoyance in Residential Areas

J.M. Fields

Inst. of Sound and Vibration Res., Univ. of Southampton, Southampton S09 5NH, UK, J. Sound Vib., 66 (3), pp 445-458 (Oct 8, 1979) 3 figs, 4 tables, 17 refs

Key Words: Railroad transportation, Traffic noise, Noise tolerance, Vibration tolerance, Human response

This paper summarizes the results from the 1975 British railway noise study. Noise from railways does cause annoyance and interfere with activities. People in Great Britain appear to find high levels of railway noise to be somewhat less annoying than high levels from other sources.

80-774

Commercial Aircraft Flight Deck Noise Criteria

J.E. Mabry, B.M. Sullivan, and R.A. Shields

Man-Acoustics and Noise, Inc., Seattle, WA, Rept. No. MAN-1037, FAA/RD-79-66, 72 pp (Jan 1979) AD-A072 029/2GA

Key Words: Aircraft noise, Human response

As a method for obtaining results that could contribute to the establishment of commercial jet aircraft flight deck noise criteria, fifty persons were exposed to simulations of various flight deck noise exposure conditions. Exposure levels investigated were 75, 80 and 85 dBA for periods of 1, 2, and 4 hours. Noise spectra representing both older narrow-body and newer technology wide-body jet aircraft were utilized. Response measures emphasized were temporary threshold shift (TTS) and speech intelligibility, but annoyance ratings to the exposure conditions were also obtained.

MECHANICAL COMPONENTS

ABSORBERS AND ISOLATORS

(Also see Nos. 720, 940)

80-775

Coupling of Finite Element Acoustic Absorption Models

A. Craggs

Dept. of Mechanical Engrg., Univ. of Alberta, Edmonton, Alberta, Canada, J. Sound Vib., 66 (4), pp 605-613 (Oct 22, 1979) 8 figs, 8 refs

Key Words: Acoustic absorption, Acoustic linings, Finite element technique

A procedure is given which is to be followed when linking an acoustic finite element model to an absorption model. The procedure ensures both equality of pressure and compatibility of the normal velocity at the interface boundary. It is illustrated and tested by applying it to a one dimensional acoustic absorption system to calculate the absorption coefficient. Good agreement with an exact solution is shown.

80-776

Reduction in Earthquake Response of Structures by Means of Vibration Isolators

S.S. Tezcan and A.Civi

Bogazici Univ., Istanbul, Turkey, Proc. 2nd U.S. Natl. Conf Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 433-442, 13 figs, 15 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Isolators, Vibration isolation, Seismic design, Earthquake response

The ultimate objective of an aseismic design is to accomplish safety and reliability at the least cost possible. The contemporary principle of aseismic design requires that in addition to possessing adequate strength, a structure should be capable of undergoing large deformations without collapse and should be able to absorb energy by experiencing excessive elasto-plastic deformations. The emphasis in this principle is to store into the structure as much energy absorption capability as possible, such that in the event of a large earthquake, the critical load carrying elements of the structure undergo large plastic deformations without collapse. As a consequence, this principle does not only involve additional cost due to special construction and detailing requirements, but the secondary elements in the structure may be damaged so substantially that prohibitively expensive repairs may be necessary after a strong earthquake.

80-777

Base Isolation Systems for Earthquake Protection of Multi-Storey Shear Structures

D.M. Lee and I.C. Medland

Dept. of Civil Engrg., California Inst. of Tech., Pasadena, CA, Intl. J. Earthquake Engr. Struc. Dynam., 7 (6), pp 555-568 (Nov/Dec 1979) 12 figs, 2 tables, 24 refs

Key Words: Isolators, Vibration isolators, Buildings, Multistory buildings, Earthquake excitation, Earthquake resistant structures

This paper is a study of the effectiveness of a wide range of bilinear hysteretic isolation systems in shielding multi-story 2-D shear structures from earthquake excitations. Important parameters of the isolation system are identified and their effect on structure response noted. The philosophy of structure isolation is discussed and an introduction given to the physical devices currently available to provide it.

80-778

The Alexisismon: An Application to a Building Structure

A.S. Ikonomou

Structural Analysis and Earthquake Engrg., Univ. of Patras, Greece, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 443-452, 18 figs, 2 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Isolators, Seismic design, Buildings, Seismic excitation

This paper, first of a series presenting the author's work during the last nine years, shows the manner of applying the Alexisismon, a structural isolation system against earthquakes, to an ordinary three-storied building structure by using elastic rubber and pot bearings for its supporting and vertical bars as connecting breakable elements.

80-779

Aseismic Base Isolation: A Review

J.M. Kelly

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 823-837, 12 figs, 24 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Isolators, Seismic design, Elastomers

In this paper four feasible aseismic base isolation systems are described. All four systems use laminated elastomeric bearings as the isolating element. In the first, neoprene rubber is used in the bearings and in the others the elastomer is natural rubber.

80-780

Seismic Performance of Piping Systems Supported by Nonlinear Hysteretic Energy Absorbing Restrainers

M.C. Lee, J. Penzien, A.K. Chopra, and K. Suzuki

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 156-164, 5 figs, 5 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Energy absorption, Isolators, Piping systems, Nuclear power plants, Seismic response

Selected results of an investigation into the desirability of using solid-state nonlinear hysteretic energy absorbing restrainers as the supporting elements for nuclear power plant piping systems are presented. These results have been generated for three cases representing simple piping systems: linear pipes with linear restrainers; linear pipes with elasto-perfectly plastic restrainers; and linear pipe with Ramberg-Osgood type restrainers.

80-781

Vibration Isolation: Use and Characterization

J.C. Snowdon

Applied Res. Lab., The Pennsylvania State Univ., University Park, PA 16802, J. Acoust. Soc. Amer., 66 (5), pp 1245-1274 (Nov 1979) 34 figs, 1 table, 231 refs

Key Words: Vibration isolators, Mountings, Noise reduction, Vibration control, Elastomers

The results of a search and critical evaluation of the literature pertinent to both the use and the characterization of the performance of antivibration mountings for the control of noise and vibration are described.

80-782

Shock Isolator for Operating a Diode Laser on a Closed-Cycle Refrigerator

D. E. Jennings

NASA, Goddard Space Flight Ctr., Greenbelt, MD, Rept. No. N79-28549/0, PAT-APPL-880 838, 6 pp (July 17, 1979)

PATENT-4 161 747

Key Words: Shock isolation, Vibration isolators, Equipment mounts

A diode laser mounted within a helium refrigerator is mounted using a braided copper ground strap which provides good impact shock isolation from the refrigerator cold-tip while also providing a good thermal link to the cold-tip. The diode mount also contains a rigid stand-off assembly consisting of alternate sections of nylon and copper which serve as cold stations to improve thermal isolation from the vaccum housing mounting structure.

80-783

Experimental Evaluation of a Portable Energy Absorbing System for Highway Service Vehicles

J.F. Carney, III

Dept. of Civil Engrg., Connecticut Univ., Storrs, CT, Rept. No. CE-79-125, FHWA/CT/RD-402-F-79-1, 59 pp (Apr 1979)

PB-299 168/5GA

Key Words: Energy absorption, Construction equipment, Experimental data, Dynamic tests

A portable energy absorbing system which is attached to the rear of a standard 14,000 pound highway service vehicle used in maintenance operations has been designed and fabricated. A full scale crash testing program has been conducted to evaluate the structural integrity and performance of the portable energy absorbing system.

80-784

Investigation of Squeeze-Film Isolators for the Vibration Control of a Flexible Rotor

J.L. Nikolajsen and R. Holmes

Univ. of Sussex, UK, J. Mech. Engr. Sci., 21 (4), pp 247-252 (Aug 1979) 7 figs, 10 refs

Key Words: Isolators, Vibration isolators, Squeeze-film bearings, Rotor-bearing systems

In this paper, the feasibility of controlling the response and the stability of a rotor-bearing system with flexible, damped bearing supports is investigated both theoretically and experimentally. The particular system under investigation consists of a flexible symmetric rotor in two plain fluid-film bearings mounted in squeeze-film isolators.

80-785

Application of Fluid-Saturated Porous Solids to Vibration Isolation Problems

S. Kowalski

Inst. of Fundamental Technological Res., Polish Academy of Sciences, 61-725 Poznan, Poland, J. Sound Vib., 66 (4), pp 577-587 (Oct 22, 1979) 4 figs, 7 refs

Key Words: Shock absorbers, Vibration isolation

One can construct vibroisolators by using fluid-saturated porous cylinder elements. The force applied to the vibroisolator must be composed of two parts, those carried by the skeleton and the fluid. Each component moves with its own speed (or frequency) and therefore the separate parts of the applied force are displaced in phase.

80-786

Synthesis and Development of an Experimental Active Suspension

H.B. Sutton

Dept. of Mech. Engrg., Highbury College of Tech., Portsmouth, Auto Engr. (UK), pp 51-54 (Oct/Nov 1979) 9 figs, 7 refs

Key Words: Suspension systems (vehicles), Active isolation, Structural synthesis, Modal control technique

The application of modal control theory to the design of vehicle suspensions is described. A synthesis design procedure is applied to a modeled suspension.

80-787

RIM Bumpers Cut Accident Damage

Des. News., 35 (22), pp 12-13 (Nov 19, 1979) 3 figs

Key Words: Energy absorption, Bumpers, Buses

Urban transit buses rolling off many assembly lines feature modular polyurethane bumpers which are helping to cut accident-related costs up to 90%. The RIM (Reaction Injection Molding) process is a high-speed method of molding large, complicated parts in a single shot, with savings in manufacturing and energy costs.

80-788

Air Filtration and Sound Control Systems for Gas Turbines - The State of the Art

F.P. Lages, III

Sound Control Systems Group, Environmental Elements Corp., Baltimore, MD, Proc. 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 83-94, 17 figs, 9 refs

Key Words: Silencers, Gas turbine engines, Noise reduction

This paper discusses some of the latest design concepts and materials currently being utilized in the design and manufacture of noise control equipment for gas turbine engines. Some related areas which are also discussed include inlet air filtration and low frequency noise. Consideration is also given to some of the various environments such as arctic, desert, offshore, etc. Several reference tables and charts are included such as NEMA and ISO NR standards, addition of sound pressure levels, and comparison of sound pressure levels to common environmental sounds. There is also other reference information such as a list of fundamental definitions frequently encountered.

80-789

Noise Reduction at Punch Presses by Means of Shock Absorber

C. Bramberger
IVF (The Swedish Inst. of Production Engrg. Res.) Molndalsvagen 85, S-412 85 Gothenburg, Sweden, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 111-117, 12 figs; Avail: see 80-931

Key Words: Shock absorbers, Presses, Noise reduction, Vibration control

An important noise source in the industry is the punch power press. The punch operation causes dangerous impulsive noise and vibrations that may be transmitted to other quiet parts of the factory. The noise is emitted at the punch operation because of the rapid release of the energy at the break through.

80-790

Development and Testing of Total Noise-Control Systems for Stoper Drills

J.B. Malosh and R.E. Manning
U.S. Steel Res. Lab., Monroeville, PA 15146, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 295-304, 12 figs, 2 tables; Avail: see 80-931

Key Words: Mufflers, Drills, Noise reduction

Stoper drills are pneumatic drills used for drilling holes in the roofs of coal mines for roof bolting. Previous publications have described the development of a noise-control system for stoper drills consisting of a muffler to reduce drill air-exhaust noise, an enclosure to reduce noise radiated from the drill body, and attenuators for drill-rod percussion noise. This paper describes an extension of this development to include an improved drill-rod noise-control system - a sleeve consisting of a steel tube lined with wear-resistant elastomer fitted on the drill rod.

80-791

Muffler Performance From Transmission Matrices

A.G. Doige and P.T. Thawani
Dept. of Mech. Engrg., The Univ. of Calgary, Calgary, Alberta T2N 1N4, Canada, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 245-254, 8 figs, 15 refs; Avail: see 80-931

Key Words: Exhaust systems, Matrix methods, Transmission matrix methods, Mufflers, Internal combustion engines

This paper outlines the application of transmission matrices to exhaust systems with steady mean gas flow and compares computed results with experiments for several situations.

80-792

Long-Hole Machine Muffling: An Update

W.R. Thornton and W.M. Daube
Gulf Science and Technology Co., P.O. Box 3240, Pittsburgh, PA 15230, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 291-294; Avail: see 80-931

Key Words: Mufflers, Drills, Mining equipment, Noise reduction

In response to the need for noise reduction of a long-hole drilling machine used for mining, a program was developed to devise a muffler since commercially available ones commonly iced and reduced or stopped production. The design goals for the muffler were to achieve relatively ice free operation, sufficient noise attenuation, and a size and weight which is operationally acceptable.

80-793

Measurement of Acoustic Parameters for Automotive Exhaust Systems

D.F. Ross and M.J. Crocker
Arvin Industries, West Lafayette, IN 47906, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 235-244, 9 figs, 18 refs; Avail: see 80-931

Key Words: Mufflers, Noise measurement, Motor vehicle noise, Noise reduction, Noise measurement

In designing an exhaust system for an engine both theory and experiment must be used to achieve a good acoustic performance. The engine-exhaust system is quite complicated and difficult to model completely in theory. In any case, if a muffler (silencer) is designed theoretically, its acoustic performance must be measured and checked subjectively before acceptance.

SPRINGS

80-794
Characteristics of Disc Springs in Combination
Engrg. Sciences Data Unit Ltd., London, UK, Rept. No. ISBN-0-85679-254-3, 10 pp (July 1979) (to be used in conjunction with ESDU-78043)
ESDU-79010

Key Words: Springs (elastic), Cyclic loading

This paper describes a method of calculating the load/deflection behavior of stacks of coned disc springs (Belleville washers). Guidance on calculation of the stiffness of spring stacks is also given. The stresses in the springs of a stack should be calculated for critical springs in the stack. Three types of stack are dealt with, namely regular stacks of identical springs, irregular stacks of identical springs and stacks of non-identical springs. Nested stacks are also covered. Notes are provided on the effect of friction on stack behavior and on ways of decreasing or increasing the friction losses in spring stacks under single stroke or low rate cyclic loading.

TIRES AND WHEELS

(Also see No. 886)

80-795
An Investigation into the Dynamic Effects on the Track of Wheelflats on Railway Vehicles
S.G. Newton and R.A. Clark
British Railways Res. & Dev. Div., Derby, UK, J. Mech. Engr. Sci., 21 (4), pp 287-297 (Aug 1979) 13 figs, 14 refs

Key Words: Wheels, Rail, Geometric effects, Initial deformation effects, Railroad tracks, Interaction: rail-wheel

Wheelflats on railway vehicles are created by wheelslide in braking: the resulting imperfection in the running line generates dynamic forces and stresses at each subsequent revolution. This problem is described and earlier work on this topic is covered. A field experiment is described, in which an irregularity in the railhead was used to simulate a wheelflat for a range of vehicles, and loads and rail stresses were monitored. The structure and solution procedures of three theoretical models of the vehicle/track system are outlined and typical results are compared with the experimental data to establish the adequacy and limitations of each of the models.

BLADES

80-796
Theoretical and Experimental Parameter Investigations of Vibration Turbine Blades in the Centrifugal Force Field (Theoretische und experimentelle Parameterstudien an schwingenden Turbinenschaufeln im Fliehkraftfeld)
Series II, No. 29 (1979) of the Progress Reports of the VDI-Zeitschriften, 136 pp, 71 figs, 9 tables, Summarized in VDI Z., 121 (18), pp 906-907 (Sept 1979) Avail: VDI-Verlag GmbH, Postfach 1139, 4000 Dusseldorf 1, Germany
(In German)

Key Words: Blades, Turbine blades, Beams, Torsional vibration, Flexural vibration

In a detailed evaluation of equations for the solution of torsional vibration of blades, it is idealized as a beam. From these equations coupled differential equations for the flexural vibration of rotating twisted and tapered beams are derived. Torsional inertia and shear deformations are also investigated.

