

Project 2: Ultrasonic bone surgery devices with cutting mechanisms inspired by nature

Supervisory Team

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Background and motivation

A group of researchers in C-MIU are undertaking a large funded project on miniaturisation of ultrasonic surgical devices, so that small surgical tips vibrating at an ultrasonic frequency can be used in bone surgeries through minimally invasive surgery. One avenue of exploration is how to learn from some of the cutting techniques found in nature, especially insects, and how to incorporate them into the designs of surgical tips.

What will you do?

This project aims to investigate novel technological approaches for making cuts in bone with ultrasonic surgical devices by designing surgical tips inspired by nature. You will be responsible for initiating our research in this field, doing the background research and uncovering potential cutting mechanisms used in nature that could form the basis of new surgical tip designs. You will work with our research team to identify the most promising candidate cutting mechanisms and develop concept designs in CAD, for surgical tips inspired and informed by these natural mechanisms. The designs will be developed into ultrasonic devices in a finite element modelling package, to calculate the vibration and impedance responses and carry out stress analysis of the cutting tips. You will define a surgical cutting device to take forward in our research project for testing and comparison with our existing and recently developing ultrasonic surgical devices. You will learn many useful research techniques, including reviewing relevant literature, modelling and analysis using finite element software, design and construction of tuned ultrasonic devices, and vibration experimentation. You will also work in a research team, reporting and presenting your work regularly throughout the internship.

Required skills and experience

Candidates should have an interest in vibration analysis and ultrasonics and in the design and analysis of devices. A passion for healthcare technology developments would be beneficial. Experience of finite element modelling is useful but is not essential. Some CAD experience is essential. Candidates can come from any degree background, which furnishes them with the required skill-set outlined above. Candidates should have strong interpersonal skills and enjoy working as part of a team.

Adjustments to the project if lab access is restricted

If lab access is restricted and/or we are required to work from home then we will adjust the project to be more heavily focussed on the design and modelling aspects of the proposed research.