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Novel non-planar SAW transducers for next generation biological sensors

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In this study, a modified form of a delay-line surface acoustic wave (SAW) has been developed. SAW sensors capable of operating in the 100MHz range have been fabricated to be employed as ultra-sensitive biological mass sensors. Typically, SAW mass sensors harness in-plane wave types such as shear horizontal and love in a delay line configuration, as opposed to Rayleigh that are not suited for biological sensing due to attenuation in liquid. Interdigitated transducers (IDTs) excite and detect an acoustic wave confined within the substrate surface that is sensitive to mass-loading, conductivity and changes in viscosity. This research aims to develop the theory and technology to exploit complex phenomena associated with non-plane wave-front geometries. This technology comprises of a ST-90X quartz substrate with gold IDTs with a unique geometry fabricated in a delay-line configuration alongside a 2μm silicon dioxide waveguide layer to excite a non-plane wave-front love wave. A vector network analyzer has been employed to confirm the response of the love wave for this approach. The exploitation of non-plane wave-front geometries has been conducted to give the ability to focus the acoustic energy on determined locations, specifically the functionalization film of a delay-line SAW biological mass sensor. Established theory has been applied to show that the focusing of the acoustic energy will increase the biological mass sensitivity beyond that of current SAW delay-line technology. Furthermore, these developments are enabling technologies expected to generate tangible progress in acoustic particle trapping and SAW tomography, amongst other fields.

Biography

Carl Dale obtained his PhD in 2012 from the University of Newcastle-upon-Tyne. He has a multidisciplinary background, holding a BSc in Applied Biochemistry and an MRes in Molecular Bioscience (Nanomedicine) before undertaking his PhD research on developing MEMs biosensor technology. He is currently a Research Associate at the Department of Diagnostic and Therapeutic Technologies (D&TT) housed within the Medical School at Newcastle University. His main research interest involves the exploitation of novel sensing technologies for the development of point-of-care diagnostic sensors.

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