80-797
Simple Finite Elements foı Dynamic Analysis of Thick Pre-Twisted Blades
B.A.H. Abbas
Dept. of Mech. Engrg., College of Engrg., Univ. of Basrah, Iraq, Aeronaut. J., 83 (827), pp 450-453 (Nov 1979) 1 fig, 3 tables, 11 refs

Key Words: Blades, Turbomachinery blades, Transverse shear deformation effects, Rotatory inertia effects, Finite element technique

The study of the effects of shear deformation and rotary inertia on the dynamic behavior of turbine blades is discussed in detail.

BEARINGS

80-798
Failure Analysis and Redesign of Large-Diameter Stacker/Reclaimer Slew Bearings

R.A. Pallini and J.H. Rumbarger
Franklin Research Ctr., Div. of the Franklin Inst., Philadelphia, PA 19103, Lubric. Engr., 35 (12), pp 692-699 (Dec 1979) 10 figs, 7 refs

Key Words: Bearings, Failure analysis, Design techniques

The paper discusses failure mechanisms as they relate to stacker/reclaimer bearings and presents a systematic analysis technique that can be used to evaluate a given bearing failure. The paper will also show how specific design criteria can be derived from the failure analysis so that a reliable redesign can be achieved.

80-799

Mounting Duplex Bearings

TRW Bearings Div., Jamestown, NY, Power Transm. Des., 22 (11), pp 38-40 (Nov 1979) 11 figs

Key Words: Bearings

Duplex bearings can make extremely stiff shaft supports for high-precision spindles - but they must be used in matched pairs and mounted in the correct direction.

80-800

Exact Two-Dimensional Analysis of Circular Disk Spiral Groove Bearing (Part II)

S. Murata, Y. Miyake, and N. Kawabata
Osaka Univ., Osaka, Japan, J. Lubric. Tech., Trans. ASME, 101 (4), pp 431-436 (Oct 1979) 8 figs, 3 refs

Key Words: Bearings, Dynamic structural analysis

The two-dimensional pressure field of circular disk grooved thrust bearing, when it has three kinds of elementary unsteady motions, is analyzed using potential flow theory.

80-801

Amplitude Effects on the Dynamic Performance of Hydrostatic Gas Thrust Bearings

A.K. Stiffler and R.R. Tapia
Mississippi State Univ., Mississippi State, MS 39762, J. Lubric. Tech., Trans. ASME, 101 (4), pp 437-443 (Oct 1979) 10 figs, 3 tables, 13 refs

Key Words: Bearings, Thrust bearings, Amplitude analysis

A strip gas film bearing with inherently compensated inlets is analyzed to determine the effect of disturbance amplitude on its dynamic performance. The governing Reynolds' equation is solved using finite-difference techniques. The time dependent load capacity is represented by a Fourier series up to and including the third harmonics.

80-802

The Effect of Radial Clearances and Housing Elasticity on Ball Bearing Life (Lebensdauer der Wälzlager in Abhängigkeit von Radialspiel und Gehäuse-Elastizität)

B. Richter and K. Wächter
Hochschule f. Verkehrswesen, Friedrich List, Dresden, Germany, Maschinenbautechnik, 28 (3) pp 102-105 (Mar 1979) 6 figs, 2 tables, 6 refs

Key Words: Bearings, Ball bearings

The life of radially loaded ball bearings is usually calculated assuming a conusoidal distribution of ball bearing forces in infinitely rigid housings. However, the distribution function is altered by bearing clearance and elasticity of bearing housing. The effect of clearance may be determined by the EDV-Program; the elasticity of the housing by means of the plane photoelasticity. The method is in an example to calculate the life of four types of rail-vehicle axle housings fitted with WI + WIP 120 x 240 TGL 20 902 ball bearing combinations.

80-803

Stability Threshold of Flexibly Supported Hybrid Gas Journal Bearings

Z. Kazimierski and K. Jarzecki
Technical Univ. of Lodz, Lodz, Poland, J. Lubric. Tech., Trans. ASME, 101 (4), pp 451-457 (Oct 1979) 7 figs, 4 tables, 12 refs

Key Words: Bearings, Gas bearings, Journal bearings, Flexible foundations

Results of experimental investigations of the dynamic properties of elastic supports for gas bearings having the form of rubber O-rings are presented. Theoretical calculations of the stability threshold of an externally pressurized gas bearing system elastically supported by means of O-rings are performed. An experimental investigation of the stability threshold of this gas bearing system is made.

80-804
High Stiffness Bearing
L. Brzeski and Z. Kazimierski
Technical Univ. of Lodz, 90-924, Lodz, Poland, J. Lubric. Tech., Trans. ASME, 101 (4), pp 520-525 (Oct 1979) 8 figs, 9 refs

Key Words: Bearings, Gas bearings, Stiffness coefficients

A new type of high stiffness gas or liquid lubricated bearing is presented. The general principle and bearing configuration are explained. The theoretical model of the bearing is given for a case of gas journal bearing. Load versus displacement data are determined both theoretically and experimentally.

80-805
Squeeze Film Damping of Non-Newtonian Fluids
J. Shah and J.B. Hunt
Dept. of Medical Engrg., The General Hospital, Southampton, UK, J. Lubric. Tech., Trans. ASME, 101 (4), pp 516-519 (Oct 1979) 3 figs, 2 tables, 5 refs

Key Words: Bearings, Squeeze-film bearings, Damping effects

In order to determine the overall dynamic response of a machine to a forcing function the damping effect of the bearings in the machine must be known. It has been assumed in the past that the grease can be treated as a Newtonian fluid with a viscosity equal to that of the base oil. This assumption is shown to produce damping coefficients which overestimate the actual damping coefficient.

80-806
Selection and Design of Tilting Pad and Fixed Lobe Journal Bearings for Optimum Turborotor Dynamics
J.C. Nicholas and R.G. Kirk
Ingersoll-Rand Co., Phillipsburg, NJ, Proc. 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 43-57, 20 figs, 6 tables, 14 refs

Key Words: Bearings, Tilting pad bearings, Journal bearings, Turbomachinery, Rotors

Current trends in bearing designs for turbomachinery are reviewed in terms of manufacturing tolerances and overall design considerations. Discussion of both fixed bore and tilting pad bearings with regard to forced response and stability leads to conclusions and recommendations for optimum rotor dynamic performance of turborotors. Examples of design studies of actual rotor systems are presented and discussed to illustrate the optimization procedures and recommendations.

80-807
Porous Wall Gas Lubricated Journal Bearings: Theoretical Investigation
E.P. Gargiulo, Jr.
Engrg. R & D Div., E.I. du Pont de Nemours & Co., Engrg. Tech. Lab., Wilmington, DE 19898, J. Lubric. Tech., Trans. ASME, 101 (4), pp 458-465 (Oct 1979) 11 figs, 9 refs

Key Words: Bearings, Journal bearings, Dynamic stiffness, Damping effects, Perturbation theory

A model has been developed to compute the dynamic stiffness and damping properties of externally pressurized, porous-wall, gas journal bearings which includes the effects of journal rotation and eccentricity. This paper presents the derivation of the governing equations and the perturbation analysis used to find the unsteady characteristics. Typical nondimensional performance curves are found and the influences of seven governing parameters are discussed. A companion paper describes an experimental investigation of porous journal bearings.

80-808
Porous Wall Gas Lubricated Journal Bearings: Experimental Investigation
E.P. Gargiulo, Jr.
Engrg. R & D Div., E.I. du Pont de Nemours & Co., Engrg. Tech. Lab., Wilmington, DE 19898, J. Lubric. Tech., Trans. ASME, 101 (4), pp 466-473 (Oct 1979) 11 figs, 3 tables, 2 refs

Key Words: Bearings, Journal bearings, Mathematical models, Dynamic stiffness, Damping coefficients

A model has been developed to compute the dynamic stiffness and damping properties of externally pressurized, porous-wall, gas journal bearings. The derivation of this model is described in a companion paper. A special test apparatus was constructed to experimentally investigate the steady and unsteady characteristics of a 51-mm diameter

by 51-mm long journal bearing. Experimental results are compared to those of the theoretical model. Reasonable qualitative agreement is shown for smaller clearances. In addition, an unstable vibration phenomenon was discovered and briefly investigated.

80-809

Analysis of Misaligned Grooved Journal Bearings

O. Pinkus and S.S. Bupara

Mechanical Technology, Inc., Latham, NY 12110, J. Lubric. Tech., Trans. ASME, 101 (4), pp 503-509 (Oct 1979) 10 figs, 3 tables, 7 refs

Key Words: Bearings, Journal bearings, Alignment

The paper presents a comprehensive analysis of misaligned journal bearings. The equations are valid for finite bearings containing grooves at any angular position in which the misalignment can vary in magnitude as well as in direction with respect to the bearing's boundaries. The relevant equations, the method of solution, and a set of results are presented. Charts are offered for a number of additional cases which bring out some of the salient features of grooved bearing misalignment.

80-810

A Parametric Study of Journal Bearing Performance: The 80 Deg Partial Arc Bearing

T. Suganami and A.Z. Szeri

The Univ. of Pittsburgh, Pittsburgh, PA 15261, J. Lubric. Tech., Trans. ASME, 101 (4), pp 486-491 (Oct 1979) 12 figs, 3 tables, 6 refs

Key Words: Bearings, Journal bearings, Thermal effects, Lubrication

The thermohydrodynamic (THD) lubrication model, tested and shown to be valid in both laminar and superlaminar flow regimes, is applied here to a series of geometrically similar, but of different size, bearings. The resulting parametric study shows significant thermal effects on both the static and the dynamic performance of the bearings.

COUPLINGS

80-811

Couplings - A User's Point of View

C. Zirkelback

Union Carbide Corp., Port Lavaca, TX, Proc. 8th Turbomachinery Symp., Gas Turbine Labs., Texas A & M Univ., Nov 1979, pp 77-81, 2 tables, 5 refs

Key Words: Couplings, Turbomachinery

This paper will deal with the application of couplings used in turbomachinery in petrochemical plants. A discussion of design selection, installation, operation, maintenance, retrofitting to improved designs, and experiences will be presented.

80-812

Experimental Investigation of the Dynamic Properties of a Torsionally Flexible Coupling (Experimentelle Untersuchung der dynamischen Eigenschaften einer drehelastischen Kupplung)

V. Zoul

Forschungsinstitut f. Diesellokomotiven, CKD Praha, Maschinenbautechnik, 28 (2), pp 66-69 (Feb 1979) 13 figs, 2 refs

Key Words: Couplings, Flexible couplings, Dynamic tests

Several experimental techniques are described for use in the selection of flexible couplings. The dynamic properties of KUBLO 833 are investigated by means of these techniques. Suggestions for further applications are also given.

FASTENERS

80-813

Elastic Flange Flexibility of Screw Joints (Part I) (Elastische Flanschnachgiebigkeit von Schraubenverbindungen (Teil 1)

K. Wachter, D. Jannasch, and R. Beer

Hochschule f. Verkehrswesen Friedrich List Dresden, Sektion Fahrzeugtechnik, Wissenschaftsbereich Grundlagen der Konstruktion, Maschinenbautechnik, 28 (2), pp 62-69 (Feb 1979) 8 figs, 2 tables, 10 refs (In German)

Key Words: Joints (junctions)

New methods for the calculation of the deflection of flanges, fitted in the plane of separation of screw joints, are described. The methods are based on experimental data and computed by means of an FEM program.

VALVES

80-814

Noise Characteristics of Control Valves

K.W. Ng

Research Dev. & Engrg., ITT Grinnell Corp., Providence, RI 02901, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 321-326, 6 figs, 4 refs; Avail: see 80-931

Key Words: Valves, Noise generation, Noise prediction

The objective of this experimental program is to relate noise spectral characteristics to the design of the valve cage trim, and thus shed some light on the development of valve noise prediction.

STRUCTURAL COMPONENTS

STRINGS AND ROPES

80-815

Multiple Equilibrium States of Nonlinearly Elastic Strings

S.S. Antman

Lefschetz Ctr. for Dynamical Systems, Div. of Appl. Mathematics, Brown Univ., Providence, RI 02912, SIAM J. Appl. Math., 37 (3), pp 588-604 (Dec 1979) 5 figs, 8 refs

Key Words: Strings, Nonlinear systems

This paper presents a comprehensive treatment of the existence, multiplicity, and qualitative behavior of equilibrium states for nonlinearly elastic strings under three different loading systems.

BARS AND RODS

80-816

In-plane Vibrations of Curved Bars Considering Shear Deformation and Rotatory Inertia

K. Suzuki and S. Takahashi

Faculty of Engrg. Yamagata Univ., Yonezawa, Japan, Bull. JSME, 22 (171), pp 1284-1292 (Sept 1979) 11 figs, 8 refs

Key Words: Bars, Transverse shear deformation effects, Rotatory inertia effects, Lagrangian equations of motion

In this paper the in-plane vibrations of a uniform curved bar, of which the center line is a plane curve, are investigated taking into consideration the bending, extension, shear deformation, and rotatory inertia of the bar. The equations of vibration and the boundary conditions are determined. As examples, calculations are made for elliptic arc bars with built-in ends and with simply supported ends. The numerical results of the analysis are compared with those of the classical theory. The effects of the shear deformation and the rotatory inertia are clarified.

BEAMS

(Also see Nos. 796, 843)

80-817

On the Multiplicity of Solutions of the Inverse Problem for a Vibrating Beam

V. Barcilon

Dept. of the Geophysical Sciences, Univ. of Chicago, Chicago, IL 60637, SIAM J. Appl. Math., 37 (3), pp 605-613 (Dec 1979) 5 refs

Key Words: Beams, Natural frequencies

The 2-fold multiplicity of solutions found by Boley and Golub in their study of the inverse problem for N x N symmetric, pentadiagonal matrices contrasts with the unicity of the solution of the inverse problem for an inhomogeneous, discrete beam. The reason for this discrepancy is elucidated and can be traced to the different properties of the spectral data used in the two cases.

80-818

Forced Vibration of Beams by Eigenmatrix Method

B. Tanimoto, K. Ishikawa, and S. Natsume
Kanazawa Inst. of Tech., Nonoichi, Kanazawa, Japan, ASCE J. Struc. Div., 105 (ST12), pp 2725-2749 (Dec 1979) 11 figs, 2 tables, 7 refs

Key Words: Beams, Frames, Forced vibration, Eigenvalue problems, Boundary value problems

The eigenmatrix method and the operational displacement are presented for the forced vibration problem of beams and frames. The differential equation for flexure is due to the classical Bernoulli-Euler's theory, and is extended to Timoshenko's. The stress-strain relationship is also extended from Hooke's law to the visco-elastic Voigt's law. The structures are treated as continuum solid bodies.

80-819
Buckling of Rotating Beams
W.F. White, Jr., R.G. Kvaternik, and K.R.V. Kaza
Structures Lab., U.S. Army Res. and Tech. Labs., (AVRADCOM), Langley Research Ctr., Hampton, VA 23665, Intl. J. Mech. Sci., 21 (12), pp 739-745 (1979) 2 figs, 12 refs

Key Words: Beams, Rotating structures, Buckling

The stability of a beam subjected to compressive centrifugal forces arising from steady rotation about an axis which does not pass through the clamped end of the beam is analyzed to determine the critical rotational speeds for buckling in the inplane and out-of-plane directions. The differential equations of motion are solved numerically using an integrating matrix method in combination with an eigenanalysis to determine the eigenvalues from which stability is assessed. The results clarify several differences which have been identified in the literature relating to the proper behavior of the critical rotational speed for buckling as the radius of rotation of the clamped end of the beam is reduced.

