A wavenumber approach to quantifying the isotropy of the sound field in reverberant spaces

This study proposes an experimental method for evaluating isotropy in enclosures, based on an analysis of the wavenumber spectrum in the spherical harmonics domain. The wavenumber spectrum, which results from expanding an arbitrary sound field into a plane-wave basis, is used to characterize the spatial properties of the observed sound field. Subsequently, the obtained wavenumber spectrum is expanded into a series of spherical harmonics, and the moments from this spherical expansion are used to characterize the isotropy of the wave field. The analytical framework is presented. The method is examined numerically and experimentally, based on array measurements in four chambers: two anechoic chambers (one with a single source and another with an array of 52 sources), a reverberation chamber, and the same reverberation chamber with a sample of absorbing material on the floor. The results indicate that the proposed methodology is suitable for assessing the isotropy of a sound field.