システム情報工学研究科修士論文概要

年 度	平成 26 年度	学位名	修士（ 工学 ）
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論文題目

Study on near field acoustic communication system using evanescent sound field
（エバネッセント音場を用いる近接音響通信システムに関する研究）

論文概要

Acoustic data communication method for mobile devices has recently received broad attention. The acoustic data communication is attractive because the method requires only loudspeaker and microphone those are originally attached to mobile devices. If the area reaching acoustic data signal to a mobile devices can be limited, i.e., sound can be generated locally, the method would be utilized for one-on-one communication such as IC cards. Therefore, we propose suitable device for near field acoustic communication for mobile devices. In the proposed method, we realize localized sound field by generating evanescent sound field which decays exponentially along a distance between sound source. In addition, we indicate the availability as the data-communication device.

In this study, we aims to construct a planar acoustic transducer generating the evanescent sound field. When bending wave propagates on a plate and its phase velocity is smaller than the sound velocity in air, the evanescent sound field is generated in the region adjacent to the plate surface. The phase velocity of bending wave was obtained by solving motion equation of beam which was defined as theoretical equation in this study, and we designed the proposed acoustic transducer using the equation. First, we adopted acrylic plastic with 2 mm thickness for the vibration plate because the requirement for generating the evanescent sound field is met in frequency band under 15 kHz based on the theoretical equation. Next, generated sound field was simulated using finite element method. Finally, the proposed acoustic transducer was made in actual. We compared between the distribution of sound pressure level of simulation and that of experiment. From the results, it was confirmed that sound pressure decayed exponentially in the frequency band under 15 kHz, and sound pressure level declined 20 dB at the receive point which is 15 mm away from the surface of the vibration plate. The results suggested that the area receiving acoustic data signal can be limited because signal-to-noise ratio becomes large with respect to the distance from the vibration plate. In addition, it was indicated that the proposed acoustic transducer can be designed easily using the theoretical equation and the simulation because the results between the simulation and the experiment was well accorded. Reconsidering the shape of the transducer for practical use is planned in a future work.

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