CYLINDERS

80-820
Experimental Seismic Study of Cylindrical Tanks
R.W. Clough, A. Niwa, and D.P. Clough
Univ. of California, Berkeley, CA, ASCE J. Struc. Div., 105 (ST12), pp 2565-2590 (Dec 1979) 17 figs, 4 tables, 17 refs

Key Words: Storage tanks, Tanks (containers), Fluid-filled containers, Cylindrical shells, Shells, Earthquake response, Experimental data

Earthquake response behavior of ground-supported, thin-shell, cylindrical liquid storage tanks is studied experimentally by means of the University of California at Berkeley shaking table. Principal test parameters include base fixity (fixed or free to uplift) and top condition (open, fixed, or floating roof).

COLUMNS
(Also see No. 723)

80-821
Improving Ductility of Existing Reinforced Concrete Columns
L.F. Kahn and B.J. Suriano
Georgia Inst. of Tech., Atlanta, GA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1095-1103, 13 figs, 5 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Columns, Reinforced concrete, Seismic design

The purpose of this experimental research is to study three simple and potentially inexpensive techniques for strengthening existing reinforced concrete columns. The scope is limited to testing four, 10-inch square columns, three of which are strengthened using different methods to confine the concrete. A qualitative comparison of the behavior of the four columns is the primary objective.

FRAMES AND ARCHES
(See No. 818)

PANELS
(Also see No. 837)

80-822
Non-Linear Vibrations of a Shallow Cylindrical Panel on a Non-Linear Elastic Foundation
C. Massalas and N. Kafousias
Dept. of Mechanics, Univ. of Ioannina, Ioannina,

Greece, J. Sound Vib., 66 (4), pp 507-512 (Oct 22, 1979) 4 figs, 8 refs

Key Words: Panels, Elastic foundations, Nonlinear systems

The influence of large amplitude on the free vibrations of a long shallow cylindrical panel with straight edges clamped and resting on a non-linear elastic foundation is investigated. The equilibrium of the panel when subjected to an external pressure is also studied.

80-823

Shear Stiffness Degradation of Tensioned Reinforced Concrete Panels Under Reversing Loads

P.C. Perdikaris, C.H. Conley, and R.N. White
Dept. of Structural Engrg., Cornell Univ., Ithaca, NY, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 175-184, 7 figs, 2 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Nuclear reactor containment, Panels, Reinforced concrete, Cyclic loads, Shear strength, Seismic design

The major objective of this paper is to present experimental data on the effects of cyclic membrane shear loading, biaxial tension, and reinforcement ratio upon the degradation of shear stiffness and strength of biaxially tensioned reinforced concrete specimens under fully reversing cyclic shear loads. The specimen configuration and the loading scheme employed were chosen to best simulate the membrane stress state in the wall of a nuclear containment vessel under combined internal pressurization plus shear loads caused by seismic forces. The present investigation is part of an extensive experimental research program of shear transfer at Cornell University. It is aimed at developing a better understanding of the shear transfer phenomenon in precracked reinforced concrete structures. One objective of the research is to develop sufficient information on orthogonally reinforced specimens such that it may become feasible to eliminate or at least reduce the amount of diagonal reinforcing steel required by current design methods for typical vessels subjected to seismic loadings.

PLATES

(Also see Nos. 900, 936)

80-824

Earthquake Response of Nonlinear Plates

G. Ahmadi
Dept. of Mech. Engrg., Shiraz Univ., Shiraz, Iran, Nucl. Engr. Des., 54 (3), pp 407-417 (Nov 1979) 52 refs

Key Words: Plates, Nonlinear systems, Earthquake response, Seismic response spectra, Stochastic processes

The finite amplitude vibration of a plate subjected to earthquake support motion is considered. Several bounds on the maximum responses of the plate are established which are based on the knowledge of the response spectra of the seismic motion. The stochastic models of the earthquake ground motion is then briefly discussed. The single mode of vibration of the plate is then considered and a perturbation series expansion is developed for the vibration amplitude. Mean square responses of the plate are calculated for both stationary as well as nonstationary seismic excitations. The reliability of design is also considered and the probability of no barrier crossing is briefly discussed.

80-825

Free Vibration of Antisymmetric, Angle-Ply Laminated Plates Including Transverse Shear Deformation by the Finite Element Method

J.N. Reddy
School of Aerospace, Mechanical and Nuclear Engrg., The Univ. of Oklahoma, Norman, OK 73019, J. Sound Vib., 66 (4), pp 565-576 (Oct 22, 1979) 2 figs, 8 tables, 21 refs

Key Words: Plates, Laminates, Free vibration, Transverse shear deformation effects, Rotatory inertia effects, Finite element technique

A finite element formulation of the equations governing the laminated anisotropic plate theory of Yang, Norris and Stavsky, is presented. The theory is a generalization of Mindlin's theory for isotropic plates to laminated anisotropic plates and includes shear deformation and rotary inertia effects. Finite element solutions are presented for rectangular plates of antisymmetric angle-ply laminates whose material properties are typical of a highly anisotropic composite material. Two sets of material properties that are typical of high modulus fiber-reinforced composites are used to show the parametric effects of plate aspect ratio, length-to-thickness ratio, number of layers and lamination angle. The numerical results are compared with the closed form results of Bert and Chen. As a special case, numerical results are presented for thick isotropic plates, and are compared with those for 3-D linear elasticity theory and Mindlin's thick plate theory.

80-826

Note on the Forced Vibration of an Orthotropic Plate on an Elastic Foundation

A. Das and S.K. Roy

Faculty of Engrg., Jalpaiguri Government Engrg. College, Jalpaiguri 735102, India, J. Sound Vib., 66 (4), pp 521-525 (Oct 22, 1979) 2 tables, 8 refs

Key Words: Plates, Elastic foundations, Forced vibration, Blast loads

An analysis is presented of the response of an infinite, linearly elastic, orthotropic plate, resting on an elastic foundation, to a forcing function which may vary in both time and space. Some numerical results are given for a case of concentrated blast loading.

80-827

Vibration and Buckling of Plates at Elevated Temperatures

R. Jones, J. Mazumdar, and Y.K. Cheung

Dept. of Appl. Mathematics, The Univ. of Adelaide, South Australia, Intl. J. Solids Struc., 16 (1), pp 61-70 (1980) 3 figs, 3 tables, 21 refs

Key Words: Plates, Buckling, Vibration response, Thermal excitation

The linear and non-linear dynamic behavior of plates at elevated temperatures are examined. Analytical solutions for the buckling and post-buckling behavior are obtained. A general formula is then presented which links the fundamental frequency of vibration to the critical buckling temperature and the corresponding frequency of the unheated plate. The behavior of certain visco-elastic plates is also considered and a criterion for thermal buckling is presented.

SHELLS

80-828

Seismic Response of Cracked Cylindrical Concrete Structures

P. Gergely and J.K. Smith

Structural Engineering, Cornell Univ., Ithaca, NY, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 185-192; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Shells, Cylindrical shells, Reinforced concrete, Nuclear reactor containment, Off-shore structures, Cracked media, Seismic response, Seismic design

The overall and local dynamic deformations, the maximum slip at cracks, and the shear stresses are important design parameters. These quantities were studied with the help of nonlinear dynamic analyses which are described briefly in this paper.

80-829

An Analysis of the Static and Dynamic Instability of Thick Cylinders

J.D. Renton

Dept. of Engrg. Science, Univ. of Oxford, UK, Intl. J. Mech. Sci., 21 (12), pp 747-754 (1979) 4 figs, 11 refs

Key Words: Shells, Cylindrical shells, Stability

A general solution of Bolotin's differential equations for the dynamic stability of a homogenous isotropic medium is given. This takes the form of displacement functions which express the solution as a sum of dilatational and distortional effects. Using these functions, solutions are found for the vibration of cylinders of finite thickness when initial axial stresses are present. The behavior of solid rods, simple vibration and simple buckling are all seen to be special cases of the general solution. The results are compared with approximate formulae for the buckling of thin cylinders.

80-830

Elastic Stability of Conservative Systems: A New Approach

C.Y. Massalas, G.I. Tzivanidis, and E.K. Manesis

Univ. of Ioannina, Ioannina, Greece, Meccanica, 13 (1), pp 37-40 (Mar 1978) 10 refs

Key Words: Shells, Cylindrical shells, Stability, Eigenvalue problems

A critical load analysis for conservative systems subjected to arbitrary constraints is presented. The principle of stationary potential energy is used. The base state, considered in general a bending state, and the non-trivial constraints are approximated by linear theory. The description of an adjacent equilibrium state is then obtained from the nonlinear theory and the eigenvalue problem is formulated using an appropriate linearization procedure. The method is subsequently applied to the stability problem of a cylindrical isotropic shell.

80-831
Dynamic Fluid Effects in Liquid-Filled Flexible Cylindrical Tanks

D. Fischer

VOEST-ALPINE AG, FAT, Linz, Austria, Intl. J. Earthquake Engr. Struc. Dynam., 7 (6), pp 587-601 (Nov/Dec 1979) 12 figs, 1 table, 24 refs

Key Words: Tanks (containers), Storage tanks, Sloshing, Fluid-filled containers, Galerkin's method

The velocity potential of a compressible fluid is found by Galerkin's method. Free surface displacements and a flexible tank wall are assumed. Explicit expressions for the impulsive mass, the impulsive moment and the overturning moment are derived for wave number m = 1.

80-832
Importance of Vertical Acceleration in the Design of Liquid Containing Tanks

T.J. Marchaj

Preload Technology, Inc., 839 Stewart Ave., Garden City, NY 11530, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 146-155, 5 figs, 8 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Storage tanks, Fluid-filled containers, Seismic excitation, Earthquake resistant structures, Seismic design

The elastic tank-fluid system when excited vertically, can be analyzed as a single-degree-of-freedom system, which vibrates (pulsates) radially against vertical center axis of the tank without distortions of its circular cross-section. In the conclusion of this paper, solutions for improvement of the existing underdesigned tanks are given.

80-833
Vibration Tests of Full-Scale Liquid Storage Tanks

G.W. Housner and M.A. Haroun

California Inst. of Technology, Pasadena, CA 91125, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 137-145, 12 figs, 3 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Storage tanks, Fluid-filled containers, Seismic design, Dynamic tests, Experimental data

Theoretical and experimental investigations of the dynamic behavior of cylindrical liquid storage tanks were conducted to seek possible improvements in the design of such tanks to resist earthquakes. This paper records the principal results obtained during the second phase of the study which was concerned with vibration tests of full-scale tanks. Three water storage tanks, with different types of foundations, were tested to assess the influence of support conditions. Ambient and forced vibration tests were carried out to determine the natural frequencies and the mode shapes of vibrations. Comparison with previously computed frequencies and mode shapes shows good agreement with the experimental results.

PIPES AND TUBES
(Also see Nos. 729, 780, 878)

80-834
The Transmission of Flow Generated Noise Through Pipe Walls at Acoustic Pipe Coincidence - Experimental Verification

J.L. Walter and G. Reethof

Noise Control Lab., The Pennsylvania State Univ., University Park, PA, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 311-319, 9 figs, 10 refs; Avail: see 80-931

Key Words: Pipes (tubes), Fluid-induced excitation, Noise generation, Experimental data

The noise from control valves and regulators is a major source of noise in chemical, petro-chemical and steam power plants. The cause of the noise inside the pipe is the extreme turbulence and/or shock turbulence interaction just downstream of the throttling orifice. This paper discusses the transmission of flow generated noise through pipe walls at acoustic pipe coincidence.

80-835
Recent Developments in Seismic Analysis of Buried Pipelines

T. Ariman and G.E. Muleski
Univ. of Notre Dame, Notre Dame, IN 46556, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 643-652, 4 figs, 23 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Underground structures, Pipelines, Seismic response

The aim of the present paper is to provide a concise review of some of the most recent developments in the seismic analysis of buried pipelines.

80-836
Role of Corrosion in Water Pipeline Performance in Three U.S. Earthquakes
J. Isenberg
Weidlinger Associates, Menlo Park, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 683-692, 4 figs, 11 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Underground structures, Pipelines, Corrosion, Seismic response

The present paper describes the seismic performance of pipelines when they are subjected primarily to wave propagation effects. Data from such regions suggest that a strong correlation exists between poor seismic performance and advanced corrosion in cast iron and steel pipes. This evidence helps to justify corrosion control programs which are in effect at some major utilities and the practice of replacing reaches of pipe which leak excessively.

BUILDING COMPONENTS
(Also see No. 857)

80-837
The Seismic Response of Simple Precast Concrete Panel Walls
J.M. Becker and C. Llorente
Massachusetts Inst. of Tech., Cambridge, MA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 423-432, 11 figs, 1 table, 9 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Walls, Panels, Concrete, Seismic response

This paper explores the possible influence of rocking and slipping phenomena on the seismic response of simple precast concrete walls. This exploration is carried out through a series of analytic studies. A finite element approach is used, in which all nonlinear inelastic behavior is concentrated in the connection elements. The paper also reports on parametric studies of 5- and 10-story walls with various reinforcement patterns for providing vertical continuity.

80-838
Selected Precast Connections: Low-Cycle Behavior and Strength
A. Aswad
Stanley Structures, Inc., Denver, Colorado, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1085-1094, 7 figs, 2 tables, 6 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Structural members, Joints (junctions), Cyclic loading, Dynamic tests, Experimental data

This paper presents some of the test results related to common precast member connections. The testing program was conducted on full-size panels at Stanley Structures (Denver plant) in 1977. Testing consisted of static, monotonic, or cyclic loading to failure. The number of full cycles was limited to three and the duration of each cycle was approximately ten minutes. The results are summarized in tabular form and provide information on the maximum force attained, secant stiffness and material strengths.

80-839
Cyclic End Moments and Buckling in Steel Members
A.K. Jain and S.C. Goel
Univ. of Michigan, Ann Arbor, MI, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 413-422, 7 figs, 1 table, 10 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Framed structures, Steel, Seismic response, Mathematical models, Computer programs, Cyclid loading, Hysteretic damping

The purpose of this paper is to present a new hysteresis model for the seismic response of steel members which accounts for reduction in compressive strength in the first two cycles, increase in member length and effects of end moments. This model is called the End Moment-Buckling Element for use with DRAIN-2D computer program.

80-840

Seismic Behavior of Masonry Piers

P.A. Hidalgo and H.D. McNiven

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 303-312, 4 figs, 2 tables, 12 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Piers, Masonry, Multi-story buildings, Buildings, Seismic response, Dynamic tests, Experimental data

This paper presents the results obtained with seventy full-scale, masonry piers, tested under cyclic lateral loads. The summary of the test program is presented in Table 1. These tests form part of a research program that has been in progress at the Earthquake Engineering Research Center, University of California, Berkeley, since 1972. The principal objective of this research is the study of the seismic behavior of structural elements commonly used in multi-story masonry buildings.

80-841

An Experimental Investigation of the Reinforcement Requirements for Simple Masonry Structures in Moderately Seismic Areas of the U.S.

P. Gulkan and R.L. Mayes

Earthquake Engineering Research Ctr., Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 293-302, 5 figs, 2 tables, 2 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Structural members, Buildings, Masonry, Seismic response, Experimental data, Dynamic tests

This paper presents an overview of an experimental investigation on the seismic reinforcement requirements for single-story masonry dwellings. The promulgation of a "Local Acceptable Standard" by the Department of Housing and Urban Development (HUD) Phoenix, Arizona, office requiring partial reinforcement in masonry houses was questioned by individuals associated with the local housing industry on the grounds that it was not rational, and compliance with it would lead to higher costs and unnecessarily large factors of safety for seismic loads. To address this question, the investigation undertaken at the request of HUD was aimed at providing information on the behavior of simple masonry structures subjected to simulated earthquakes. The objective was to determine reinforcement requirements for adequate resistance of typical masonry housing construction for the level of seismic activity expected in Seismic Zone 2 areas of the 1973 Uniform Building Code (UBC). A unique feature of the investigation was the testing of full scale structural components of typical masonry houses on the University of California, Berkeley, shaking table.

