result, the process of focussing of stress waves due to reflection from the semi-circular boundary was observed and the difference in propagation behaviour of stress waves was discussed in materials represented by some kinds of constitutive equations.

Kobe University, 1-1 Rokko, Nada, Kobe, 657, Japan

Random Vibrations of a Beam Structure with Elastoplastic Hysteresis

Koji KIMURA, Kazuyuki YAGASAKI, Hiroshi YOSHIMURA and Masaru SAKATA An experiment is conducted by using a lead cantilever beam with a mass in order to examine the random vibrations of an hysteretic system. Power spectra and root mean square values of the stationary responses to two types of random excitation, i.e., white noise, and nonwhite noise with a dominant frequency, are measured. A theoretical analysis is carried out by assuming a bilinear hysteresis model and using the moment equation approach. A fairly good agreement is found between the theoretical and experimental results. It is shown that the effect on the response of energy dissipation due to hysteresis is observed even in the case of small amplitude excitation.

Department of Physical Engineering, Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo, 152, Japan

A Nonlinear Vibration Analysis of Membranes with Various Shapes by the Boundary Element Method

Kimihiko YASUDA and Shozo KAWAMURA The nonlinear vibrations of membranes with various shapes are analyzed by the boundary element method. In order that the application of the boundary element method may be practical in such nonlinear dynamic problems, a treatment that produces modal equations from the governing nonlinear partial differential equations is employed. In this way, it is shown that the original problem is reduced to solving successively several easier problems, and that the modal equations derived thus enable the treatment of various nonlinear oscillations. As an example of the application of this treatment, rectangular and circular membranes are first analyzed, the results of which are compared with other published data to confirm the validity of the treatment. Then, trapezoidal and elliptical membranes are analyzed, and some typical nonlinear oscillations such as subharmonic and summed-and-differential harmonic oscillations are shown to occur.

Nagoya University, School of Engineering, Furo-cho, Chikusa, Nagoya, 464, Japan

A Method of Vibrational Analysis Using a Personal Computer (2nd Report, Application of the Transfer Influence Coefficient Method to a Distributed Flexural Vibrational System)

Atsuo SUEOKA, Takahiro KONDOU*, Isao YOKOMICHI**, Takashi AYABE* and Hideyuki TAMURA** The transfer matrix method for a distributed flexural vibrational system possesses some defects such as cancelling, attributable to the sum and difference of the hyperbolic and trigonometrical functions appearing in the elements of the transfer matrices, and occurrnce of numerical instability due to numerical imbalance among elements and multiplication of the matrices. The authors apply the concept of the transfer influence coefficient method, treated in the previous report, to a distributed flexural vibrational system, and formulate an algorithm for free vibrational analysis with a high speed and with high accuracy which succeeds in overcoming all these defects of the transfer matrix method. The validity of the present algorithm is demonstrated by a relatively simple example computing critical speeds of a rotating shaft, and is also compared with that of the transfer matrix method on a personal computer.

*Faculty of Engineering, Kyushu University, 6-10-1 Hakozaki, Higashi-ku, Fukuoka, 812, Japan
**Kitakyushu Technical College, 140, Shii, Kokuraminami-ku, Kitakyushu, 803, Japan

Non-linear Vibrations of a Shallow Arch Under Periodic Lateral Forces (2nd Report, Experiment)

Ken-ichi NAGAI Detailed experimental results have been obtained for the non-linear vibration response of a clamped shallow arch under uniformly distributed periodic lateral forces. An aluminum alloy test specimen with thickness 0.5 mm, breadth 30 mm, length 180 mm and radius of curvature 5 619 mm was used and tests were conducted by shaking the base frame with a constant amplitude of acceleration and measuring the relative displacement of the arch to the frame. It is found that experimental results are good agreement with the theoretical ones. Besides the results for comparison with theoretical results, various non-linear responses were observed in connection with the super-sub harmonic resonance and dynamic snap-through phenomena.

College of Technology, Gunma University, 1-5-1 Tenjin-cho, Kiryu, Gunma, 376, Japan

Active Control of Structural Vibration by a Software Servo System (1st Report, On the Vibration Control Using the Linear Quadratic Optimal Control Theory)

Yoshihiro TAKITA and Kazuto SETO Advanced micro-processer permits high speed performance in numerical calculation and progress of the mechatronics techniques. The software servo is one of the most promising control methods for mechanical systems because of its wide applicability in programing. This paper presents a study on vibration control using a software servo system for a mechanical structure which varies the dynamic characters. The design procedure for vibration control is based on the use of linear quadratic optimal control (LQ