PhD stipend

**Acoustic metamaterials using Willis coupling**

This project will sit with the
- Centre of Audio, Acoustics and Vibration
- Mechanical and Mechatronic Engineering
- School of Computer Science

The Centre for Audio, Acoustics and Vibration (CAAV) was formed in 2017 and now has nine full time academic staff. The Centre is based at Tech Lab, which is a brand new research led facility that is close to the airport in Sydney. Tech Lab hosts brand new state-of-the-art acoustics experimental facilities that includes an anechoic chamber, semi-anechoic chamber, reverberation room and sound transmission loss suite. These new facilities will support new research projects in acoustics, including this current project.

Metamaterials have demonstrated a rich variety of fundamental physical properties in many fields, including optics, microwaves, gravitational water waves, and condensed matter. There has been a strong push to transfer these ideas and create metamaterials for structural mechanics, elastic waves in solids, and acoustic waves in fluids. One of the most interesting types of metamaterials to emerge in recent years are metasurfaces, structures which are much thinner than their operating wavelength. There have been some demonstrations of metasurfaces for acoustic waves propagating in air and water. We have developed a method on how to extract experimentally monopole and dipole polarizability of two-dimensional acoustic meta-atoms (Jordaan et al., 2018). We have further shown that Willis coupling, a principle used in optics and Snell’s law can be applied to manipulate the coupling of acoustic monopoles and dipoles and that this coupling is efficient and does not require the commonly used meandering, complex meta-atoms but Helmholtz resonator geometries instead (Melnikov et al., 2019). Using these findings the results with a 2D waveguide will need to be extended to the ultrasonic range and incorporated into a metagrating design, which also tackles 3D problems. A setup to efficiently steer and focus acoustic beams need to be designed to then manipulate acoustic radiation forces in the ultrasonic range.

The successful candidate will work in a thriving acoustics research group at a brand new facility dedicated to impactful research and which will include the chance to collaborate with researchers in other areas at Tech Lab, as well as undergo research training and development. The project will develop a strong understanding of how to excite and manipulate contactless small or thin-elastic and fragile structures. Applications for controlling efficiently acoustic radiation forces range include those in medical acoustics and devices for levitation and contact less excitation, structural health monitoring to acoustic holography using arrays of meta-atoms.
The candidate holds a MSc/MEng degree in physics, mechanical or electrical engineering with a strong interest in acoustics and vibrations. Excellent command of English is necessary and communications as well as presentation skills are important.

The PhD candidate should be self-driven and motivated to explore new grounds using cutting edge technologies and have strong skills in experimental testing and classical physics, acoustics and vibration as well as numerical analyses (Comsol, Abaqus).

About the Faculty
The Faculty of Engineering and Information Technology at UTS is a world-class faculty with a growing reputation for its quality and impact. Our research is highly advanced, industry-focused and part of the lively and rigorous research culture at UTS.

Focused on 'practical innovation', our researchers are pioneering research solutions with real-world impact. They’re recognised leaders in their fields, responsible for delivering new, better and more cost-effective innovative solutions to current national and international challenges.

Over the last five years, the Faculty has received more than 60 Australian Research Council projects and attracted a total research funding well in excess of $30 million.

About the University
UTS is a dynamic and innovative university in central Sydney. One of Australia’s leading universities of technology, UTS has a distinct model of learning, strong research performance and a leading reputation for engagement with industry and the professions.

UTS has a culturally diverse campus life and vibrant international exchange study and research programs that prepare graduates for the workplaces of today.

Funding Notes
Ca. AU$28,000 p.a. stipend (tax free) + ca. $51,000 p.a. tuition fee waiver for International and Domestic Candidates for 3 years. An application for a top-up scholarships is possible.

Closing date for next intake
International students: 30th June 2019 (for commencement January 2020) or 15 January 2020 (for commencement July 2020). If interested please contact sebastian.oberst@uts.edu.au sending a (1) motivation letter and your (2) Curriculum Vitae together with relevant diploma, transcripts, publication list and contact details of two referees.