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Abstract
Micromachined acoustic devices are recently being focused on a lot of applications such as hearing aid, cellular phone, earphone as well as wearable electronics. However,the traditional moving-coil loudspeaker has the limitation on size reduction due to the magnet, coils and horn-type diaphragm. On the other hand, piezoelectric loudspeaker not only can generate good quality of sound with planar diaphragm structure but also has the possibility of integration with micromachining technologies. Nevertheless, the response in the low frequency range for a piezoelectric microspeaker is still inadequate
to compare with a dynamic loudspeaker. In order to enhance the sound pressure level in the low frequency range, a polymer-based piezoelectric thin film (PVDF) was utilized in this study instead of ceramic piezoelectric material such as PZT. In addition, a
ring-type bimorph piezoelectric transducer was designed to excite a polymeric diaphragm, PDMS thin film, for improving the sound pressure in the low frequency range (<5KHz). Due to the microspeaker was mostly made by polymer-based material,therefore, it ehibits excellent mechancical flexiblity for bending deformation, which can
not be achieved by ceramic piezoelectric material. Aslo, the sound pressure level of microspeaker with PDMS diaphragm in the low frequency range was larger than microspeaker with Al diaphragm as indicated in the experimetnal results. Generally, the enhancement of sound pressure in the low frequency reange is due to the light weight
and low stiffiness of PDMS thin film that can be easily excited by bimorph PVDF transducer. We have developed a directional audible sound system using micorspeaker array based on bimorph transducer in this study. The directivity of single transducer and III transducer array are discussed according to Huygen’s principle. A method is proposed by increasing the quantity of spot sound sources to generate high directivity sound wave，and to suppress the amplitude of sidelobes when it is impossible to make the distance between spot sound sources less than or equal to a half of the wavelength of
ultrasonic sound wave. This novel directional audio is a result of the nonlinear propagation and subsequent self-demodulation of high-intensity amplitude modulated (AM) ultrasonic waves. In this study, the propagation characteristic of the directional sound generated by parametric acoustic

arrays. Based on an experiment, a directional
loudspeaker has been designed and prototyped. Furthermore, the directional loudspeakers are applied to the sound reproduction in a target zone.
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