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Analysis of enclosed sound fields using spherical microphone array processing

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Enclosed sound fields in rooms and auditoria are characterized by multiple reflections in addition to the direct sound. The spatial and temporal manner in which sound propagates from the sound source to a listener determines the acoustics of the enclosed space. Recent studies showed that spherical microphone arrays and associated array processing can be used effectively in the experimental study of the acoustics of auditoria. The main advantages presented are the true three-dimensional analysis and the effectiveness of array processing in the spherical harmonics domain. Spherical microphone array design issues will first be reviewed in this work, in particular concerning the design of open-sphere arrays useful in room acoustics analysis with high spatial resolution. Then, beam-forming methods will be presented which can facilitate identification of individual room reflections, and computation of directional room impulse responses. Finally, the use of optimal array processing methods will be presented which facilitates improved sound field analysis.