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Influence of Periodic Stiffenning on Flanking Noise Transmission

numerical analysis based on various frame design of a lightweight panel structure

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[SS31] Prediction of Sound Transmission in Buildings **TS-6 (Room 1007)**

9:40-10:00 Invited

Tue-6-1 Using the framework of Statistical Energy Analysis to incorporate tunneling mechanisms for bending wave transmission across a ribbed periodic plate

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This paper investigates the prediction of bending wave transmission on an L-junction comprising a homogenous, isotropic plate and a ribbed, periodic plate using the framework of Statistical Energy Analysis (SEA). SEA models based on two subsystems are assessed using coupling loss factors (CLFs) that either treat the periodic plate as a uniform plate with an effective bending stiffness or use the wave approach of Tso and Hansen to incorporate Bloch theory. Good agreement between SEA and numerical experiments using the Finite Element Method (FEM) is achieved for the former in the low-frequency range, and the latter in the high-frequency range. However, at high frequencies FEM results indicate a significant decrease in energy along successive bays of the periodic plate; hence it is no longer appropriate to model the periodic plate as a single subsystem. Each bay on the periodic plate is subsequently considered as an individual subsystem using CLFs from wave theory; however, this leads SEA to underestimate the response by up to 30dB. Experimental Statistical Energy Analysis (ESEA) is then used to investigate this large discrepancy. The results indicate the existence of tunneling between physically disconnected subsystems, which is not usually incorporated in standard SEA between structural subsystems. In order to model this tunneling mechanism, Advanced Statistical Energy Analysis (ASEA), as proposed by Heron, is used to track the energy flow across the plate system. In contrast to SEA, ASEA generally shows good agreement with FEM although discrepancies occur which require further investigation.

10:00-10:20 Contributed

Tue-6-2 Influence of Periodic Stiffening on Flanking Noise Transmission -Numerical Analysis Based on Various Frame Designs of a Lightweight Panel Structure

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In this paper, a finite-element model is utilized for analysis of noise transmission in a lightweight structure consisting of a source panel subjected to external forces, a receiver panel used to measure the output, and a panel in between acting as a transmission path. Each panel consists of two plates with internal ribs, where it is assumed that the ribs are fully fixed to the plates. A parametric study is carried out on centre panel with regard to various spacing between the ribs. Solid finite elements are adopted for the structure and the computations are carried out in frequency domain in the range below 500 Hz. The responses of the receiving wall are studied under point-force excitation and diffuse-field excitation applied on the source wall. It is found that the positions of the ribs have a significant impact over flanking noise transmission. Thus, a panel with few ribs transmits vibrations in the entire frequency range, whereas a panel with periodic stiffening provides a wide band gap with a significant reduction of the transmitted energy.