80-842

Building Damage Caused by the Miyagi-Ken-Oki Japan Earthquake June 12, 1978

M. Watabe

Structural Engrg. Dept., Bldg. Research Inst. Ministry of Construction, Japan, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 363-372, 16 figs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Earthquake damage

The damage features and causes of damages due to this Miyagi-Ken-Oki earthquake June 1978 are summarized in this paper.

80-843

Effects of Beam Strength and Stiffness on Coupled Wall Behavior

J.D. Aristizabal-Ochoa, K.N. Shiu, and W.G. Corley

Portland Cement Assn., Skokie, IL, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 323-332, 11 figs, 3 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Beams, Reinforced concrete, Walls, Dynamic tests, Earthquake response

Results of an experimental investigation to determine effects of coupling beam strength and stiffness on overall response of two reinforced concrete coupled wall systems subjected to earthquake like loadings are reported. Objectives of the experimental investigation were to evaluate: effects of axial load induced by the coupling beams on behavior of the individual walls; and effects of coupling beams on crack development, general behavior and sequence of yielding. Performance of walls and connecting beams was evaluated based on previous tests of the individual elements. Conclusions are drawn with regard to existing procedures for analyzing and designing coupled wall systems.

80-844

Calculation of the Sound Transmission Between Dwellings by Partitions and Flanking Structures

E. Gerretsen

Technisch Physische Dienst TNO-TH (Institute of Applied Physics), Delft, The Netherlands, Appl. Acoust., 12 (5), pp 413-433 (1979) 10 figs, 1 table, 23 refs

Key Words: Walls, Sound transmission, Mathematical models

A calculation model is presented for the sound transmission between dwellings by partitions and by flanking structures, based on the application of classical theory. The most important data needed are the sound reduction index for direct transmission of the different structures and the vibration level differences across junctions. Information on the reduction index is given, based on theory, taking into account the influence of boundary conditions by means of the structural reverberation time in situ. The vibration level differences have been determined for different junctions on the basis of in situ measurements.

80-845

Accidental Explosions and Effects of Blast Leakage into Structures

K. Kaplan and P.D. Price

Scientific Service, Inc., Redwood City, CA, Rept. No. ARLCD-CR-79009, AD-E400 320, 156 pp (June 1979)

AD-A072 787/5GA

Key Words: Explosion effects, Blast effects, Buildings, Opening-containing structures, Windows, Doors

The effects of openings in structures struck by blast waves from accidental explosions are of two types: those that alter loadings used for design of the basic structures; and those that subject interior elements to loadings. Basic design loadings on structures with openings such as windows and doorways can differ substantially from what they would be on closed structures. Interior spaces are affected both by the portion of the blast wave that enters through openings, spreads out, and reflects from all interior surfaces, and by high-velocity jets that can form later due to blast-caused pressure differences between the exterior and interior. Methods of determining the effect of these loads are presented.

DYNAMIC ENVIRONMENT

ACOUSTIC EXCITATION

(Also see Nos. 669, 675, 677, 681, 688, 689, 690, 693, 724, 739, 742, 743, 744, 748, 749, 750, 752, 753, 754, 756, 757, 769, 770, 771, 772, 773, 775, 793, 814, 844, 873, 879, 881, 883, 884, 887, 888, 902, 929, 931, 944, 946, 947)

80-846

Acoustic-emission Analysis of Fracture-toughness Tests

D. Dilipkumar and W.E. Wood

Materials Science Dept., Oregon Graduate Ctr., Beaverton, OR 97005, Exptl. Mech., 19 (11), pp 416-420 (Nov 1979) 7 figs, 2 tables, 9 refs

Key Words: Acoustic emission, Steel, Fracture properties

Acoustic-emission behavior of 300M steel is investigated as a function of the fracture toughness and microstructure. A model is presented to correlate acoustic emission arising from plastic deformation as well as crack growth during fracture-toughness tests and experimental data.

80-847

Scattering of Acoustic Waves by Elastic and Viscoelastic Obstacles of Arbitrary Shape Immersed in a Fluid

B.A. Peterson, V.V. Varadan, and V.K. Varadan

Ohio State Univ., Res. Foundation, Columbus, OH Rept. No. OSURF-761251/711374, 44 pp (June 1979)

AD-A072 274/4GA

Key Words: Sound waves, Acoustic scattering, Underwater sound

A scattering or T-matrix approach is presented for studying the scattering of acoustic waves by elastic and viscoelastic obstacles immersed in a fluid. A Kelvin-Voigt model is used to obtain the complex elastic moduli of the viscoelastic solid. Extensive numerical results for prolate and oblate spheroids for a variety of scattering geometries are obtained. The backscattering, bistatic, absorption and extinction cross-section are presented as a function of the frequency of the incident wave.

80-848

Underwater Sound Propagation-Loss Program. Computation by Normal Modes for Layered Oceans and Sediments

D.F. Gordon

Naval Ocean Systems Ctr., San Diego, CA, Rept. No. NOSC-TR-393, 104 pp (May 17, 1979) AD-A072 201/7GA

Key Words: Underwater sound, Sound transmission, Computer programs

A normal-mode program for a sound-speed profile of an arbitrary number of layers is constructed. It has been used extensively and successfully for 12 years to compute sound propagation in idealized underwater acoustic ducts. The FORTRAN statements are given for both the normal-mode and a mode-follower program. The numerical analysis necessary for computing modified Hankel functions of order 1/3 is given. The analysis includes a continued fraction technique.

80-849

Variation of the Vertical Directionality of Noise with Depth in the North Pacific

V.C. Anderson

Marine Physical Lab. of the Scripps Instn. of Oceanography, Univ. of California, San Diego, CA 92152, J. Acoust. Soc. Amer., 66 (5), pp 1446-1452 (Nov 1979) 11 figs, 1 table, 2 refs

Key Words: Underwater sound, Experimental data

A vertical array of 20 vibration isolated hydrophones was suspended from the Research Platform FLIP at various depths from 713 to 4816 m. Preformed sets of beams were formed with a digital beamformer to observe the vertical noise distribution at several frequencies between 23 and 100 Hz. Directional spectra derived from 10-min samples of digital records are presented. Interpretation of the data set leads to a model for the vertical noise directional spectrum as a function of depth which indicates a reduction of a factor of 2 in the vertical extent of the noise window as depth increases from the sound channel axis to the critical depth.

80-850

Vibration and Structure-Borne Sound in the Vicinity of Road Tunnels

H.W. Koch

Curt-Risch-Institut f. Schwingungs- und Messtechnik, Universität Hannover, Hannover, Germany, J. Sound Vib., 66 (3), pp 381-386 (Oct 8, 1979) 3 figs, 1 table, 6 refs

Key Words: Structure-borne noise, Noise measurement, Noise source identification

Vibration together with structure-borne sound finally projected into the air from adjacent surfaces can, depending on the particular circumstances, be detected in houses located in the vicinity of road tunnels, the degree of disturbance depending on the intensity of the source. The results of measurements of such sound and vibration in the vicinity of a large motorway tunnel are given in this paper. First the vibration and sound arising during the construction of the tunnel is considered.

80-851

Investigation of Acoustical Barriers Used in the Foundry Industry

S. Czarnecki, Z. Engel, and A. Mielnicka

Univ. of Mining & Metallurgy, 30-059 Krakow, Poland, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 345-352, 11 figs, 5 refs; Avail: see 80-931

Key Words: Machinery noise, Machinery vibration, Noise barriers, Sound transmission, Industrial noise

In the last few years the Institute of Mechanics and Vibroacoustics at the University of Mining and Metallurgy in Krakow has conducted research into noise and vibration control of machines used in the foundry industry. Two noise control approaches were used: so-called active and passive methods. Active methods rely on reduction of noise radiation of a source and source surface vibrations. Identification of the sources becomes the basic problem in the case of active noise control methods. The most important aims of source identification are: identification of separate source locations in a machine, ranking of the sources, and source characteristics and relationships between them. Passive noise control methods rely on improving the insulation between a source and a receiver. For this purpose identification of sound transmission paths is very important to define the paths and their transfer functions. In the paper an investigation of sound transmission paths is presented for a barrier with free-field conditions using a cross-correlation method.

80-852

Acoustic and Vibratory Characteristics of a 300 Ton Dieing Machine

R.L. Krause, L.L. Faulkner, and D.A. Guenther

Plant & Factory Engrg., Western Electric Corp., Columbus, OH, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 119-125, 3 figs, 2 tables, 2 refs; Avail: see 80-931

Key Words: Machinery noise, Machinery vibration

For several years there has been a continuing research program at Ohio State University and Systems Engineering Associates aimed at noise and its related physical phenomena relative to heavy machinery. It is the purpose of this paper to present the analysis with specific application to a 300 ton dieing machine.

80-853

Cold Heading Noise and Noise Control

R.N. Baker

H.L. Blachford, Inc., Troy, MI, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 93-100, 4 figs, 4 refs; Avail: see 80-931

Key Words: Machinery noise, Noise reduction

In early 1975, over 100 fastener manufacturing companies and three major builders of fastener-making machinery joined together to sponsor the Fastener Industry Noise Control Research Program (FINCRP). This group has been studying the noise emissions of fastener machinery and developing retrofit engineering noise controls as well as identifying administrative controls and personal hearing protection devices suitable for the industry. A report was issued in 1976 presenting the findings of the first phase. The second phase of the program began late in 1976. It includes the design, fabrication, installation and evaluation of various types of engineering controls for cold headers and other fastener machinery. In 1980, the FINCRP will be completed with the publication of a design guide manual to aid participants in reducing employee noise exposures to within the limits of the Occupational Safety and Health Administration's noise standards.

80-854

Machinery Noise Source Analysis Using Surface Intensity Measurements

J.D. Brito

Deere & Company Technical Ctr., Moline, IL 61265, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 137-142, 5 figs, 1 table, 1 ref; Avail: see 80-931

Key Words: Machinery noise, Noise source identification

Surface intensity measurements provide a means of source identification, ranking and quantification of machinery noise. An experimental procedure is presented to measure the normal component of the acoustic intensity at a point on a vibrating surface based on local measurements of acceleration and acoustic pressure. The resulting "local intensity" values can be used to show which parts of the structure are most responsible for the radiated noise, or can be space averaged to obtain an estimate of radiated acoustic power. An application of the technique is presented with comparison to reverberant room results.

80-855

Computerized Noise Modeling at General Motors Corporation

J.R. Hofmeister and R.T. Sliwinski

General Motors Corp., Detroit, MI 48202, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 129-135; Avail: see 80-931

Key Words: Industrial facilities, Noise generation, Mathematical models, Computer aided techniques

Engineering decisions regarding noise control at General Motors Corporation are being made with the help of computers. The simulation of complex situations in manufacturing facilities through computer modeling has resulted in significant savings through the avoidance of unnecessary expenditures and by indicating where expenditures should be made to benefit the greatest number of employees.

80-856

Performance of Absorptive Treatments for Noise Control in Factory Spaces

C.I. Holmer

Div. of Underwater Systems, Inc., Noise Control Technology, 8121 Georgia Ave., Silver Spring, MD 20910, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 337-344, 5 figs, 1 table, 2 refs; Avail: see 80-931

Key Words: Industrial facilities, Noise generation, Machinery noise, Mathematical models, Experimental data, Measurement techniques, Acoustic absorption

This report describes a new analytic model and supporting full-scale experimental studies for quantitatively describing the performance of absorptive treatments for noise control in factory spaces. The purposes of the study include: identification of an analytic model to readily permit quantitative evaluation of noise from arrays of machinery; identification of a measurement procedure to permit accurate dete.mination of the usefulness of acoustic absorption; and measurement of achieved performance of representative installations of acoustic treatments.

80-857

Sound Generation in a Flow Near a Compliant Wall

W. Mohring and S. Rahman

Max-Planck-Institut f. Stromungsforschung, D3400 Göttingen, Germany, J. Sound Vib., 66 (4), pp 557-564 (Oct 22, 1979) 11 refs

Key Words: Sound generation, Walls

The generation of sound near an infinite compliant wall is studied, with account taken of a uniform mean flow. Stable and unstable configurations are considered.

SHOCK EXCITATION

(Also see Nos. 698, 699, 700, 702, 703, 704, 705, 706, 707, 709, 710, 711, 712, 713, 714, 715, 716, 717, 722, 723, 725, 729, 730, 731, 732, 733, 734, 735, 736, 737, 740, 745, 747, 755, 760, 776, 777, 778, 779, 780, 790, 792, 820, 821, 824, 828, 832, 833, 835, 836, 837, 839, 840, 841, 842, 843, 845, 878, 892, 897, 898, 899, 901, 911, 912, 913, 914, 915, 917, 918, 919, 922, 923, 924, 925, 927, 928, 932, 933, 934, 938, 942, 943)

80-858

An Approximate Method for Estimating the Strong Motion Earthquake Spectra on Bedrock

K. Ishida

The John A. Blume Earthquake Engineering Ctr., Stanford Univ., Stanford, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 273-282, 17 figs, 15 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic response spectra, Seismic design

In this paper, the variation of the observed spectrum from the theoretical spectrum in the short period range is estimated.

80-859

Attenuation of Strong-Motion Parameters in the 1976 Friuli, Italy, Earthquakes

E. Faccioli and D. Agalbato

Istituto di Scienza e Tecnica delle Costruzioni, Politecnico, Milano, Italy, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 233-242, 7 figs, 1 table, 19 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic waves, Wave attenuation, Data processing

Instrumental observations of the Friuli events of NE Italy initiating with the destructive shock of May 6, 1976, yielded a large body of local data associated with a strong earthquake. An attempt is presented herein to review the attenuation characteristics of several ground motion parameters obtained from the Friuli records, including certain aspects of data processing. The salient results are compared with previous findings both from the Mediterranean area and from Western US.

80-860

Empirical Data about Local Ground Response

W.W. Hays, A.M. Rogers, and K.W. King
U.S. Geological Survey, Denver, CO 80225, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 223-232, 9 figs, 16 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Ground motion, Seismic excitation, Earthquakes, Nuclear explosions

This paper presents results of research on local ground response obtained from analysis of broadband ground-motion data recorded from earthquakes and nuclear explosions. The results are given in terms of transfer functions which are defined as the average ratio of the 5-percent damped, horizontal response spectra for a pair of sites.

80-861

Critical Review of Dynamic Effective Stress Analysis

W.D.L. Finn
Univ. of British Columbia, Vancouver, B.C., Canada, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 853-867, 13 figs, 24 refs

Key Words: Sand, Soil, Cyclic loading, Earthquake response

In this paper a critical analysis of the two most important features of each of the existing methods for dynamic effective stress response analysis is presented, the pore-water pressure prediction model and the stress-strain law. It is hoped that the presentation will stimulate some interaction among those doing research in this area and provide guidance to the profession in appraising this new tool for estimating the dynamic response of saturated sand and cohesionless silts to cyclic and earthquake loading.

80-862

A Probabilistic Seismic Damage Model

R. Del Tosto
J.W. Wiggins Co., Redondo Beach, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 773-782, 4 figs, 5 tables, 7 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Earthquake damage, Damage prediction, Statistical analysis

In this study, the damage-statistics approach is followed, developing damage probabilities and incorporating the uncertainty of these estimates resulting from the limited data processed. No assumption is made on the structural system behavior, and direct correlations are obtained between strong ground motion parameters and damage.

