Blind estimation of acoustic transfer functions (ATFs) and dereverberation based on convolutive transfer functions (CTFs)

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In general, Acoustic Transfer Functions (ATFs) yield better array signal processing performance than Relative Transfer Functions (RTFs). However, the issue that the source signal is usually not available prevents us to obtain a reliable estimate of ATFs. To address this problem, this paper describes a blind ATF estimation approach based on convolutive transfer functions (CTFs). Initially, the target source signal at a known location is dereverated using Weighted Prediction Error (WPE) and extracted using the Delay and Sum (DAS) beamforming. Next, the CTF coefficients are computed using Wiener filters or adaptive filters such as Recursive Least Squares (RLS). To obtain the ATFs in the time domain, the short-time Fourier transform (STFT) of a unit pulse sequence is convolved with the estimated CTF coefficients before the inverse STFT is used. To validate the proposed ATF estimation technique, we perform the dereverberation using the Multiple Input/Output Inverse Theorem (MINT), which requires accurate ATF estimates. A thirty-microphone Uniform Linear Array (ULA) is employed with reverberation simulated using the image source method. The results reveal that the proposed method yields ATF estimates in close agreement with the ground truth room impulse responses. The dereverberated signals reproduce the oracle dry source signals well in Perceptual Evaluation of Speech Quality (PESQ).