Prof. Zhikang Li

Xi'an Jiaotong University

Title:

Design, modeling, fabrication and application of micromachined ultrasonic transducers

Abstract:

Ultrasonic transducers harness ultrasound waves to realize different types of sensing functions, which features the merits of non-invasive detection and biocompatibility, enabling their widespread applications in clinic medical imaging, industrial nondestructive testing, ultrasonic three-dimensional (3D) biometrics identification and 3D ultrasonic gesture recognition. However, most of commercially available transducers are based on bulk PZT, suffering from large size, significant acoustic impedance mismatch and difficulty to fabricate two-dimensional (2D) arrays for 3D ultrasonic imaging. Micromachined ultrasonic transducers (MUTs) take advantages of MEMS fabrication technologies, featuring small size, easy fabrication of 2D array and integration with integrated circuits (ICs), as well as better acoustic impedance mismatch with fluid and human tissue in comparison with conventional PZT-based ultrasonic transducers. These advances make MUTs a promising alternative to conventional transducers in aforementioned applications. To date, numerous efforts from different institutes over the world have been put on research of MUTs.

MUTs can be categorized into two types: capacitive micromachined ultrasonic transducers (CMUTs) and piezoelectric micromachined ultrasonic transducers (PMUTs). This talk is aimed at overviewing the advance in the design, modeling, fabrication and application of CMUTs in our group. First, the structure design and

theoretical modeling of CMUTs are introduced, to show how the performances such as output acoustic pressure, electromechanical coefficient and collapse voltage are improved. Then, the low-temperature wafer bonding-based fabrication technologies of CMUTs is presented, which solves the obstacle between the integration of CMUTs with ICs. Finally, several typical applications of developed CMUTs are given to show their appealing potential.

Biography：

Zhikang Li received the B.S. degree in mechanical manufacturing and automation from Xidian University, Xi'an, China, in 2010, and the Ph.D. degree in mechanical engineering from Xi'an Jiaotong University, Xi'an, in 2017. From 2014 to 2015, he was with the group of Professor Liwei Lin at the University of California at Berkeley, Berkeley, CA, USA, as a jointly cultivated Ph.D. student, for one year. Since 2018, he has been an Assistant Researcher with the group of Prof. Ali Khademhosseini at the Department of Bioengineering, University of California at Los Angeles, Los Angeles, CA, USA. He is currently an Assistant Professor with the School of Mechanical Engineering, Xi'an Jiaotong University.

His research interests include nano-electromechanical systems (NEMS)/ micro-electromechanical systems (MEMS) sensors, capacitive micromachined ultrasonic transducers (CMUTs), piezoelectric micromachined ultrasonic transducers (PMUTs), skin-like electronics and wearable sensors.