Vibration

1- Vibration analysis of carbon nanotube-reinforced composite microbeams

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Abstract:
In the present article, free vibration behavior of carbon nanotube-reinforced composite (CNTRC) microbeams is investigated. Carbon nanotubes (CNTs) are distributed in a polymeric matrix with four different patterns of the reinforcement. The material properties of the CNTRC microbeams are predicted by using the rule of mixture. The microstructure-dependent governing differential equations are derived by applying Hamilton's principle on the basis of couple stress theory and several beam theories. The obtained vibration equation is solved by using Navier's solution method. The effects of length scale parameter, length/thickness ratio, volume fraction and the reinforcement pattern of CNTs on frequencies are examined. It is observed that the biggest frequencies occur in X-Beam while O-Beam has the lowest ones. It is also found that the size effect is more prominent when the thickness of the beam is close to the length scale parameter and this effect nearly disappears as the thickness of the beam increases.

2- Review of ultrasonic vibration-assisted machining in advanced materials

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Abstract:
Compared to conventional machining (CM), ultrasonic vibration-assisted machining (UVAM) with highfrequency and small-amplitude has exhibited good cutting performances for advanced materials. In recent years, advances in ultrasonic generator, ultrasonic transducer, and horn structures have led to the rapid progress in the development of UVAM. Following this trend, numerous new design requirements and theoretical concepts have been proposed and studied successively, however, very few studies have been conducted from a comprehensive perspective. To address this gap in the literature and understanding the development trend of UVAM, a critical overview of UVAM is presented in this study, covering different vibration-assisted machining styles, device architectures, and theoretical analysis. This overview covers the evolution of typical hardware systems used to achieve vibratory motions from the one-dimensional

UVAM to three-dimensional UVAM, the discussion of cutting characteristics with periodic separation between the tools and workpiece and the analysis of processing properties. Challenges for UVAM include ultrasonic vibration systems with high power, large amplitude, and high efficiency, as well as theoretical research on the dynamics and cutting characteristics of UVAM. Consequently, based on the current limitations and challenges, device improvement and theoretical breakthrough play a significant role in future research on UVAM.

3- Dynamical Modeling and Boundary Vibration Control of a Rigid-Flexible Wing System

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Abstract:
A boundary control approach is used to control a two-link rigid-flexible wing in this article. Its design is based on the principle of bionics to improve the mobility and the flexibility of aircraft. First, a series of partial differential equations (PDEs) and ordinary differential equations (ODEs) are derived through the Hamilton's principle. These PDEs and ODEs describe the governing equations and the boundary conditions of the system, respectively. Then, a control strategy is developed to achieve the objectives including restraining the vibrations in bending and twisting deflections of the flexible link of the wing and achieving the desired angular position of the wing. By using Lyapunov's direct method, the wing system is proven to be stable. The numerical simulations are carried out with the finite difference method to prove the effectiveness of designed boundary controllers.

4- Study on Three-Dimensional Dynamic Stability of Open-Pit High Slope under Blasting Vibration

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Abstract:
The propagation process of blasting vibration has always been a difficult problem affecting the stability of high slopes in open-pit mines. Taking the Jianshan Phosphorus Mine as the research background, combined with engineering geological investigation, field blasting test, blasting vibration monitoring, numerical simulation technology, and theoretical analysis, the three-dimensional dynamic stability of the adjacent high slope after blasting vibration was systematically studied. In our study, a small-diameter buffer shock-absorbing blasting technology near the slope was proposed, which greatly improved the production efficiency. Through regression analysis of a large amount of vibration test data, the law of blasting vibration propagation in Jianshan stope and Haifeng stope was obtained. In addition, by establishing four three-dimensional geomechanical numerical models, the slope's own frequency, damping characteristics, and dynamic response acceleration distribution after detonation were studied, respectively. On the other hand, under the action of Ei Centro wave with 8-degree seismic intensity, the maximum total acceleration and maximum total displacement of the slope were calculated and analyzed. Both the explosion unloading of the 8-degree earthquake and the Ei Centro wave simulation results showed that the high slope near the Jianshan Phosphorus Mine was generally in a stable state. Thus, this study can provide technical support and theoretical guidance for mine blasting.

5- On the modelling of the vibration behaviors via discrete singular convolution method for a highorder sector annular system

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Abstract:
This research presents a numerical investigation on the dynamic information of the axisymmetric sandwich annular sector plate via a higher-order continuum elasticity theory. The sandwich annular sector plate comprises multi-hybrid nanocomposite reinforced (MHCR) face sheets in the top, bottom layers, and a honeycomb core. For modeling the thermal situation and the thickness of the structure, three-kinds of thermal loading are presented. For simulating MHCR face sheets, the role of the mixture and Halpin-Tsai micromechanics model is utilized. For obtaining the governing equations and various boundary conditions, first-order shear deformation theory (FSDT), as well as Hamilton's principle, are presented. For solving the equations and obtaining eigenvalue, and eigenvector of the current structure, discrete singular convolution method (DSCM) as a numerical one is investigated. Consequently, a parametric study is carried out to examine the impacts of honeycomb network angle, thickness to length ratio of the honeycomb, honeycomb to face sheet thickness ratio, fibers angel, outer to inner radius ratio, and weight fraction of CNTs on the dynamics of the current sandwich structure. The results show that for clamped edge and each t(h)/l(h), increasing theta(h)/pi is a reason for decreasing the natural frequency of the disk. Another consequence is that the impact of temperature changes on the frequency of the disk is hardly dependent on the fiber angle. It means that the effect of temperature changes on the frequencies of the current system is more considerable at 0.2 <= theta(f)/pi <= 0.4 and 0.6 <=theta(f) /pi <= 0.8.