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Mechanik-Seminar

Referent: **Prof. Evgeny Glushkov**
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Datum: Donnerstag, 14.02.2008
Uhrzeit: **15.45 Uhr**
Ort: Hertz-Hörsaal, Geb. 10.11, Raum 126

Thema: **Integral equation based modeling of wave phenomena in laminate structures:**
1. Selective mode excitation by piezoelectric patch actuator.
2. Resonance trapped-mode effects and band gaps in elastic waveguides with obstacles.

Abstract

An analytically based computer model for the investigation into wave excitation, propagation and diffraction in laminate structures with hidden or surface-breaking obstacles (cracks, cavities, interface imperfections etc.) has been developing. The model relies on wave expressions in terms of path Fourier integrals, Green's matrices for the laminate structures considered and asymptotics for body and traveling waves derived from those integrals. The characteristics of incident waves excited by given sources as well as of reflected and diffracted waves are obtained from the integral equations resulted from satisfying boundary conditions in the source-structure contact domain and on the obstacles' surface. The model's application to specific problems is illustrated by two rather independent examples indicated in the title.

1. A smart structure consisting of piezoelectric flexible patch actuators bonded to an elastic layered substrate is considered [1]. The rigorous solution to the patch–substrate dynamic contact problem extends the range of the model's utility far beyond the bounds of conventional simplified models that rely on plate, beam or shell equations for the waveguide part. It provides the possibility to reveal the effects of resonance energy radiation associated with higher modes that would be inaccessible using the models accounting for the fundamental modes only. Algorithms for selective mode excitation in a layer as well as for body waves directed to require zones in a half-space have been elaborated.

2. The investigation is focused on the trapped-mode phenomena featured by the time-averaged harmonic wave energy localization near the obstacles in the form of energy vortices [2]. The latter results, in particular, in band gaps in the frequency spectrum of transmission coefficients. The connection between the resonance effects under consideration and the allocation of natural frequencies (spectral points of the related boundary value problems) in the complex frequency plane is analyzed as well. The eigenforms associated with such discrete spectral points lying on a continuous spectrum depict strong wave energy localization. A possibility of band gaps' broadening by controlling the resonance trapped-mode properties of a limited (non-periodic) set of obstacles is demonstrated and discussed.

References

1. E. Glushkov, N. Glushkova, O. Kvasha and W. Seemann, Integral equation based modeling of the interaction between piezoelectric patch actuators and an elastic substrate. Smart Mater. Struct. 16 (2007) 650–664.

2. E. Glushkov, N. Glushkova, M. Golub, A. Boström, Natural resonance frequencies, wave blocking, and energy localization in an elastic half-space and waveguide with a crack. J. Acoust. Soc. Am., 2006, 119(6), 3589-3598.

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Alle Interessenten sind herzlich eingeladen.
Prof. Dr.-Ing. Wolfgang Seemann