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Acoustic Radiation Properties of Dynamic Loudspeaker Arrays versus Multiactuator Panels for Wave Field Synthesis

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Wave Field Synthesis (WFS) is a spatial sound rendering technique that generates a true sound field using loudspeaker arrays. Dynamic loudspeaker arrays, that were used since the beginning of WFS, is the technology employed in most prototypes. Alternatively, Distributed Mode Loudspeakers can be used to build arrays for WFS, also known as Multiactuator Panels (MAPs). For that purpose, multiple vibrating exciters are attached to a single flat panel of a light and stiff material, creating bending waves that are then radiated as sound fields. An analysis of the radiation properties and spatial performance of such loudspeaker arrays for WFS reproduction is presented in this paper. Wave fields have been interpreted in the wavenumber domain, where the source radiation is decomposed into plane waves for arbitrary angles of incidence. Then, measurement and analysis of the radiation performance, evaluation of the spatial aliasing frequency and associated sampling artefacts for both linear loudspeaker arrays are addressed. In addition, parameters that can modify spatial aliasing artifacts, such as truncation effects caused by the array geometry or array directivity are also discussed. Simulations and experiment results are discussed through several case studies, comparing dynamic loudspeaker arrays and MAPs in WFS operation.