80-863

Nonlinear Soil Dynamics by Characteristics Method

E.B. Wylie and R. Henke
Dept. of Civil Engrg., The Univ. of Michigan, Ann Arbor, MI 48109, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 563-571, 4 figs, 12 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic excitation, Seismic waves, Shear wave propagation technique, Method of characteristics

This study presents a concept of interpolations along the time line, rather than the depth line, in an attempt to improve upon the numerical accuracy. Additionally an evaluation of the success of the MOC (method of characteristics) is provided by utilizing an energy calculation which compares the energy input to the soil deposit with the sum of the energy dissipated and the residual energy stored.

80-864

Effect of the Miyagi-Oki, Japan Earthquake of June 12, 1978, on Lifeline Systems

K. Kubo
Univ. of Tokyo, Tokyo, Japan, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 343-352, 7 figs, 4 tables; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Lifeline systems, Earthquake damage

The city of Sendai with a population of 617,000 was attacked by a destructive earthquake of magnitude 7.4 at 17:14 on June 12, 1978. In the event of this 1978 Miyagi-Ken-Oki earthquake, several reinforced concrete buildings on the soft ground collapsed and some damages were sustained by various lifeline structures. This paper describes the seismic damage to city gas and water supply systems in Sendai, as well as railway and highway structures.

80-865

Some Effects of a Surface Dipping Layer on Structure and Ground Response in Earthquakes

G.L. Wojcik

Weidlinger Associates, Menlo Park, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1114-1123, 14 figs, 7 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic waves, Amplification, Discontinuity-containing media

This paper examines the role of a very simple lateral geologic inhomogeneity, the surface dipping layer, in modifying the response of both the free surface and surface structures to SH seismic input.

80-866

The Effectiveness of Trenches and Scarps Reducing Seismic Energy

B.A. Bolt and T.W. May

Univ. of California, Berkeley, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1104-1113, 6 figs, 6 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic waves, Wave scattering, Discontinuity-containing media, Seismic barriers

In this paper, some preliminary numerical results for two-dimensional seismic barriers, as well as sharp changes in surface elevation (scarps), are presented for crustal models with horizontal layering. The finite element analysis is restricted to horizontally polarized (SH) waves and is carried out in the time domain.

80-867

Equivalent Linear SDF Response to Earthquakes

V. Tansirikongkol and D.A. Pecknold

URS/John A. Blume & Associates, Engrs., San Francisco, CA, ASCE J. Struc. Div., 105 (ST12), pp 2529-2545 (Dec 1979) 10 figs, 27 refs

Key Words: Oscillators, Single degree-of-freedom systems, Seismic excitation, Equivalent linearization method

The objective of this paper is to examine the accuracy of an equivalent linearization method for prediction of maximum response of a single degree-of-freedom bilinear hysteretic oscillator subjected to earthquake input. Simple expressions are developed for equivalent linear frequency and damping in terms of maximum attained response ductility. Comprehensive numerical results are presented in which the effects on accuracy of elastic frequency, yield strength, bilinear hardening slope, initial viscous damping, and earthquake input are examined.

80-868

Structural Response to Traveling Seismic Waves

S.D. Werner, L.C. Lee, H.L. Wong, and M.D. Trifunac

Agbabian Associates, El Segundo, CA, ASCE J. Struc. Div., 105 (ST12), pp 2547-2564 (Dec 1979) 13 figs, 3 tables, 20 refs

Key Words: Interaction: soil-structure, Seismic waves, Bridges

A new methodology for analyzing the three-dimensional response of soil/structure systems to traveling seismic waves is described and used to analyze a single-span bridge subjected to incident plane SH-waves. The analysis results demonstrate the importance of traveling wave effects and show how the excitation frequency and direction of incidence of the seismic waves influence the three-dimensional response characteristics of this bridge/soil system.

80-869

The Effect of Random Compressional Waves on a Rigid Sphere Embedded in an Elastic Medium

A. Beltzer, B. Robinson, and N. Rudy

Holon Center for Technological Education, Holon, Israel, J. Sound Vib., 66 (4), pp 513-519 (Oct 22, 1979) 4 figs, 20 refs

Key Words: Compression waves, Spheres, Seismic excitation

The response of a movable rigid sphere embedded in an elastic medium to random compressional wave disturbances is considered. The exact solution is obtained for the case of a narrow-band process. Excitation by band-limited white noise is treated numerically. The influence of the elasticity and inertia parameters on the randomness of the sphere motion and on the scatter of the force acting on the sphere is studied. The results are applicable to problems in material fatigue and seismic engineering.

80-870

Site-Dependent Critical Design Spectra

P.C. Wang and C.B. Yun

Polytechnic Inst. of New York, Brooklyn, NY, Intl. J. Earthquake Engr. Struc. Dynam., 7 (6), pp 569-578 (Nov/Dec 1979) 4 figs, 16 refs

Key Words: Critical response spectra, Seismic response spectra, Seismic design

A new type of seismic response spectrum is presented. It is based on the concept of a critical excitation which is defined here as an excitation among a certain class of excitations that will produce the largest response peak for a design variable of interest. *Site conditions, namely rock,* stiff soil and deep cohesionless soil, are taken into account through the definition of the class of allowable excitations.

80-871

Pretest Simulation of Event S4 HAVE HOST Series

F.S. Wong and J. Isenberg

Weidlinger Associates, Menlo Park, CA, Rept. No. R-7841, DNA-4669T, AD-E300 546, 99 pp (July 1978)

AD-A071 502/9GA

Key Words: Finite element technique, Protective shelters, Nuclear explosion damage, Damage prediction, Blast effects

This is the third phase of an effort which examines the application of dynamic finite element methods to the analysis of shelter-like structures in a nuclear environment. In Phases 1 and 2, the elastic deformation modes of the shelter structure, their sensitivity to variations in the applied airblast wave forms, and the effects of inelasticity and computer modeling were investigated. The reported phase (three) consists of applying the methodology developed to a particular case study, i.e., Event S4 of the HAVE HOST test series. Event S4 was the test of a half-scale prototype shelter using the HEST simulated attack environment. The objective of this effort was to provide pre-test analysis and prediction data for Event S4. Detailed pre-test analytical results are provided for the headworks and the shelter main body.

80-872

Simulation Development for Target Assessment. Part 1.

J.A. Earickson

Eric H. Wang Civil Engrg. Research Facility, New Mexico Univ., Albuquerque, NM, Rept. No. AFWL-TR-78-158-PT-1, AD-E200 306

AD-A071 521/9GA

Key Words: Missile silos, Hardened installations, Nuclear explosions, Simulation

This effort produced design information and experimental data for improving high explosive simulation of nuclear airblasts. The results of this effort were transmitted to USAE Waterways Experiment Station. WES is conducting tests on generic silos as part of a DNA targeting research and test program.

80-873

The Determination of Acoustic Source Levels for Shallow Underwater Explosions

J.B. Gaspin, J.A. Goertner, and I.M. Blatstein

Naval Surface Weapons Ctr., White Oak, Silver Spring, MD 20910, J. Acoust. Soc. Amer., 66 (5), pp 1453-1462 (Nov 1979) 18 figs, 12 refs

Key Words: Underwater explosions, Sound pressure levels, Underwater sound

Pressure-time records from the underwater detonation of 8-, 48-, and 1000-lb explosive charges are presented. These data allow a limited verification of the extrapolation of depth dependent parametric relationships for the pressure-time waveform from deep to shallower sources. Time-domain deconvolution of the data to remove the effects of surface reflection is demonstrated.

VIBRATION EXCITATION

(Also see Nos. 718 719, 751, 910)

80-874

Whirl Dynamics of Pendulous Flywheels Using Bond Graphs

M. Hubbard

Dept. of Mech. Engrg., Univ. of California, Davis, CA 95616, J. Franklin Inst., 308 (4), pp 405-421 (Oct 1979) 8 figs, 1 table, 19 refs

Key Words: Flywheels, Whirling, Critical speeds, Bond graph technique, Active control

Bond graphs are used to generate the equations of motion of a whirling flywheel. Critical frequencies are interpreted as rotational speeds at which non-zero equilibrium configurations exist for displacements (as opposed to the more familiar momenta). In addition, oscillatory modes corresponding to non-zero eigenvalues are examined. Time simulations and other numerical results are given for an example flywheel system which has been proposed for electric utility energy storage.

80-875

Resonant Non-Linear Vibrations in Continuous Systems - I. Undamped Case

M.J. Ablowitz, A. Askar, A.S. Cakmak, and H. Engin

Princeton Univ., Princeton, NJ 08540, Intl. J. Nonlin. Mech., 14 (4), pp 223-233 (1979) 2 figs, 5 refs

Key Words: Forced vibration, Nonlinear systems, Soils, Mathematical models

A method is presented for obtaining periodic solutions to forced oscillations of nonlinear systems. The method is presented by application to an equation which governs the vibrations of a soil layer that is free on the top surface and is forced harmonically at the bedrock.

80-876

Driveline Failure Modes Characterized

T.B. Johnson

Borg Warner Corp., Auto. Engr. (SAE), 87 (9), pp 28-30 (Sept 1979) 4 figs

Key Words: Drive line vibrations, Fatigue

The most common subsystems encountered in a driveline are universal joints, yoke connection, drive tube, and slip components. Three driveline component failure modes are discussed: the structural overload failure, structural fatigue failure and surface wear.

80-877

On the Internal Resonance in a Nonlinear Two-degree-of-freedom System (When the Natural Frequencies are in the Ratio 2:3)

T. Yamamoto, K. Yasuda, and I. Nagasaka

Faculty of Engrg., Nagoya Univ., Chikusa-ku-Nagoya, Japan, Bull. JSME, 22 (171), pp 1274-1283 (Sept 1979) 12 figs, 5 refs

Key Words: Forced vibration, Internal resonance, Two-degree-of-freedom systems

Forced vibrations of a nonlinear two-degree-of-freedom internally-resonanced system with the natural frequencies in the ratio 2:3 are treated. Theoretical analysis is carried out on the behavior of the system near the lower and higher resonance frequencies. The validity of the theoretical analysis is confirmed by an analog computer.

MECHANICAL PROPERTIES

DAMPING

(Also see No. 885)

80-878

An Overview of Soil-Structure Interaction Procedures with Emphasis on the Treatment of Damping

H. Kamil, S. Hom, and G. Kost

Engineering Decision Analysis Co., Inc., Palo Alto, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 623-632, 4 figs, 14 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Interaction: soil-structure, Structural response, Piping systems, Earthquake response, Damping effects

This paper presents an overview of the different procedures of soil-structure interaction currently in use in the industry, with emphasis on the treatment of damping in these procedures. The description of procedures is followed by results from analyses of typical emergency feedwater and auxiliary buildings. Conclusions and recommendations are then presented.

80-879

Evaluation of Viscoelastic Properties for Use in the Design of Structure Damping

E. O'Keefe
Douglas Stewart, Specialty Composites Corp., Newark, DE, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 147-152, 7 figs, 5 refs; Avail: see 80-931

Key Words: Vibration damping, Viscoelasticity, Machinery noise, Noise barriers

This paper discusses an evaluation of viscoelastic properties for use in the design of structure damping.

FATIGUE

(Also see Nos. 738, 764, 930, 937)

80-880
Fatigue-Limit Effect on Variable-Amplitude Fatigue of Stiffeners
P. Albrecht and I.M. Friendland
U.S. Nuclear Regulatory Commission, Washington, D.C., ASCE J. Struc. Div., 105 (ST12), pp 2657-2675 (Dec 1979) 12 figs, 9 tables, 12 refs

Key Words: Fatigue life, Experimental data

The effect of the constant-amplitude fatigue limit on the variable-amplitude fatigue life is determined experimentally. Tensile specimens with transverse stiffeners welded either automatically or manually are tested.

EXPERIMENTATION

MEASUREMENT AND ANALYSIS

(Also see Nos. 702, 759, 761, 846, 945)

80-881
Free Field Rooms for Industrial Applications
J.B. Moreland and L.J. Harper
Westinghouse Electric Corp., Res. and Dev. Ctr., Pittsburgh, PA 15235, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 365-372, 6 figs, 1 table, 3 refs; Avail: see 80-931

Key Words: Noise measurement, Test facilities

In order to develop a cost-effective design for a free field room having an overall shape of a rectangular parallelepiped, we calculate the acoustical field within such rooms by summing the contributions of the six primary images formed by the four walls, the ceiling, and the acoustically "hard" floor. The performance of a free field room is described in terms of the sound pressure levels that would exist out-of-doors.

80-882
Amplitude-Distribution Analysis of Acoustic Emission
D. Dilipkumar, V.S.R. Gudimetla, and W.E. Wood
Materials Science Dept., Oregon Graduate Ctr., Beaverton, OR 97005, Exptl. Mech., 19 (12), pp 438-443 (Dec 1979) 6 figs, 5 tables, 3 refs

Key Words: Measurement techniques, Acoustic emission, Fracture properties

Amplitude distribution of acoustic-emission events generated during fracture of materials contains the potential information about the fracture mechanisms. A methodology is developed for the analysis of acoustic-emission burst signals. A model for amplitude distribution is proposed here, which can potentially identify two mechanisms operating simultaneously.

80-883
Determination of Sound Pressure Level of Machines with Many Similar Working Positions (Bestimmung der Schalleistung von Vielstellenmaschinen)
R. Guse, J. Kallmann, and G. Mandl
Institut f. Textiltechnik, Stuttgart, West Germany, Appl. Acoust., 12 (6), pp 435-445 (Nov 1979) 3 figs, 6 refs
(In German)

Key Words: Sound pressure levels, Measurement techniques

The German standard DIN 45 635 Part 1 describes the determination of sound power level by the envelope measuring method. The method can only be used under certain conditions which arise in a number of industrial measuring tasks. Such conditions do not arise in other tasks of a similar nature. Machines with many similar working positions - e.g. spinning frames - seriously violate one of the conditions. That is, the sound source can be considered approximately as a point source. This can introduce a systematic error of up to 2 dB when the sound power level is determined by the envelope measuring method. In this paper this is proved both theoretically and experimentally. A possibility for correction is given.

80-884

Sound Attenuation by Multiple Barriers

M. Yuzawa, T. Sone, and T. Nimura

Tohoku Inst. of Tech., Sendai 982, Japan, Appl. Acoust., 12 (6), pp 447-458 (Nov 1979) 9 figs, 7 refs

Key Words: Sound attenuation, Noise barriers, Measurement techniques

A method (tentatively called 'the method of equivalent sound source') of predicting the sound attenuation achieved by multiple barriers with knife edges and/or right-angled wedges is proposed. This paper shows that the sound pressure level in the shadow region behind the multiple barriers can be obtained by successively setting imaginary sound sources for respective edges and/or wedges. The locations of the imaginary sound sources are determined by means of the traditional solution for sound attenuation by a single edge. The calculated results for several kinds of small-scale model, obtained by 'the method of equivalent sound source', are compared with experimental results.

80-885

Determination of Ultrasonic Velocities and Damping Coefficients in Polymers (Dispositif de mesure de la vitesse de propagation et du coefficient d'attenuation d'ultrasons dans les polymeres)

J. Arman

Laboratoire de Thermodynamique, Universite de Pau et des Pays de l'Adour, 64000 Pau, France, Acustica, 43 (3), pp 212-216 (Oct 1979) 21 figs, 6 refs
(In French)

Key Words: Measuring instruments, Pulse compression technique, Damping coefficients, Polymers

This paper gives the description of an apparatus designed for the determination, by a pulse method, of the velocity and damping coefficient of longitudinal ultrasonic waves in solid and molten polymers.

