Additive Manufacturing of an Insect Bio-inspired Hair Acoustic Sensor

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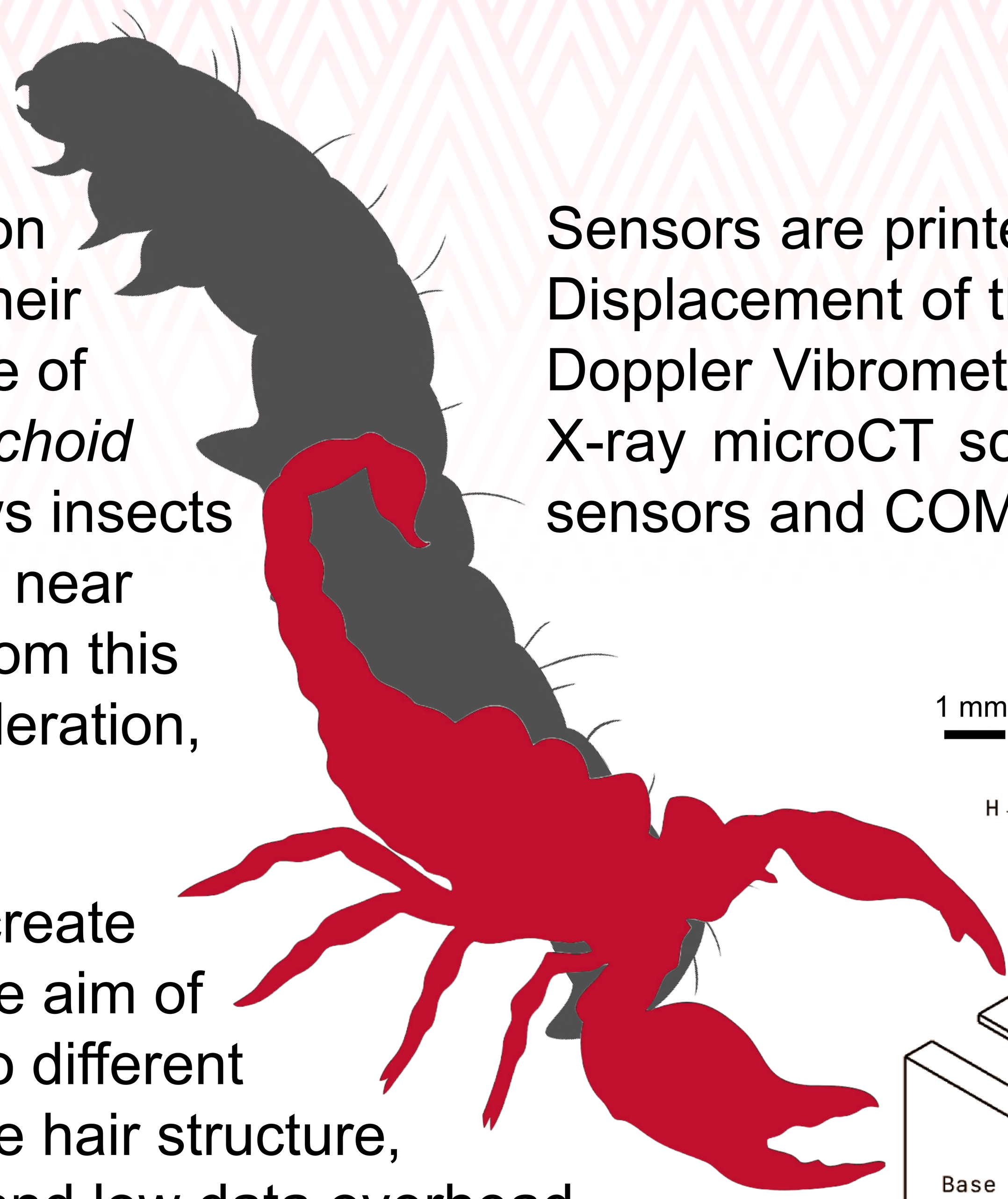


