Design, Simulation and Experimental Evaluation of Tri-Phasic Piezoelectric Composite Transducers

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An integrated design, simulation, and experimental evaluation toward the central goal of developing multi-phasic piezoelectric transducers is reported in this paper. The tri-phasic transducers are found to be advantageous for Non-Destructive Evaluation, Non-Destructive Testing (NDE/NDT) and energy harvesting applications. We report that the tri-phasic piezoelectric transducer performs with improved mechanical and electrical responses. Testing in a laboratory environment demonstrated that it is possible to eliminate unwanted modes of operation and achieve both high electromechanical coefficients and bandwidth of the device. This work laid out the foundation for tri-phasic transducer design with extensive finite element simulation that predicts upon optimization, $k_{33} > 84\%$, Qm ~ 1.3, and bandwidth > 70 kHz (f_r=100 kHz) can be realized in a tri-phasic transducer.

1 Tamez, J.P., Bhalla, A., and Guo, R.: 'Design and simulation of 100 kHz and 200 kHz tri-phasic PZT piezoelectric transducers', *Integrated Ferroelectrics*, 2015, **166**, (1), pp. 99-107
2 Tamez, J.P., Bhardwaj, M.C., Bhalla, A., and Guo, R.: 'Simulation and experimental studies on tri-phasic PZT piezoelectric transducer', *Ferroelectrics*, 2014, **473**, (1), pp. 45-54

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