

## A High-Density Beam-Forming Acoustic Sensor Array Design Based on Acoustoelectric Effect

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(Received November 1, 2012; accepted February 7, 2013)

**Key words:** sensor array, beam forming, acoustoelectric effect, nondestructive testing, acoustic detection

It is important to nondestructively detect the operating electrical equipment of a power grid. Acoustic detection is one of the most effective methods of electric equipment malfunction detection. A single sensor can only detect acoustic signals. A sensor array is needed for imaging acoustic field and acoustic source localization. Traditional acoustic measuring devices are available depending on the application. These devices, however, are limited by their specific physical properties, often leading to limited bandwidth, susceptibility to damage under high pressure and fragility to fabrication. Thus, it is difficult to integrate a high-intensity, large-scale acoustic sensor array. In this paper, a sensor array based on acoustoelectric effect is proposed for noninvasively imaging acoustic fields. This device can use material with excellent fabrication properties as an acoustic sensitivity element, so photolithography can be adopted to integrate a high-intensity, large-scale acoustic sensor array. A focused spherical sensor array with a large focal length and a small focal spot is designed for imaging acoustic fields. The beam pattern calculation method is provided. Computer simulation results indicate that a beam with a large focal length of 180 cm and a small ellipse focal spot of 4.52 cm<sup>2</sup> can be formed using the proposed sensor array. Computer simulation of imaging a target acoustic field shows that a clear map of the target acoustic field can be obtained by noninvasively scanning the acoustic field with the proposed sensor array.

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