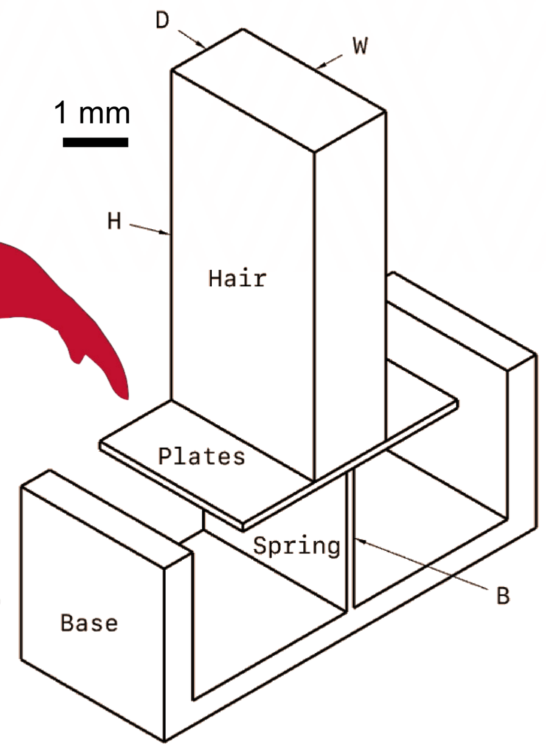
INTRODUCTION

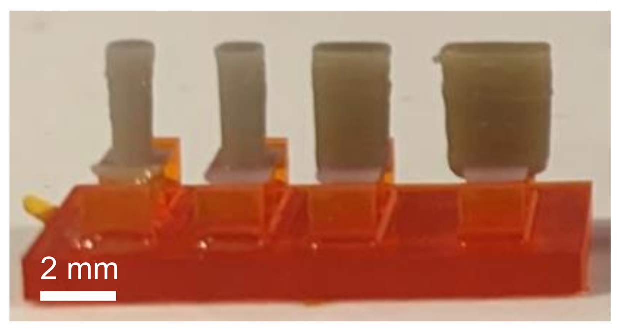
In the past century, thorough biological studies on insects allowed a better understanding of how their different acoustic sensory systems work [1]. One of these fascinating structures, the hair shaped *Trichoid Sensilla* (TS), also known as trichobothria, allows insects to sense and react to airflow and low frequency, near field sound [2]. Moreover, it is speculated that from this structure other sensing mechanisms (e.g., acceleration, temperature, etc.) are derived [3-5].

This poster describes the use of 3D printing to create a novel sensor inspired by the TS of insects. The aim of this work is to develop a sensor that responds to different frequency bands based on the dimensions of the hair structure, providing low power consumption, low latency, and low data overhead.

METHODOLOGY

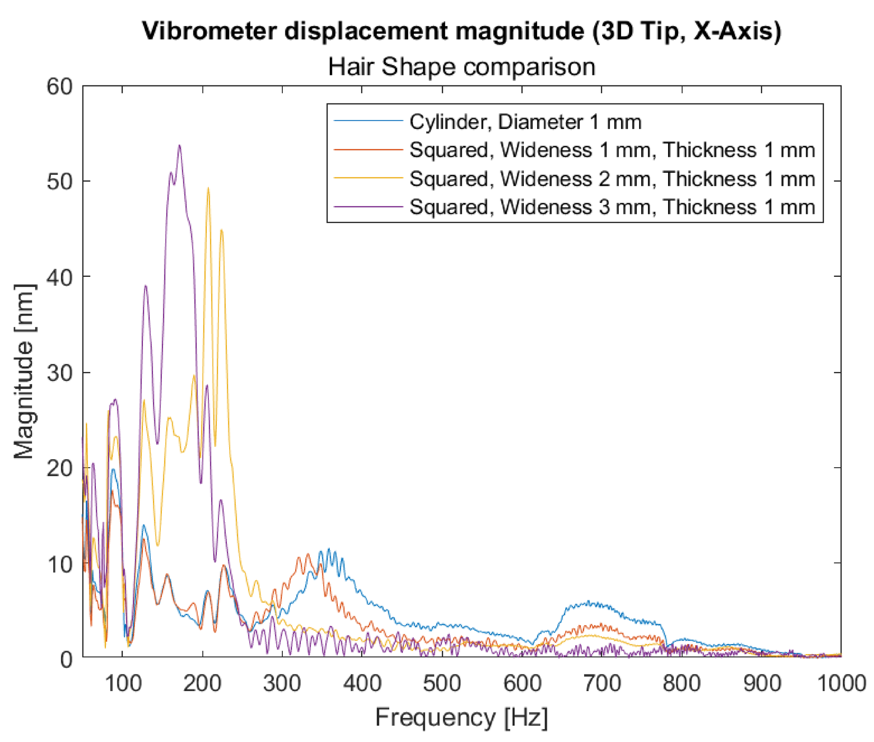
Sensors are printed with an Asiga MAX X27 3D printer. Displacement of the hair is measured using a 3D-Laser Doppler Vibrometer (Polytec MSA-100) and a speaker. X-ray microCT scan is used to investigate the printed sensors and COMSOL for computer simulation.

