

BINAURAL TRANSFER PATH ANALYSIS & SYNTHESIS EMBEDDED IN AN ACOUSTIC DESIGN PROCESS

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Sound quality of vehicle is more and more an important product feature which significantly influences the perceived product quality. Over recent years, the broad variety of new models, which resulted in increased competition, has led to rising customer demands with regard to NVH (Noise, Vibration and Harshness) aspects. Apart from the indispensable troubleshooting, the acoustic engineer's scope of work is extended to NVH design engineering. Thus, innovative, ambitious measurement technologies were developed to meet these new, challenging tasks and to maintain a competitive advantage.

Binaural Transfer Path Analysis and Synthesis (BTPA/BTPS) are tools for troubleshooting and sound design of vehicle interior noise. BTPA/BTPS enable exploring the causal mechanisms for noise transfers, based on measuring excitation source strengths and the corresponding structure-borne and airborne transfer paths to a receiver position. The results of these methods represent a considerable milestone with respect to acoustic simulation and auralization. The engineer can analyze and listen not only to the overall sound comparable to a binaural recording of the vehicle interior sound, but also to components of the total noise transmitted via a single path or a combination of paths to identify the cause of a particular disturbing noise pattern.

An extension of time-domain transfer path analysis will be presented where structure-borne paths can be described using four-pole networks, and results can be simulated with immediately-audible results. This presents new possibilities for NVH design, where effects of changes in engine mount geometry and material properties can be predicted via Finite Element Analysis (FEA) calculations, and vehicle interior sound can be auralized using only engine dynamometer input data.