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Binaural room acoustics - cross-correlation

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The subject of “Binaural room acoustics” combines the disciplines of room acoustics with facts and models of human binaural physiology and psychology. It considers the linear effects of rooms on the inputs to the two ears of a listener, and it considers the nonlinear effects of binaural hearing processes on perceptually relevant acoustical characterizations of rooms. Linear effects of interest are binaural differences in amplitude and phase spectra, which are combined in the cross-correlation function (CCF). A psychophysically relevant CCF is computed over frequency bands approximately corresponding to auditory filters. Because the bands are narrow, the effects on the CCF of frequency-dependent interaural parameters, most importantly dispersion, can be modelled analytically. The roles of amplitude incoherence and dispersion can also be independently modelled. A systematic experimental approach begins with the dependence of the CCF on head related transfer functions (HRTF) as measured at different azimuths in a free field. Although there are notable individual differences, the effects of HRTFs appear to be almost entirely below detection threshold. An empirical relationship between the CCF for a waveform and for its envelope has been established numerically and in extensive room experiments. [Work supported by the NIDCD, grant DC00181.]