Effect of Pivot Clearance on Head Positioning of a Rotary Actuator for Magnetic Disk Storage
by Takao KAKIZAKI

The effect of pivot clearance on the dynamic characteristics of a rotary actuator for head positioning in magnetic disk storage is numerically investigated. A motion equation which takes pivot clearance and pivot bearing elasticity into account is derived for a track-following servo controlled actuator. Elastic deformation of a bearing as well as head positioning error increase in a sudden step when the bearing makes alternating impacts at the antipodes of the pivot shaft. Based on the result, design criteria are obtained for the maximum acceptable clearance for high accuracy in head positioning.

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Optimum Analysis for Structural Vibration Character (First Report Proposilion of a New Eigen Mode Sensitive Analysis and Comparison between Some Different Methods)
by Ichiro HAGIWARA by Toshikira FUJWARA by Kazuo NAGABUCHI

The particular eigen modes of the body and the suspension of a vehicle have a great influence on vehicle compartment noise and idling vibrations etc. Therefore, it is desirable to develop the optimum method for effective control of these eigen modes and improvement of these phenomena. The most effective analysis method to accomplish it is, in the broad sense, the mode sensitive analysis. A new method for mode sensitive analysis is proposed in this paper. By using some eigen vectors of the current structure as the initial value, we calculated some eigenvectors of the changed structure with this method, that is, the modified simultaneous iteration method. The inverse matrix of the current structure shortens the calculation time greatly, when applying this modified simultaneous iteration method. By using a 5-degrees of freedom vibration model and an FEM beam model, we compared it with the four existing methods and confirmed its effectiveness. We also discovered some new characters of these existing methods.

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Vibration Analysis of Rectangular Plates with Slits
by Akiyoshi OKITSU* Masatoshi SHIMODA** and Takanori TAIRA*

The present paper deals with both the eigenvalue problems and the frequency response problems of rectangular plates with narrow slits, and investigates the effects of slit geometry. Analytically and experimentally vibration problems are solved for plates with an internal straight slit, plates with a slit emanating from one edge, and plates with an internal cross slit. The analytical technique of the Finite Element Method, which can be applied to complex boundary conditions and arbitrarily located slits, has been used to evaluate the dynamic characteristics of slit plates. The experimental technique of time-average holographic interferometry has been used to record their transverse vibration modes. The location and length of the slits have been varied, while the width has been kept constant. The analytical results obtained are favorably compared with experimental data, and it can be realized that the analytical technique of F. E. M. used adequately predicts the dynamic behavior of plates with arbitrarily located slits.

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Vibration and Vibration Control of a Flexible Robot Arm with Multiple Joints Subjected to a
Vibration Force at the Tip of the Arm  
by Kosuke NAGAYA* and Jianli SUN**  
This paper presents a method for controlling the vibrations of a robot arm with multiple joints subjected to a vibration force at the tip of the arm. The method proposed here is the velocity and position feedback system having a damping effect on the robot arm during the excitation. The paper derives the exact theoretical results by combining the electrical differential equations and the equation of motion of the arm with consideration of flexural vibrations. To verify the theoretical results, experimental tests were carried out for the robot arm with two joints. Both the theoretical and experimental results were in good agreement. The vibration characteristics of the general robot arm with three joints have been discussed in detail.

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Forced Torsional Vibration of a Two Degrees of Freedom System Including Clearance and Friction (2nd Report, Case of Stick-Slip Motion)  
by Masanori KATAOKA,*Shinichi OHNO** and Tsunoo SUZUKI**  
The engine-clutch-manual transmission system of an automobile is modelled by a forced torsional vibration system of two degrees of freedom including two nonlinear terms, namely clearance and friction. In the derivation of the analytical solution, the friction term is linearized based upon the approximate solution of motion. The conclusions are as follows: 1) Experiments, computer simulations and the analytical solution show that the stick-slip motion occurs when the friction torque takes a value within certain limits. 2) When the system approaches resonance, the sum of torque impulse becomes large in the system with small friction, but it remains almost unchanged in the system with large friction. 3) It seems that the effects of system parameters on the magnitude of shock can be estimated by the amplitude magnification factor of an approximate single degree of freedom system.

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Dynamic Characteristics of a Workpiece at Cutting (1st Report, On Vibration in the Direction of Thrust Force)  
by Akio YAMADA and Takeshi KAKUBARI  
The frequency characteristics of the workpiece at cutting on the lathe were investigated using the impulse technique. The natural frequencies and damping ratios of the workpiece at cutting were greater than those at no cutting. The damping ratios decreased with an increase in the cutting speed. The estimated natural frequencies, which were calculated from data of the static cutting experiments, were smaller than those of the dynamic experiments, and the estimated damping ratios larger than those of the dynamic experiments. The reason for decrement in the frequencies and increment in the damping ratios was considered to be the difference of the shear angle between the static and dynamic conditions. The dynamic shear angle was smaller than the static one. The cutting process was expressed in the first order system which became the lead or lag factor.

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An Analysis of Running Stability for High Speed Railway Vehicles Connected in Series against Truck Turning with Spring and Friction (2nd Report, Body Hunting Having Small Clearance between Truck Frame and Bolster Anchor)  
by Keiji YOKOSE and Hiroshi SHINDOH  
In this paper, we analysed theoretically the hunting stability of a high speed vehicle having a small clearance in the connecting position between the truck frame and the bolster anchor when the spring and friction are connected in series against truck turning. According to the theoretical analysis, it was found that the stability of hunting depends on the angular amplitude of the truck. And the limit cycle corresponding with the hunting velocity is a stable limit cycle when the amplitude is small, while the limit cycle is an unstable one when the amplitude is large. Then, the fact that the body hunting ceases to exist in the range between both amplitudes is made clear. Further, the analysis revealed that the stabil-