

Interfacing piezoelectric inter-digitated transducers to printed circuit boards

Logan Henderson¹ Dr Joe Chen¹ Dr Ciaran Moore¹
Dr Romain Arnal¹

¹ University of Canterbury

Ultrasonic interdigitated transducers (IDTs) can be used for a wide variety of sensing and transduction applications such as sonoporation [1], biosensing [2], microfluidic mixing [3] and particle manipulation [4]. Packaging these actuators in lab-on-a-chip devices expands the number of applications that they can address; however, this packaging introduces the challenge of securing the fragile piezoelectric substrate, which is typically only 0.5 mm thick, to a print circuit board (PCB) that typically houses connectors and circuitry for impedance matching and amplification.

We explore different methods of interfacing piezoelectric substrate to a fiberglass PCBs, and the resulting effects on the performance at multiple frequencies, from 10 MHz to 250 MHz by measuring the Rayleigh wave transmission. Both IDTs were attached to a vector network analyser with the response of the system measured with additional matching circuits added where needed.

Initial results show that attaching IDT to PCBs with a two part araldite epoxy causes significant attenuation in lower frequency IDTs operating around 10MHz and less attenuation in higher frequency IDTs that operate closer to 100MHz. Matching circuits were shown to have a minor effect on the output at the operating frequency, while also increasing attenuation above and below the operating frequency. This work paves the way for the creation of higher performance and more robust ultrasonic based lab on chip devices.



Figure 1: system response of 10MHz IDTs

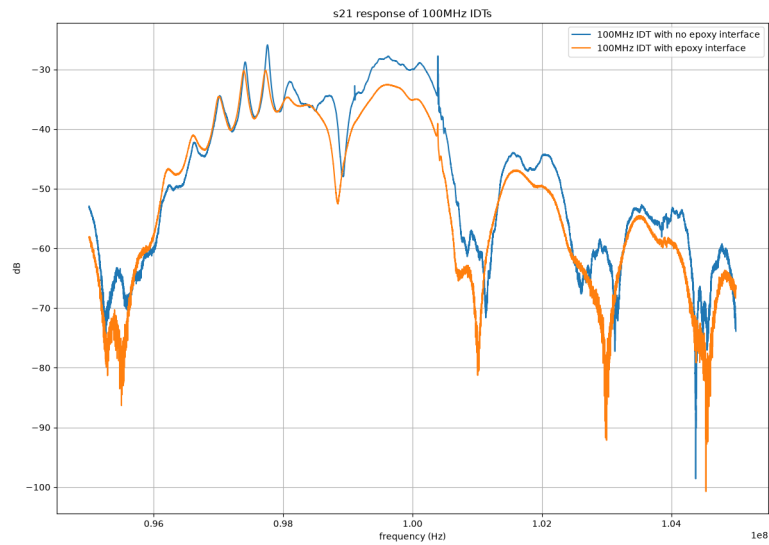


Figure 2: system response of 100MHz IDTs

References

- [1] J. Rich, Z. Tian, and T. J. Huang, “Sonoporation: Past, Present, and Future,” *Advanced Materials Technologies*, vol. 7, no. 1, p. 2100885, 2022, doi: <https://doi.org/10.1002/admt.202100885>.
- [2] L. Fertier *et al.*, “Love wave immunosensor for antibody recognition using an innovative semicarbazide surface functionalization,” *Sensors and Actuators B: Chemical*, vol. 140, no. 2, pp. 616–622, 2009, doi: <https://doi.org/10.1016/j.snb.2009.04.069>.
- [3] R. J. Shilton, M. Travagliati, F. Beltram, and M. Cecchini, “Nanoliter-Droplet Acoustic Streaming via Ultra High Frequency Surface Acoustic Waves,” *Advanced Materials*, vol. 26, no. 29, pp. 4941–4946, 2014, doi: <https://doi.org/10.1002/adma.201400091>.
- [4] X. Ding *et al.*, “On-chip manipulation of single microparticles, cells, and organisms using surface acoustic waves,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 109, no. 28, pp. 11105–11109, 2012.