Experimental validation of sound field control with a circular double-layer array of loudspeakers.

This paper is concerned with experimental validation of a recently proposed method of controlling sound fields with a circular double-layer array of loudspeakers [Chang and Jacobsen, J. Acoust. Soc. Am. 131(6), 4518-4525 (2012)]. The double-layer of loudspeakers is realized with 20 pairs of closed-box loudspeakers mounted back-to-back. Source strengths are obtained with several solution methods by modeling loudspeakers as a weighted combination of monopoles and dipoles. Sound pressure levels of the controlled sound fields are measured inside and outside the array in an anechoic room, and performance indices are calculated. The experimental results show that a method of combining pure contrast maximization with a pressure matching technique provides only a small error in the listening zone between the desired and the reproduced fields, and at the same time reduces the sound level in the quiet zone as expected in the simulation studies well above the spatial Nyquist frequency except at a few frequencies. It is also shown that errors in the positions of the loudspeakers can be critical to the results at frequencies where the distance between the inner and the outer array is close to half a wavelength.