



Sound zone reproduction using loudspeaker array

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Abstract

Reproduction of a desired sound field over the target region is a hot topic in the research area of the spatial audio. For the multi-zone sound field reproduction (SFR) problem, I) an improved acoustic contrast control (ACC) method using multi-point equalization is proposed to avoid the difficulty of selecting the optimal spatial reference point, II) an algorithm integrated a Least-Square (LS) criteria with ACC constraint is proposed, which tunes the balance between the acoustic contrast and the spatial average error, III) two time-domain ACC design based on response variation and differential constraints is proposed, respectively, which can avoid the causality problem and maintain a flat frequency response in the “bright” zone. Moreover, the issues around ensuring robust performance in SFR systems are studied. A framework for robust SFR design is proposed, which allows a physical perspective on the regularization required for a system, increases robustness of the SFR systems against perturbations, and simplifies the SFR system design. For the single-zone SFR problem, I) an time-domain SFR method using the group Lasso is proposed, which achieves an accurate SFR over the target region using a small number of activated loudspeakers, II) two kinds of block sparse models to interpolate the early part of the acoustic transfer functions (eRTF) are proposed, which can accurately interpolate the broadband eRTF by using a random array containing a small number of microphones.