80-886

Torque Transducer for Automotive Wheels (Drehmomentaufnehmer für Kraftfahrzeugräder)

R. Stahl and L. Koch

Volkswagenwerk AG, Forschung-Messtechnik, Postfach, 3180 Wolfsburg, Germany, Techn. Messen-ATM, 10, pp 365-368 (1979) 8 figs, 5 refs
(In German)

Key Words: Measuring instruments, Torque, Wheels

A transducer is developed which is capable of measuring the moment acting on the wheel directly. The construction of the transducer enables further developments for the measurement of vertical and lateral forces.

80-887

Microphone Coupler for Noise Source Location

J.H. Botsford

Howard Engineering Co., 3456 Altonah Rd., Bethlehem, PA 18017, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 143-146, 1 fig; Avail: see 80-931

Key Words: Machinery noise, Noise source identification, Measuring instruments

A flexible rubber coupler, known as the BOTSEAR, was developed for use with the microphone of a sound level meter. The microphone of a sound level meter fits into the throat of the flaring coupler and the mouth of the coupler is pressed against any surface suspected of radiating sound. The flexible mouth conforms even to curved surfaces and seals out extraneous noises. Sound radiated from the surface closing the coupler mouth is collected in the cavity, sensed by the microphone and indicated on the sound level meter. The sound sensed in this way may also be studied with frequency analyzers. This device allows positive identification of vibrating surfaces responsible for sound generation.

80-888

Sound Power Determination from Surface Intensity Measurements on a Vibrating Cylinder

N. Kaemmer and M.J. Crocker

Institut f. Stromungsmaschinen, Hannover, Federal Rep. of Germany, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 153-160, 7 figs, 7 refs; Avail: see 80-931

Key Words: Machinery noise, Noise source identification, Noise measurement, Vibration measurement, Measurement techniques

In this paper a comparison is presented between the values of sound power of a vibrating cylinder measured with the surface intensity method and with the conventional reverberant room method.

80-889

Universally Usable Position Measuring System with Analogue Displaying, Position Sensitive Photodiodes. Part 1. Properties of the Applied Bi-axial Photodiodes (Universell einsetzbares Wegmessystem mit analoganzeigenden, positionsempfindlichen Fotodioden. Teil 1. Eigenschaften der verwendeten zweiachsigen Fotodioden)

H. Janocha and R. Marquardt

Institut f. Grundlagen der Elektrotechnik und Elektrische Messtechnik, Universität Hannover, Callinstr. 32, 3000 Hannover, Techn. Messen-ATM, 10, pp 369-373 (1979) 5 figs, 2 tables, 8 refs
(In German)

Key Words: Measuring instruments

The intention of this paper is first to describe the most important sources of errors and characteristics of position sensitive photodiodes with regard to position accuracy. The requirements for the measuring amplifier and rectifier are shown in order to obtain high resolution and fast dynamic response. The basic concept of a practical, easy to realize electronic position measuring system is described. Finally procedures are given which eliminate systematic linearity errors and errors due to deviations in operating temperature and intensity of the light spot.

80-890

Instant Replay for Vibration Analysis

W. Edgerley

Hewlett-Packard Co., Santa Clara, CA, Mach. Des., 51 (27), pp 87-91 (Nov 22, 1979)

Key Words: Vibration analyzers, Modal analysis

The analysis of vibrating structures once required tedious calculations and complicated plotting routines. New instruments simplify matters by capturing complex dynamic events and displaying them on a CRT in animated slow motion.

80-891

A New Method of Measurement and Evaluation for Investigations on Rotating Annular Cascades (Ein neues Mess- und Auswerteverfahren f. Untersuchungen an rotierenden Ringgittern)

H. Heinemann

VDI Forsch., No. 594, 30 pp (1979) 39 figs, 60 refs
(In German)

Key Words: Measurement techniques, Aerodynamic characteristics, Turbine components

A new method of measurement and evaluation for the determination of the aerodynamic characteristics of two-dimensional turbine cascades is developed. This new method and the experimental proc: are described in the report. The latter was accomplished by evaluation of measurements on two geometrically different cascades. On the basis of the experimental results, the domain of validity and applicability of the measurement and evaluation method is determined.

80-892

Measured of Ground Motion

H. Sandi

INCERC (Building Research Institute), Bucharest, Romania, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 263-271, 8 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Ground motion, Earthquake damage, Measurement techniques

The paper is intended to contribute to the development of more suitable concepts and techniques related to the measurement of the size of local ground motion and of the effects of an earthquake as a whole. The approach adopted is intended to meet the engineering needs of accuracy and flexibility and is basically empirical from a seismological viewpoint.

80-893

A Decision-Theory Methodology for the Selection of Buildings for Strong-Motion Instrumentation

G.C. Hart and C. Rojahn

Mechanics and Structures Dept., Univ. of California, Los Angeles, CA, Intl. J. Earthquake Engr. Struc. Dynam., 7 (6), pp 579-586 (Nov/Dec 1979) 7 tables, 11 refs

Key Words: Measuring instruments, Ground motion, Seismic excitation, Buildings

Current projections indicate that six buildings per year will continue to be instrumented under the California Strong-Motion Instrumentation Program for the next several decades. In order to select these buildings systematically for instrumentation, a methodology is developed that incorporates the fundamental elements of decision theory. These elements include an identification of the types of buildings that should be instrumented, a definition of the expected severity of ground shaking at each possible building site along with the probability of occurrence, and a quantification of the relative value of obtaining a building-response record for each building type. Using this information, decision theory is applied to calculate the expected utility (degree of preference) of instrumenting buildings of a particular type at various sites. The sites are then ranked in order of preference for each building type. This procedure, developed for the California Strong-Motion Instrumentation Program, can be extended to instrumentation programs in other areas.

80-894

Generation of Artificial Strong Motion Accelerograms

H.L. Wong and M.D. Trifunac

Dept. of Civil Engrg., Univ. of Southern California, CA, Intl. J. Earthquake Engr. Struc. Dynam., 7 (6), pp 509-527 (Nov/Dec 1979) 10 figs, 6 tables, 37 refs

Key Words: Accelerograms, Graphic methods, Measuring techniques, Simulation, Seismic excitation

A method for generating synthetic strong motion accelerograms for use in engineering design is presented. This method utilizes the model proposed by Trifunac in 1971 in conjunction with the recent empirical scaling functions for characterization of amplitudes and duration of strong shaking in terms of earthquake magnitude, M, and epicentral distance, R, or Modified Mercalli Intensity (MMI) at the recording station. The method also enables one to consider the desired levels of confidence that the synthetic motion will not be exceeded, direction of ground motion (horizontal or vertical) and the dispersive properties of geologic environment beneath and surrounding the station.

DYNAMIC TESTS

(Also see Nos. 672, 715, 716, 732, 767, 768, 783, 812, 833, 838, 840, 841)

80-895

Experimental Determination of the Nonlinear Shear Behavior of Fiber-reinforced Laminae under Impact Loading

J.M. Lifshitz and A. Gilat

NASA Ames Research Ctr., Moffett Field, CA 94035, Exptl. Mech., 19 (12), pp 444-449 (Dec 1979) 10 figs, 5 refs

Key Words: Testing techniques, Laminates, Fiber composites, Impact tests

A procedure is developed for the experimental determination of the nonlinear shear behavior of fiber-reinforced composites by testing angle-ply laminates. The experimental program involves four groups of tensile specimens tested under impact conditions using a drop weight testing machine. Analysis is performed using classical plate theory and an incremental loading procedure. Some problems involved in conducting dynamic tests are discussed and a solution is presented.

80-896

The Munson Test Course, A Unique Army Facility for Vehicle Tests

C.D. Montgomery

Aberdeen Proving Ground, MD, J. Environ. Sci., 22 (6), pp 20-23 (Nov/Dec 1979) 8 figs

Key Words: Test facilities, Ground vehicles, Tracked vehicles, Weapons systems

The vehicle test course at the US Army's Munson Test Complex, located at Aberdeen Proving Ground, Maryland, is unparalleled in the Free World for diversity of challenges. Founded more than 40 years ago, Munson has long provided the acid test for generations of Army wheeled and tracked vehicles and mobile weapons systems. The course consists of 30 separate standardized, reproducible, and specialized subcourses covering 150 acres. In addition to Munson, other vehicle test courses at Aberdeen provide a total of 40 miles of courses over 3300 acres, not including water test areas. Through the years, selected subcourses at Munson have been copied by agencies of US and foreign governments as well as industry; in its totality, however, it is without peer.

80-897

Seismic Response of Soft Offshore Soils – A Parametric Study

G.R. Martin, I.P. Lam, C.F. Tsai, and D.G. Anderson

Fugro, Inc., Long Beach, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stan-

ford University, Stanford, CA, pp 583-592, 11 figs, 1 table, 10 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Offshore structures, Seismic response, Soils, Dynamic tests

In this study effects of soil-property uncertainties on ground-response predictions at a seismically active offshore site are assessed. The site is characterized by a soft, deep cohesive soil profile. Soil parameters are determined from the results of in situ cone penetrometer tests and laboratory cyclic triaxial and resonant column tests. Ranges in properties are assigned on the bases of observed data scatter and general experience.

80-898
Large Scale Vibration Testing of Engineering Structures
J.B. Sterett and C.E. Watson
NASA Marshall Space Flight Ctr., Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 333-342, 1 fig, 2 tables; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berekely

Key Words: Dynamic tests, Testing techniques, Buildings, Soils, Interaction: soil-structure, Seismic response

Testing of large space vehicle structures results in identifying local response effects, damping, and higher order modal responses that are different than those predicted by the analytical model and scale model tests. Large scale vibration testing to establish empirical results would be similarly beneficial to compare with analytical predictions for earthquake engineering problems, including building structures, soils and soil-structure interaction.

80-899
Simulation of Strong Earthquake Motion with Contained Explosive Line Source Arrays
J.R. Bruce, H.E. Lindberg, and G.R. Abrahamson
SRI International, 333 Ravenswood Ave., Menlo Park, CA 94025, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg. Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1134-1143, 6 figs, 2 refs, Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Testing techniques, Seismic design, Earthquake-resistant structures, Buildings, Nuclear reactors, Pipelines, Lifeline systems, Dams, Bridges, Tunnels

During the past two years, SRI International (formerly Stanford Research Institute) has been conducting a program funded by the National Science Foundation to develop an explosive method for testing in-situ structures at strong earthquake levels. The objective of testing in-situ structures is to observe vibration modes and explore potential damage mechanisms in complete soil-structure and internal equipment systems. The technique will be applicable to buildings, nuclear reactors, pipelines, power lines, dams, bridges, and tunnels.

80-900
Fluid-Structure Interactions in Pressure-Suppression Pools: Small-Scale Experiments
P.W. Huber and Y.B. Javadi
Dept. of Mech. Engrg., Massachusetts Inst. of Tech., Cambridge, MA, 83 pp (Sept 1979)
NUREG/CR-0978

Key Words: Interaction: fluid-structure, Hydrodynamic excitation, Testing techniques, Plates, Circular plates

Experiments were conducted in a laboratory scale system to investigate fluid structure interaction effects on hydrodynamically induced boundary pressure histories. A single flexible member -- a clamped circular plate -- formed the base of a rigid cylindrical water pool. Base plate thicknesses were varied to vary the natural frequency of the plate pool system. Two types of hydrodynamic transients were tested: the first, a pressure rise over the flat pool surface, the second, an air driven 'pool swell' involving large liquid displacements and a more complicated boundary pressure history.

SCALING AND MODELING

80-901
Possibilities and Limitations of Scale-Model Testing in Earthquake Engineering
H. Krawinkler
Stanford Univ., Stanford, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 283-292, 2 figs, 1 table, 7 refs; Avail. see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Buildings, Scaling, Sesimic response

This paper presents an overview of dynamic modeling theory and the types of scale models that may be useful for dynamic studies in earthquake engineering. The emphasis is on modeling of building structures; some attention is given to the possibilities and limitations of scale-model testing for other civil engineering systems.

80-902
The Prediction of Traffic Noise Using a Scale Model
K.A. Mulholland
Dept. of Construction and Environmental Health, Univ. of Aston, Gosta Green, Birmingham, B4 7ET, UK, Appl. Acoust., 12 (6), pp 459-478 (Nov 1979) 3 figs, 7 tables, 30 refs

Key Words: Scaling, Test models, Traffic noise, Noise prediction

This paper describes the development of means of using a scale model of a road and its surrounding urban environment to predict L_{eq}, L_{10} and other measures of traffic noise. The model described is that of the Centre Scientifique et Technique du Batiment, Grenoble, France. The problems involved in the development include allowance for relative sound absorption between real life and the model situation, the constraints on the accuracy of the results due to noise source variations on the model and the effects of the finite size of the model.

DIAGNOSTICS

(Also see Nos. 663, 678, 946)

80-903
Selection of a Prototype Engine Monitor for Coast Guard Main Diesel Propulsion
R.N. Hambright, J.O. Storment, and C.D. Wood
Southwest Research Inst., San Antonio, TX, Rept. No. USCG-D-131-76, TSC-USCG-79-3, 91 pp (Aug 1979)
AD-A071 712/4GA

Key Words: Diesel engines, Diagnostic techniques, Marine engines, Vibration monitoring

A diesel engine monitor system has been synthesized from several parameter measurement subsystems which employ measurement techniques suitable for use on the main propulsion engines in U.S. Coast Cutters. The primary functions of the system are to monitor selected parameters, activate alarms or warnings when a critical failure mode is in progress, display all monitored data for hand recording by engineering personnel, and provide limited but adequate data-processing capability for analysis of these data. Diagnosis of existing engine problems and prognosis or prediction of incipient problems are accomplished by application of an interpretation rationale to the raw and analyzed data.

BALANCING

80-904
Programmable Calculators Simplify Balancing of Rotating Equipment
S.G. Scheneller
Power, 123 (12), pp 70-71 (Dec 1979) 10 figs, 2 refs

Key Words: Balancing techniques, Rotors (machine elements)

A procedure for the calculation of single-plane balancing on a calculation with rectangular/polar conversion capability is presented. A sample problem is included.

80-905
Dynamically Balanced Linkages Couple Misaligned Shafts
B.J. Hogan
Des. News, 35 (21), pp 64-65 (Nov 5, 1979) 5 figs

Key Words: Balancing techniques, Dynamic balancing, Shaft couplings, Couplings

Inventor couples shafts by pinning three linkages together through common center of mass, then rotating linkages about that center. One end of each linkage is secured to driving shaft through plate or web, other to driven shaft through identical plate or web. When two perfectly aligned shafts connected by this coupling begin to rotate, the center of mass of the linkages is aligned with the axes of the shafts. The coupling then transmits power just as if it were a solid mass. If the shafts move out of alignment (in any direction, in a plane normal to the axes of the shafts), the linkages extend and move their common center of mass radially in the direction of misalignment.

80-906

Prevention of Torsional Vibration in Fan Motor Shaft Systems with Multiblade Fans (3rd Report: Method of Frequency Control Using Correction Weights)

Y. Segawa, F. Fujisawa, K. Shiohata, and M. Shiga

Mech. Engrg. Research Lab., Hitachi Ltd., Hitachi, Japan, Bull. JSME, 22 (171), pp 1307-1313 (Sept 1979) 7 figs, 3 tables, 5 refs

Key Words: Balancing techniques, Shafts (machine elements), Fans, Torsional vibration, Least squares method

In order to avoid torsional resonance in a fan motor shaft system with multiblade fans and plural planes of symmetry perpendicular to the shaft, a method of frequency control using correction weights is devised. In this method, the vibration characteristics of a shaft system are controlled by using the natural frequencies of the system. A least squares method which uses the influence coefficients is used to calculate the size of the correction weights. This method is applied to the shaft systems with asymmetrical mass distribution, and its effectiveness is investigated in numerical simulations.

