Master Thesis
Implementation of a Wave based analysis method for plate assemblies

Motivation

Vibro-acoustic behaviour of physical systems is an important task in engineering acoustics. Acoustic problems cover the entire frequency range between 20 Hz and 20 kHz. In the low frequency range wide knowledge exists on how to approach numerical tasks, e.g. with the help of element based methods such as Finite-Element-Methods and Boundary-Element-Methods. Statistical methods, namely the Statistical Energy Analysis, can handle high frequencies if certain preconditions are fulfilled. In contradiction there is still a lack of knowledge about the frequency range in between, the so called mid-frequency gap.

To close this gap the wave based method has been developed [1] based on the theory of an Indirect Trefftz method and extended for vibrations of plate assemblies [2]. The method approximates the solution by so called wave functions (Fig. 1). With the help of a weighted residual approach, the integrated errors over the domain boundaries are minimized. The unknowns then are the Contribution factors of the different wave functions.

![Wave functions for a certain wave number](image)

In a research project at the chair of structural Mechanics different joints of lightweight wooden structures are investigated. Therefore it is necessary to evaluate the internal energies in the different plates for certain excitations scenarios. This shall be achieved with the help of a numerical calculation based on the wave based method.

Task

In this master thesis the wave based method shall be implemented for plates considering bending and shear waves in a programming language of choice e.g. Matlab ©.

In a second step a structure of two coupled plates shall be considered. The energy in each plate shall be evaluated and compared against the numerical results of a Finite Element model.


Supervisor

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