Combined Spherical Nearfield Acoustic Holography and Sound Quality Analyses

Jiangming.Jin Huancai.Lu Weijie.Hu

Key Laboratory of E&M, Ministry of Education & Zhejiang Province,
Zhejiang University of Technology, Hangzhou, 310014

Abstract: The method of near-field acoustic holography (NAH) can not reveal the global psychoacoustic attributes features of indoor sound field, which could be got by sound quality objective analysis. While traditional sound quality analysis can not show the 3D sound source distribution， we introduced a new way to find the 3D sound source distribution which is the Spherical Nearfield Acoustic Holography - Sound Quality (SNAH-SQ) hybrid method. The essential idea of this method is that from 3D distribution of interior acoustic parameters reconstructed by spherical nearfield acoustic holography (SNAH) we can find the three dimension distribution of sound quality parameters, which represents the human auditory perceive can be obtained. Two kinds of sound field are considered for numerical simulation in this work: 1) a monopole source on one side of the spherical microphone array (Figure 1); 2) two monopole sources with certain angle(Figure 2). The accuracy and validation of the method are verified by the numerical simulation, errors of numerical simulation is calculated with varying reconstruction distance and frequency of sound field for the one monopole source sound field. The 3D distribution trend of sound quality parameters varied with the sound field reconstruction distance, sound frequency, and intersection angle between two sound sources in a two monopole sources sound field are also study in this paper. Compared with the traditional sound source localization by nearfield acoustic holography and the sound quality sound field evaluation, the SNAH-SQ method are able to identify and locate sound source based on people's auditory feeling, further more the results of SNHA-SQ are showed by 3D holography image. In case of this paper, the two monopole sources (center frequency of one sound source is 200Hz, the other one is 800Hz, Figure 2) were placed with an intersection angle with 30 °, 60 °, 90 °, 120 °, 150 ° or 180 °, the 3D distribution of the sound quality parameters and the identification and localization of the sound sources by SNHA-SQ are shown in figure 1. As the figure 3 shows, the localization results of the main sound source in sound field based on the distribution of the sound pressure is different from the results based on the distribution of sound quality parameters. Hence, some conclusions also could be obtained: 1) Only sound pressure distribution could not reflect people's auditory feeling of specific sound field, high sound pressure doesn't mean high loudness or sharpness. 2) Through SNHA-SQ method, we can get an approach to revealing the inherent correlation between noise source locations and sound quality parameters, and target the noise sources in three dimensional spaces which contribute most to the sound quality at the specified locations. 3) Combining different source localization methods which could reflect some unique attributes of sound sources respectively is a useful way for identifying multiple sound sources existing in space.

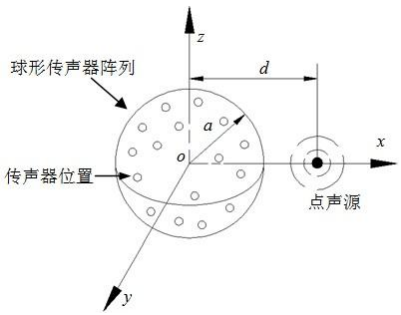

Figure. 1

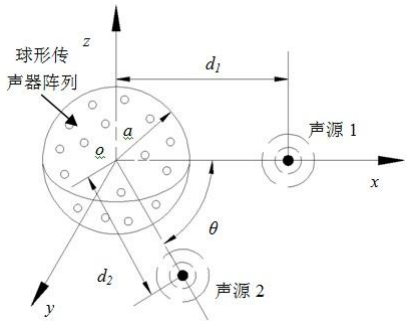

Figure. 2

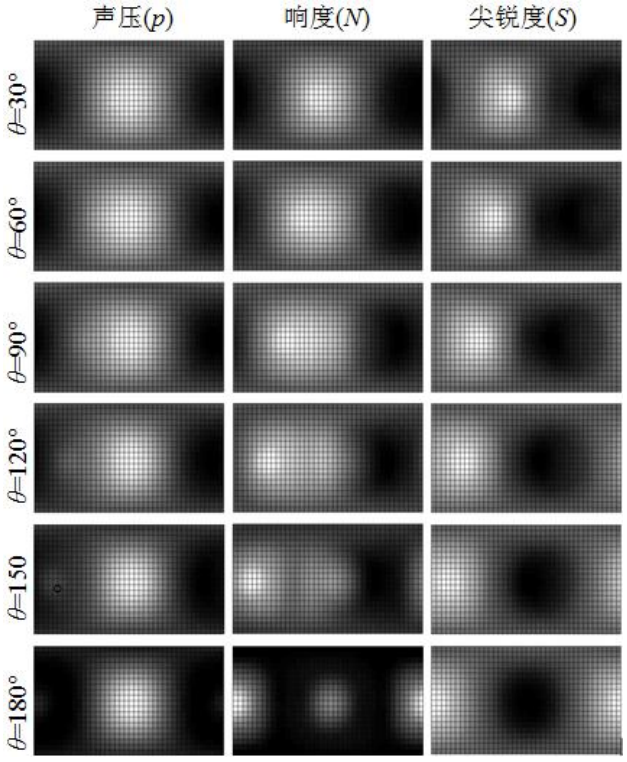

Figure 3