80-907

Mechanical Installation of Electric Motors.' Part III: Aligning Techniques

W.R. Symons

Reliance Electric, Cleveland, OH, Plant Engr., 33 (24), pp 71-73 (Nov 29, 1979) 4 figs

Key Words: Motors, Aligning

Efficient, quiet, troublefree service can be obtained from horizontal motor-driven machine sets only if the motor/load combination is properly aligned and the components are set on a proper, firm base that will permit alignment to be maintained. A detailed description of a procedure for the alignment of such machinery is presented.

ANALYSIS AND DESIGN

ANALYTICAL METHODS

(Also see Nos. 829, 859, 863, 867, 941)

80-908

Propagation of Periodic Long Waves

L. Guerri and L. Natale

Laboratorio di Analisi Numerica del CNR, Pavia, Meccanica, 13 (1), pp 28-36 (Mar 1978) 7 figs, 7 refs

Key Words: Wave propagation, Water waves, Eigenvalue problems

A method is developed for the computation of the steady solution of the shallow water equations with quasi periodic boundary conditions. The unknown variables (velocity and surface elevation) and the boundary conditions are developed in power series of a small perturbation parameter. The problem is then transformed into a sequence of linear problems which have the same associated homogeneous problem.

MODELING TECHNIQUES

(Also see Nos. 748, 755, 762, 797, 839, 855, 922, 939)

80-909

Step-by-Step Integration of Linear Structural Systems Considering Uncertainty in the Parameters

H. Contreras

URS/John A. Blume & Associates, San Francisco, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg, Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 525-532, 2 figs, 14 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Mathematical models, Stochastic processes, Finite element technique

This paper presents a generic stochastic finite-element method for modeling structures. Stochastic differential and difference equations are combined with the finite-element method such that loads for structures are idealized as stochastic processes and incorporated into multidimensional finite-element dynamic models with uncertainty in their parameters.

80-910

Finite Element Modeling of Structures Under Impact Loading as a Tool for Noise Analysis and Control

A. Seireg

Univ. of Wisconsin, Madison, WI 53706, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 71-77, 6 figs, 10 refs; Avail: see 80-931

Key Words: Finite element technique, Impact shock, Elastic media, Vibration response, Noise generation

This paper describes a finite element based procedure for the modeling of structural systems under impulsive loading. The effect of material damping on the vibratory response spectrum generated by the impact is illustrated. A procedure for the simulating of structural noise due to impulsive loading is proposed. When completely developed it can provide a valuable tool for the analysis and control of noise emanating from or transmitted through structures with different shapes and material properties.

80-911

Some Aspects of the Mathematical Modelling of Long Nonlinear Waves

A. Jeffrey

Dept. of Engrg. Mathematics, The University, Newcastle upon Tyne, UK, Arch. Mech., 31 (4), pp 559-574 (1979) 7 figs, 27 refs

Key Words: Mathematical models, Shock wave propagation

This paper begins with a brief review of the notions of far fields and long waves, and indicates why the study of equations of KdV and KdVB type are important to the modeling of unidirectional long nonlinear waves. An asymptotic solution is then developed for the shock wave solution for the KdVB equation that applies when dissipative effects predominate over dispersive effects. The sensitivity of this solution to the matching condition used at the origin is demonstrated. Some numerical experiments are then described concerning the propagation of one or more KdV solitons in the presence of noise.

80-912

Analysis of Multiple Degree of Freedom Systems with Correlated and Uncertain Response Spectra Parameters

F.A. Webster and J.R. Benjamin

Engineering Decision Analysis Co., Inc., Palo Alto, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 505-511, 6 figs, 6 tables, 9 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Mathematical models, Seismic design, Seismic response spectra

The purpose of this paper is threefold: a new data based response spectra model is introduced which summarizes any response spectra data with a mean value function and a measure of variability; parameters of the model are found to be correlated from one earthquake record to the next at a specific site, and a multivariate probabilistic model with dependent variables is introduced for site-specific response spectra criteria; and two example multiple degree of freedom structures are analyzed by response spectra-modal analysis to compare conventional criteria with the proposed model.

80-913

Dynamic Response of Horizontally Layered Systems Subjected to Traveling Seismic Waves

T. Udaka, J. Lysmer, and H.B. Seed

Soil Dynamics and Earthquake Engrg., Civil Systems, Inc., San Leandro, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 593-602, 13 figs, 16 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic waves, Layered materials, Finite element technique, Mathematical models

A finite element model is developed for the analysis of horizontally layered systems subjected to traveling seismic waves. The responses using the traveling wave assumption are computed for various phase velocities and compared with those computed using the rigid base assumption.

80-914

Prediction of Nonstationary Earthquake Motions for Given Magnitude, Distance, and Specific Site Conditions

H. Kameda, H. Goto, M. Sugito, and T. Asamura

Kyoto Univ., Kyoto, Japan, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 243-252, 10 figs, 16 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Earthquake prediction, Statistical analysis, Mathematical models

A statistical prediction model is developed for generating nonstationary earthquake motions for given values of magnitude and distance, and for local soil conditions of specific sites. The model is verified for use in inelastic structural response. Statistical uncertainty of the model parameters is incorporated to give a rational basis for engineering evaluation. Applicability of the proposed model to a wide frequency region enables one to use it not only for generation of ground acceleration but for velocity and displacement.

80-915

Some Observations on the Effective Period and Damping of Randomly Excited Yielding Systems

R.L. Grossmayer and W.D. Iwan

California Inst. of Tech., Pasadena, CA 91125, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 533-542, 11 figs, 7 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic design, Hysteretic damping, Digital simulation

In this study a bilinear hysteretic system is used as a simple model of a yielding structure. Its response to a broadband Gaussian random excitation is investigated by means of digital computer simulations. These simulation results are intended to serve as a guide in developing both simplified and reliable analytical theories for the earthquake response of yielding systems.

NONLINEAR ANALYSIS

80-916

Resonant Non-Linear Vibrations of Continuous Systems - II. Damped and Transient Behavior

H. Engin, M.J. Ablowitz, A. Askar, and A.S. Cakmak

Princeton Univ., Princeton, NJ 08540, Intl. J. Nonlin. Mech., 14 (4), pp 235-246 (1979) 4 figs, 4 refs

Key Words: Resonant response, Nonlinear response, Continuum mechanics

The method presented in Part I is extended to cover the damped and transient behavior of nonlinear systems. A method of multiple time scales is presented for the study of the transient behavior and the stability of the branches for steady vibrations.

STATISTICAL METHODS

(Also see Nos. 704, 824, 862, 909)

80-917

A Statistical Analysis of Accelerogram Peaks Based Upon the Exponential Distribution Model

T. Zsutty and M. DeHerrera

Stanford Univ., Stanford, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 733-742, 5 figs, 1 table, 2 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Statistical analysis, Seismic excitation, Ground motion, Seismic design

The purpose of this paper is to present a statistical procedure for the estimation of this peak number and value distribution from available strong-motion time histories. The method to be employed differs from current procedures involving effective duration, RMS values, and related random vibration models; the goal is to provide efficient estimates of the type of distribution and its parameters for the family of acceleration peaks.

80-918

A Statistical Study of Inelastic Response Spectra

N.M. Newmark and R. Riddell

Univ. of Illinois, Urbana, IL, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 495-504, 6 figs, 1 table, 4 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Statistical analysis, Seismic response spectra, Seismic design, Damping effects

The dynamic response of nonlinear systems subjected to earthquake excitations has been recently considered with the purpose of assessing the reliability of present procedures for specifying inelastic design spectra. Special attention is devoted to the influence of structural damping combined with various types of material nonlinearity on the response of single-degree-of-freedom systems. The resulting responses are studied statistically to derive amplification factors and improved rules for determining inelastic design spectra for a range of conditions.

80-919

Determination of Seismic Design Parameters: A Stochastic Approach

J B. Savy

Massachusetts Inst. of Tech., Cambridge, MA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 723-732, 5 figs, 9 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic design, Stochastic processes, Mathematical models, Failure analysis

It is proposed here that a distribution of earthquake recurrence which takes into account the apparent time dependency characteristics be chosen for the seismic-risk analysis.

PARAMETER IDENTIFICATION

(Also see Nos. 712, 723)

80-920

Remarks on Parameter Identification

R.B. Guenther and R. Schmidt

Dept. of Mathematics, Oregon State Univ., Corvallis, OR 97331, SIAM J. Appl. Math., 37 (3), pp 619-623 (Dec 1979) 1 table, 2 refs

Key Words: Parameter identification technique

Suppose the values of the solution of a differential equation have been measured at discrete points in time. Then the continuous dependence of the undetermined coefficients on the data and the time intervals is proven for certain differential equations which arise in reaction kinetics.

80-921

Synthesis of Linear Lumped-Parameter Systems in Which a Mode Shape is Partially Prescribed

J.H. Hibbert

Dept. of Aeronautical and Mech. Engrg., Univ. of Salford, Salford M54WT, Lancashire, UK, Intl. J. Mech. Sci., 21 (12), pp 755-761 (1979) 3 figs, 4 refs

Key Words: Lumped parameter method, Structural synthesis, Mode shapes

The paper presents a means of synthesizing the inertial elements of a linear lumped-parameter system so that the system will freely vibrate at a prescribed frequency with a mode shape which, although not completely defined, satisfies certain specified requirements. The procedure is illustrated by two numerical examples, the second of which demonstrates a means of extracting mode shape admissibility criteria for systems in which the stiffness matrix is known.

80-922

Identification of Linear Structural Models from Earthquake Records

G.H. McVerry, J.L. Beck, and P.C. Jennings

California Inst. of Tech., Pasadena, CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 515-524, 5 figs, 5 refs; Avail: see 80-932

Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Parameter identification technique, Seismic excitation, Mathematical models, Time domain method, Frequency domain method

Limitations in analyses using trial-and-error adjustment of the parameters of a synthesized model, and similar limitations in the use of typical transfer function approaches in the frequency domain, have recently led to the development of systematic techniques of structural identification. Two such techniques for determining linear models of structures from their recorded earthquake excitation and response are described, together with the results of their application to the earthquake response of some multi-story buildings.

MOBILITY/IMPEDANCE METHODS

(See No. 670)

DESIGN TECHNIQUES

(Also see Nos. 700, 702, 703, 705, 710, 713, 746, 778, 821, 832, 858, 870, 899, 912, 915, 918, 919, 932, 934)

80-923

Configuration and Seismic Design: A General Review

C. Arnold

Building Systems Development, Inc., San Francisco,

CA, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 22-36, 9 figs, 6 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Reviews, Seismic design, Buildings

This paper discusses the relationships between building configuration and seismic design; that is, the influences that the size and shape of a building, in combination with other factors, have on the way in which it will react to earthquakes.

80-924
A Probabilistic Definition of Effective Acceleration
C.P. Mortgat
TERA Corp., 2150 Shattuck Ave., Suite 1200, Berkeley, CA 94704, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 743-752, 8 figs, 1 table, 10 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic design, Probability theory, Ground motion

This paper presents a definition of effective acceleration based on the probability of a number of excursions beyond different levels of acceleration during an earthquake. An exponential distribution is fitted to the peaks of the time history after reordering them in ascending order. A stable parameter correlating peak amplitude and root mean square acceleration is presented.

80-925
Towards a Simple Energy Method for Seismic Design of Structures
W.E. McKevitt, D.L. Anderson, N.D. Nathan, and S. Cherry
Dept. of Civil Engrg., Univ. of British Columbia, Vancouver, B.C. V6T 1W5, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 383-392, 8 figs, 1 table, 4 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic design, Energy methods

The effects of varying periods, hysteretic properties, damping, and yield strength ratios in single-degree-of-freedom systems subjected to a number of ground motion records are studied. The total energy dissipated, the distribution of total energy within the system, peak displacements, and ductility demands are examined.

80-926
Seismic Study of the George R. Moscone (Yerba Buena) Convention Center, San Francisco, California
S. Tandowsky
GKT Consulting Engineers, Inc., 141 Battery St., San Francisco, CA 94111, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 1046-1055, 6 figs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Seismic design, Earthquake resistant structures

The Yerba Buena Convention Center (renamed the George R. Moscone Convention Center) is a large, essentially underground structure, to be constructed in the South-of-Market area of San Francisco. This paper will describe the development of seismic criteria.

COMPUTER PROGRAMS

(Also see Nos. 758, 765, 848, 940)

80-927
Coded Calculation of Equations of Motion of Multidegree of Freedom Systems (Symbolische Berechnung der Bewegungsgleichungen von Mehrkorpersystemen)
Fortschritt-Berichte der VDI Zeitschriften (Progress Reports of VDI Zeitschr.), Series 11, No. 32 (1979) 120 pp, 14 figs, 7 tables, Summarized in VDI Z., 121 (20), p 998 (Oct 1979) Avail: VDI-Verlag, GmbH Düsseldorf, Germany
(In German)

Key Words: Computer programs, Multidegree of freedom systems, Equations of motion, Dynamic structural analysis, Mechanical systems, Chains

A compilation of operations required to solve an equation of motion of multidegree of freedom systems shows that the only operations required for setting up a coded equation are addition, multiplication and differentiation. Therefore, instead of a general formula manipulation program, a special purpose process was developed. The syntax and semantics of this process are represented by the usual notations. The type and structure of coding, which enables symbol manipulation by means of a FORTRAN Program, is explained in detail. The procedure for programming the symbol manipulation system is presented in a flow chart; the sequence of operations in the investigation of multidegree of freedom system is explained. The instantaneous limits and the advantages of the program are also indicated. The program is a very powerful tool for an accurate and quick dynamic analysis of mechanical systems.

80-928

MVMA Two-Dimensional Crash Victim Simulation, Version 4. Volume 2

B.M. Bowman, R.O. Bennett, and D.H. Robbins
Highway Safety Research Inst., Michigan Univ., Ann Arbor, MI, Rept. No. UM-HSRI-79-5-2, 293 pp (June 29, 1979)
PB-299 306/1GA

Key Words: Computer programs, Collision research (automotive)

Volume Two is intended primarily as a guide to the day-to-day usage of the MVMA Two-Dimensional Crash Victim Simulator. This volume contains specifications for the input data cards together with a detailed description of input data quantities. Normal output options and certain normal output quantities are described. Input and output is presented for two sample exercises of the computer model.

80-929

MVMA Two-Dimensional Crash Victim Simulation, Version 4. Volume 3

B.M. Bowman, R.O. Bennett, D.H. Robbins, and J.M. Becker
Highway Safety Research Inst., Michigan Univ., Ann Arbor, MI, Rept. No. UM-HSRI-79-5-3, 337 pp (June 29, 1979)
PB-299 307/9GA

Key Words: Computer programs, Collision research (automotive)

Volume Three is intended primarily for the professional computer programmer who is responsible for program maintenance and improvements in the MVMA Two-Dimensional Crash Victim Simulator. This volume describes the organization of the computer program into five processors and their interactions. Description of program organization and flow, packing techniques, binary output formats, and auxiliary program output is presented for each of the five processors. Design information concerning certain special output subprocessors is provided. Conversion of the computer program for use on various computer systems is discussed.

80-930

A Computer Program for Beam Noise Prediction

R.M. Zeskind and W.L. Scott
Bolt Beranek and Newman, Inc., Arlington, VA, Rept. No. BBN-3654, 88 pp (May 1979)
AD-A072 775/0GA

Key Words: Computer programs, Noise prediction

The purpose of this report is to document the computer programs that have been written to implement the prediction algorithm described in BBN Report 3653 by M. Moll, R.M. Zeskind and W.L. Scott entitled "An Algorithm for Beam Noise Prediction". The authors asume that the reader is already familiar with the contents of that report.

