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Characterizing Tire and Wind Noise Using Operational Path Analysis

Sottek, Roland[a] and Philippen, Bernd[b]
[a]HEAD acoustics GmbH
[b]RWTH Aachen University
roland.sottek@head-acoustics.de

An interactive driving simulation requires on-demand reproduction of vehicle sound components such as engine, wind and tire noises as separate sound contributions. For realistic sound perception, wind and tire noises are extracted from road measurements. The structure-borne excitation and airborne noise radiation of all four tires are measured during a coast-down from maximum vehicle speed to standstill. By evaluating the multiple coherence between the excitation signals and a simultaneous binaural recording of the interior sound, speed-dependent FIR filters can be calculated in order to predict, from the mixture in the cabin, the wind and tire noise shares.
In this paper an alternative approach will be presented describing the physical system as a **M**ultiple-**I**nput-**M**ultiple-**O**utput (MIMO) model. The tire noise can be synthesized using transfer functions estimated from road measurements using an **O**perational **P**ath **A**nalysis (OPA); the uncorrelated wind noise can be determined as the difference signal between actual interior noise and synthesized tire noise. In case of uncorrelated excitation signals OPA is very efficient and accurate; no additional laborious transfer function measurement is required. The advantages and possible drawbacks of OPA for characterizing tire and wind noise in comparison to coherence filtering will be discussed.

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