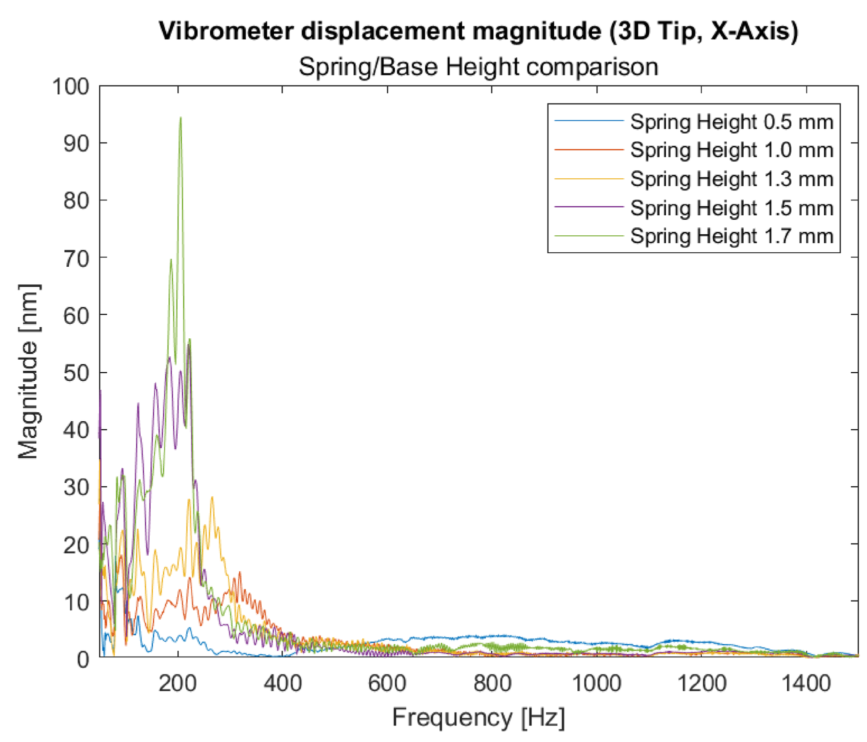


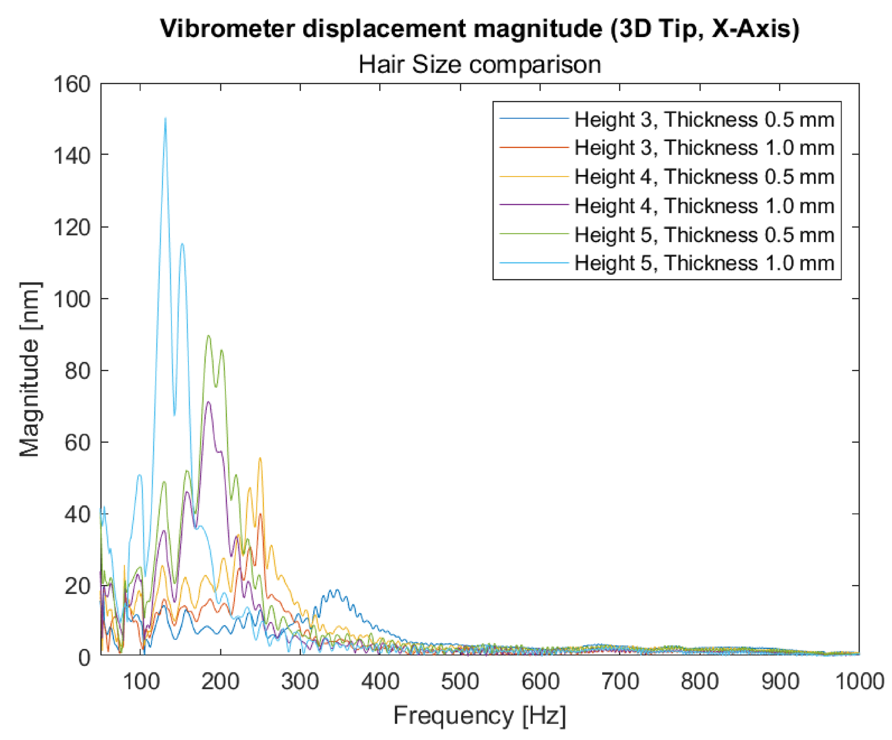


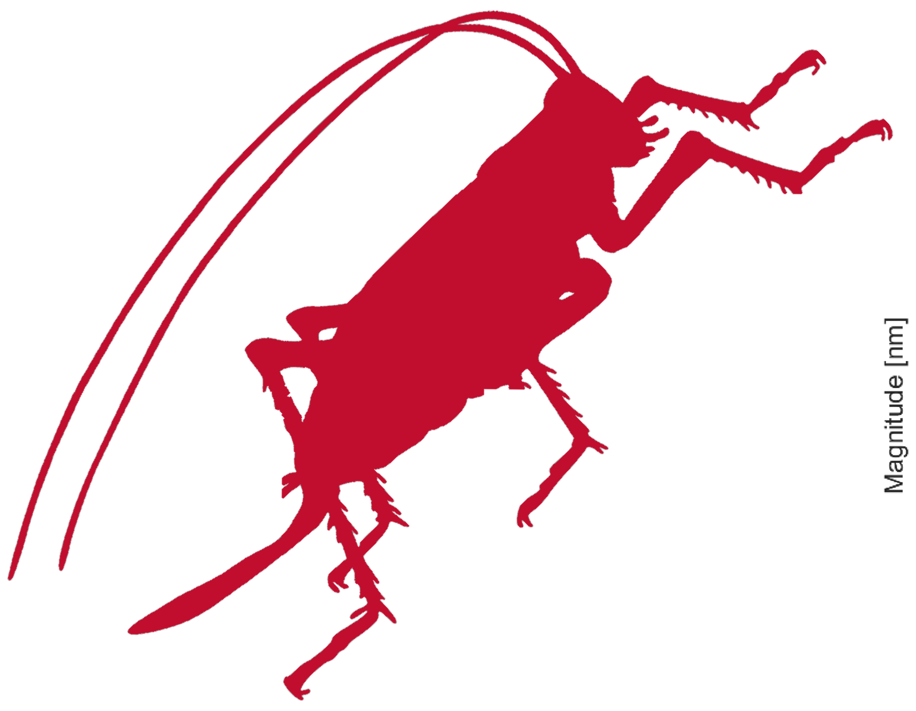
Sensors are named based on the sizes of the parameters in this diagram in millimetres (e.g., H4D1W3B1.7 is a sensor with a hair 4 mm tall, 1 mm thick and 3 mm wide, with a spring height of 1.7 mm).