CONFERENCE PROCEEDINGS AND GENERAL TOPICS

CONFERENCE PROCEEDINGS

80-931

Fatigue Life Technology

T.A. Cruse and J.P. Gallagher, editors
Pratt & Whitney Aircraft, ASME: New York, NY, 1977

Key Words: Proceedings, Fatigue life, Turbine components, Turbine engines, Nondestructive tests

Papers presented at this 22nd Annual International Gas Turbine Conference, held in Philadelphia, PA on March 29-31, 1977 present a span of topics reflecting component or engine procurement policies, design methodology for predicting the influence of actual usage on fatigue life, and retirement of components as they reach a defined life limit. Further, the papers address the range of turbine engine requirements from the advanced military gas turbine engines to massive industrial power generation turbine engines. Finally, an attempt was made to reflect real world considerations of monitoring component usage, field repair capabilities, and nondestructive inspection sensitivity.

80-932
NOISE-CON 79

Machinery Noise Control, Proc. of 1979 National Conference on Noise Control Engineering, M.J. Crocker and J.W. Sullivan, Editors, 404 pp, Price: $37.50, Avail: Noise Control Foundation, P.O. Box 3469, Arlington Branch, Poughkeepsie, NY 12603

Key Words: Proceedings, Machinery vibration, Vibration control, Noise reduction

"Machinery Noise Control" was the theme of NOISE-CON 79, the 1979 National Conference on Noise Control Engineering. NOISE-CON 79 was sponsored jointly by the Institute of Noise Control Engineering and Purdue University, West Lafayette, Indiana. The three-day meeting was held on the Purdue Campus on 30 April-2 May 1979 and covered a wide variety of subjects all related to the theme "Machinery Noise Control." Featured at the meeting were papers on agricultural and construction equipment noise, forging and impact noise, noise of engines and components, and noise generated by metal cutting. In addition, other papers on government programs, diagnostic techniques for noise control, computer noise control and noise levels in factories were presented.

80-933
Proc. of the 2nd U.S. National Conference on Earthquake Engineering

Aug 22-24, 1979, Stanford Univ., Stanford, CA, Price: $36.00, Sponsored by the Earthquake Engrg. Research Institute, Avail: EERI, 2620 Telegraph Ave., Berkeley, CA 94704 - (415)848-0972

Key Words: Seismic design, Earthquakes, Proceedings

The papers presented at this interdisciplinary conference dealt with the following general topics: lifeline earthquake engineering, seismic risk, earth structures, soil-structure interaction, structural materials, design parameters, response of structures, structural design, industrial facilities, seismology and geology, public policy and economic studies, and engineering aspects of the Miyagi (Japan) earthquake of June 12, 1978.

80-934
Structural Engineering and Structural Mechanics

K.S. Pister, Editor
Prentice-Hall, Inc., Englewood Cliffs, NY, 1980

Key Words: Proceedings, Wind-induced excitation, Seismic excitation, Off-shore structures, Cooling towers

The volume contains the Proceedings of a Symposium on Structural Engineering and Structural Mechanics, held Aug 11 and 12, 1977 at the University of California, Berkeley, California. The technical program encompassed eighteen papers covering a broad range of topics: engineering education, applied mechanics, structural theory, and structural engineering practice.

80-935
Central American Conference on Earthquake Engineering

Envo Publishing Co., Inc. USA. and UCA/Editors, San Salvador, CA

Key Words: Proceedings, Seismic excitation, Seismic design, Interaction: soil-structure, Standards and codes

The purpose of the Conference, held in San Salvador, 9-12 Jan, 1978, was to make available the information needed for this earthquake hazard area. Eight major subjects including seismic risk analysis, earthquake prediction, soil-structure interaction, structural response, seismic resistant design, low-cost building, rehabilitation, and building codes are presented in more than one hundred technical papers contributed from twenty-one countries. The papers in the first volume are technical papers received prior to the Conference; the second volume contains individual papers, state-of-art papers on selected topics, together with discussions and current research papers resulting from the Conference.

80-936

Technical Evaluation Report on the Symposium of the Propulsion and Energetics Panel (52nd) on Stresses, Vibrations, Structural Integration and Engine Integrity (Including Aeroelasticity and Flutter)

L. Beitch

AGARD, Neuilly-sur-Seine, France, Report No. AGARD-AR-133, 14 pp (Mar 1979)

AD-A071 594/6GA

Key Words: Airframes, Aircraft engines, Flutter, Proceedings

The Symposium was divided into eight sessions concerned with the following subjects: experimental stress analysis; stress analysis techniques, life prediction; engine structural integrity, vibration, containment; engine-airframe integration/compatibility; aeroelasticity and flutter.

TUTORIALS AND REVIEWS

80-937

Recent Research in Composite and Sandwich Plate Dynamics

C.W. Bert

School of Aerospace Mech. and Nuclear Engrg., Oklahoma Univ., Norman, OK, Rept. No. OU-AMNE-79-11, TR-5, 13 pp (July 1979)

AD-A072 277/7GA

Key Words: Plates, Sandwich structures, Reviews

This paper is a survey of literature concerning dynamics of plate-type structural elements of either composite material or sandwich construction. Papers which appeared from late 1976 through early 1979 are reviewed. Special attention is given to anisotropic plates, laminated plates, thick and sandwich plates, and nonlinearities. Free vibration and various kinds of forced vibration are treated, as well as classical and finite-element methods of analysis.

80-938

A Review of Australian Investigations on Aeronautical Fatigue during the Period April 1977 to March 1979

G.S. Jost

Aeronautical Research Labs., Melbourne, Australia, Rept. No. ARL/STRUC-TM-303, 68 pp (Apr 1979)

AD-A071 641/5GA

Key Words: Aircraft, Fatigue life, Reviews

A summary is presented on the aircraft fatigue research and associated activities which form part of the programs of the Aeronautical Research Laboratories, Commonwealth Aircraft Corporation Pty., Ltd., Department of Transport (Airworthiness Branch), Royal Australian Air Force and the Government Aircraft Factories. The major topics discussed include the fatigue on both civil and military aircraft structures, fatigue of materials and components and fatigue life monitoring and assessment.

80-939

ONAC Industrial Noise Activity

J.C. Schettino and H.J. Nozick

Office of Noise Abatement & Control, Environmental Protection Agency, Washington, D.C. 20460, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 3-9, 16 refs; Avail: see 80-931

Key Words: Machinery noise, Construction equipment, Household appliances, Noise reduction

This paper provides a summary of the EPA Office of Noise Abatement and Control activities to date, and future plans in the area of machinery noise abatement and control. For purposes of this review "machinery" refers to industrial equipment, construction equipment, and home appliances. Recommendations on research or demonstration needs for future Federal, industry and university action are presented.

80-940

Flow-Induced Vibration of Nuclear Reactor Fuel. Part I: Modeling

M.W. Wambsganss and T.M. Mulcahy

Components Tech. Div., Argonne National Lab., Argonne, IL 60439, Shock Vib. Dig., 11 (11), pp 11-22 (Nov 1979) 3 figs, 86 refs

Key Words: Reviews, Nuclear reactor components, Fluid-induced excitation, Mathematical models

This two-part article focuses on the role of reactor fuel in flow-induced vibrations in nuclear reactors. Part I is on mathematical modeling of the fuel assemblies. Part II describes design considerations.

80-941
Computer Programs: Shock and Vibration Isolation
T.F. Derby
Barry Controls, Barry Wright Corp., 700 Pleasant St., Watertown, MA 02172, Shock Vib. Dig., 11 (11), pp 23-28 (Nov 1979) 30 refs

Key Words: Reviews, Computer programs, Shock isolation, Vibration isolation

This article is a review of literature pertaining to computer programs useful in the analysis of shock and vibration isolation. The discussion is broken down as follows: design of isolators; determining required or optimum isolator parameters; and computational techniques.

80-942
A Review of Substructure Analysis of Vibrating Systems
F.C. Nelson
Dept. of Mech. Engrg., Tufts Univ., Medford, MA 02155, Shock Vib. Dig., 11 (11), pp 3-9 (Nov 1979) 1 fig, 38 refs

Key Words: Reviews, Component mode synthesis, Substructuring methods

This article contains a general review of substructuring; emphasis is placed on the method of component mode synthesis. Static substructuring is described as are dynamic substructuring by component mode synthesis and substructure truncation. Other substructuring methods are summarized.

80-943
Seismological Aspects of Strong Motion Seismology
T.C. Hanks
U.S. Geological Survey, 345 Middlefield Rd., Menlo Park, CA 94025, Proc. 2nd U.S. Natl. Conf. Earthquake Engrg., Aug 22-24, 1979, Stanford Univ., Stanford, CA, pp 898-912, 8 figs, 38 refs; Avail: see 80-932
Sponsored by Earthquake Engrg. Res. Inst., Berkeley

Key Words: Reviews, Seismic response, Ground motion

Since the first U.S. National Conference on Earthquake Engineering in 1975, there has been a number of significant seismological developments pertinent to the estimation of strong ground motion across the frequency band and amplitude range of engineering interest. In this contribution they are recaptiulated within a framework of three structural elements. The first summarizes observations and model techniques appropriate to the estimation of long-period strong ground motion. The second section discusses recent developments in the estimation of high-frequency strong ground motion via the root-mean-square acceleration. The third section addresses the problem of the magnitude-dependence of peak accelerations by developing an indicated connection between magnitude saturation and the larger peak accelerations.

CRITERIA, STANDARDS, AND SPECIFICATIONS

(Also see No. 706)

80-944
Noise in the Mining Industry -- An Overview
D.A. Giardino and L.C. Marraccini
Noise Branch, Div. of Health Tech., Pittsburgh Technical Support Ctr., Mine Safety and Health Administration, U.S. Dept. of Labor, NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 263-273, 5 figs, 4 tables; Avail: see 80-931

Key Words: Mines (excavations), Mining equipment, Noise reduction, Human response, Regulations

The characterization of the mining environment in terms of noise levels, noise exposure patterns and frequency spectra is given. The effects of mining noise on the working population is discussed, along with the quantification of hearing loss in the mining industry. The Federal mining noise regulations are briefly touched upon. The present state of the industry, with respect to noise control technology, is discussed. Examples of proven noise controls are given, along with measured noise reductions. Future noise control technology for the industry is examined and forecasts of potential noise problem areas are briefly discussed.

80-945
Noise Emission Measurements for Computer and Business Equipment
L.F. Luttrell
Control Data Corporation, Arden Hills, MN 55112,

NOISE-CON 79, Machinery Noise Control, Proc. of 1979 Natl. Conf. on Noise Control Engrg., pp 201-206, 2 figs, 5 refs; Avail: see 80-931

Key Words: Standards, Measurement techniques, Noise measurements

A proposed American National Standard method for measurement and designation of noise emitted by computer and business equipment, S1.29-197X (1), specifies the acoustic measurement procedures to be employed and the installation and operation of the equipment during the test. This paper addresses standardization of these measurement procedures and the application of the procedures to computer and business equipment.

BIBLIOGRAPHIES

80-946

Acoustic Emission. A Bibliography with Abstracts

T.F. Drouillard

Rockwell International Corp., Golden, CO, IFI/Plenum Data Co., A Division of Plenum Publishing Corp: New York, NY, 1979

Key Words: Bibliographies, Acoustic emission, Nondestructive tests

The purpose of this bibliography is to list all of the known literature on acoustic emission in a single volume. The bibliography is intended to serve as a reference to the literature for those interested in the acoustic emission phenomenon, for those engaged in materials research, and for those interested in applying acoustic emission as a nondestructive testing method. It provides an invaluable reference to both undergraduate and graduate students, as well as engineers and scientists in the fields of pressure vessel design and maintenance, stress analysis, mechanical engineering, welding engineering, nuclear engineering, metallurgy, and quality control. The bibliography contains 1996 entries, most of which are abstracted or annotated. It is comprised of four parts: Bibliography, List of Journals, Author Index, and Subject Index. The bibliography includes literature published up through the first quarter of 1977.

80-947

Maneuvering Aircraft: Noise Pollution and Control. Volume 2. 1976-August 1979 (A Bibliography with Abstracts)

G.E. Habercom Jr.

National Technical Information Service, Springfield, VA, 168 pp (Sept 1979)

NTIS/PS-79/0973/2GA

Key Words: Bibliographies, Aircraft noise, Noise reduction

Methods for alleviating noise created by maneuvering aircraft are cited. Flyby, turning flight, takeoffs, and landings are the maneuvers investigated. (This updated bibliography contains 159 abstracts, 18 of which are new entries to the previous edition.)

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CALENDAR

APRIL 1980

21-25 **Acoustical Society of America, Spring Meeting** [ASA] Atlanta, GA *(ASA Hq.)*

28-May1 **NOISEXPO '80** [S/V, Sound and Vibration] Hyatt Regency O'Hare, Chicago, IL *(Acoustic Publications, Inc., 27101 E. Oviat Rd., Bay Village, OH 44140)*

MAY 1980

5-8 **Offshore Technology Conference**, Astrohall, Houston, TX *(ASME Hq.)*

5-8 **26th International Instrumentation Symp.** [ISA] Seattle, WA *(ISA Hq.)*

11-14 **1980 Annual Technical Meeting & Equipment Exposition** [IES] Philadelphia, PA *(IES Hq.)*

19-23 **Fourth International Conference on Pressure Vessel Technology** [ASME] London, England *(ASME Hq.)*

25-30 **Fourth SESA International Congress on Experimental Mechanics** [SESA] The Copley Plaza, Boston, MA *(SESA Hq.)*

JUNE 1980

11 **Experimental Techniques for Fatigue Crack Growth Measurement** [SEE] British Rail Technical Centre *(SEE Hq.)*

22-26 **Summer Annual Meeting** [ASME] Waldorf-Astoria, New York, NY *(ASME Hq.)*

JULY 1980

7-11 **Recent Advances in Structural Dynamics Symp.**, [Institute of Sound and Vibration Research] University of Southampton, Southampton, S09 5NH, UK *(Mrs. O.G. Hyde, ISVR Conference Secretary, The University, Southampton, S09 5NH, UK - Tel (0703) 559122, Ext. 2310)*

SEPTEMBER 1980

2-4 **International Conference on Vibrations in Rotating Machinery** [IMechE] Cambridge, England *(Mr. A.J. Tugwell, Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ, UK)*

8-11 **Off-Highway Meeting and Exposition** [SAE] MECCA, Milwaukee, WI *(SAE Hq.)*

OCTOBER 1980

Stapp Car Crash Conference [SAE] Detroit, MI *(SAE Hq.)*

Joint Lubrication Conference [ASME] Washington, D.C. *(ASME Hq.)*

6-8 **Computational Methods in Nonlinear Structural and Solid Mechanics** [George Washington University & NASA Langley Research Center] Washington, D.C. *(Professor A.K. Noor, The George Washington University, NASA Langley Research Center, MS246, Hampton, VA 23665 - Tel (804)827-2897)*

21-23 **51st Shock and Vibration Symposium** [Shock and Vibration Information Center, Washington, D.C.] San Diego, CA *(Henry C. Pusey, Director, SVIC, Naval Research Lab., Code 5804, Washington, D.C. 20375)*

NOVEMBER 1980

18-21 **Acoustical Society of America, Fall Meeting** [ASA] Los Angeles, CA *(ASA Hq.)*

DECEMBER 1980

Aerospace Meeting [SAE] San Diego, CA *(SAE Hq.)*

8-10 **INTER-NOISE 80** [International Institute of Noise Control Engineering] Miami, FL *(INTER-NOISE 80, P.O. Box 3469, Arlington Branch, Poughkeepsie, NY 12603)*