Author: Winter, C.; Buchschmid, M.; Müller, G.; Schanda U.

Titel: A Hybrid FEM/SEA Approach to Predict Sound Transmission via Component Connections

Abstract: Nowadays the sound prediction of structures at a very early stage of the planning process becomes more and more important. In the low frequency range the Finite Element Method (FEM) is a convenient tool to predict the vibroacoustic behaviour of structures because the modes are in general clearly separated. Reaching higher frequencies the modal density increases. On one side this impedes an FEM on the other side it allows statistical methods like the Statistical Energy Analysis (SEA). As both techniques have a restricted validity regarding the frequency range the so called mid frequency gap results, which is examined and attempted to be closed. Therefore some criteria of the SEA procedure have to be modified to be able to reach an adapted “SEA-conform” approach. Hereby the approach unites the advantages of both techniques, FEM and SEA. At the same time it is neglecting the drawbacks. The Finite Element Model of the examined structure is exposed to a spatially random distributed load. To neglect the sensitivity of the response at higher frequencies regarding the modelled structure a postprocessing as practiced in the SEA is applied. By varying the loaded subsystem it is possible to determine the particular Energy Influence Coefficients (EIC) which describe the energy flow between the different subsystems. Therefore the potential and kinetic energy of the individual subsystems and the input power is evaluated. Inverting the EIC-matrix the Coupling Loss Factors as well as the Damping Loss Factors of the different subsystems can be calculated if the subsystem definition fulfils the SEA requirements. One of the decisive SEA criteria is a weak coupling of the subsystems to avoid indirect energy transmissions between non-adjacent...
subsystems. This postulation is not applicable for each real structure and is depending of the definition of subsystems. Therefore the “SEA-like” approach is applied, which implies also strong coupling. Using this hybrid approach acoustical predictions can be performed also in the mid frequency range e.g. for component connections in an early design phase.

Stichworte:
FEM, SEA, Mid Frequency

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