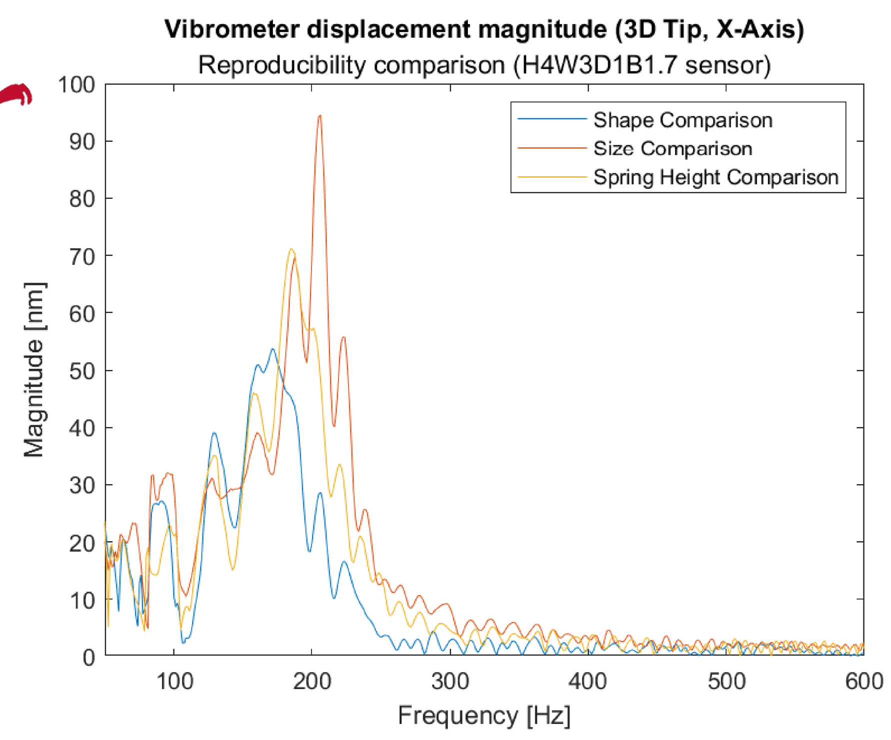
RESULTS

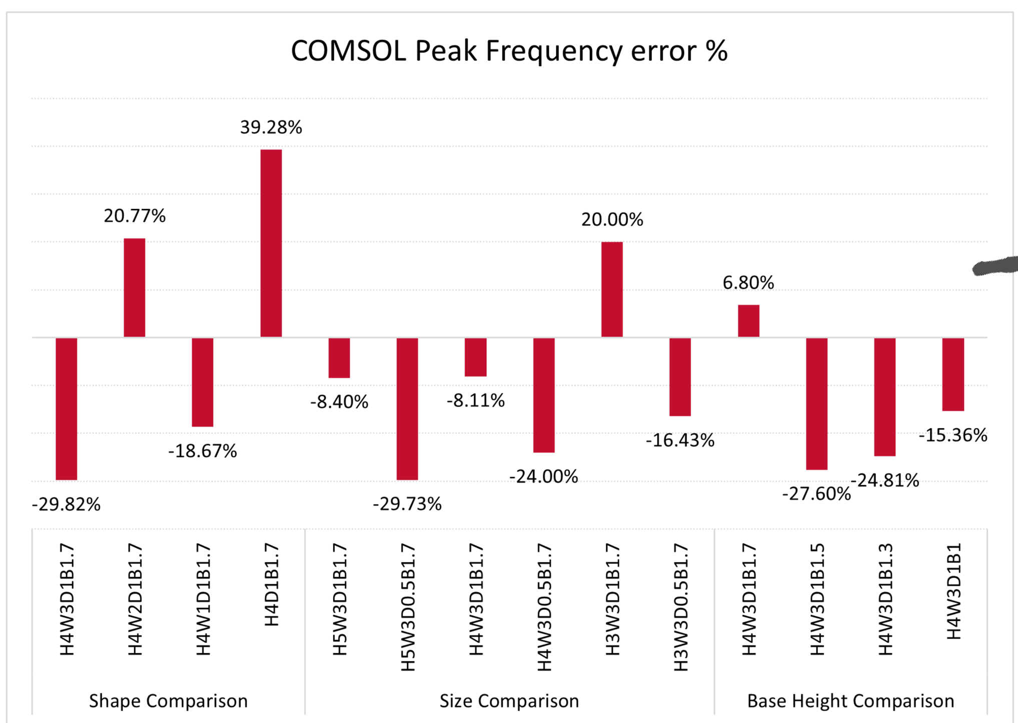












CONCLUSION

The results show that it is possible to create a structure that, based on geometrical differences, can react to different frequencies. In early experiments, an electric response was recorded but conditioning is required to properly use it and to verify the sensor's response.

Further work includes improvements in manufacturing, which can increase reproducibility, overall response and simulation prediction. As well as collecting a useful electrical output signal.

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