ACOUSTICS2008/3104
Variable Source-Directivity Using Dodecahedron-Loudspeakers

Gottfried Behler and Martin Pollow
RWTH Aachen University, Templergraben 55, D-52056 Aachen, Germany

For room-acoustical measurements dodecahedron loudspeakers are commonplace to achieve a uniform directivity. Therefore all transducers are fed with the same signal. If the signals for the twelve transducers are individually adjustable, the variation of amplitude and phase offers the possibility to achieve a predefined directivity. The goal is to calculate the twelve frequency dependent amplitude- and phase-coefficients for any given directivity with the least possible error.
A simple approach like superposition unfortunately does not reveal a correct result, since all transducer interact with each other. The decomposition of spherical functions into spherical harmonics, however, leads to an analytic solution for the prediction of the sound radiation. The acoustical components - like sound pressure and sound velocity - are split up into weighted, orthogonal base functions which can be combined in a way that the mutual coupling between different membrane vibrations is respected. Under these conditions complex filter transfer functions, individually optimized for each one of the twelve transducers can be computed with respect to the target directivity function.
Different approaches for the optimization procedure are discussed. Besides the more theoretical approach measurements with a real multichannel system are shown.