VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Huaijin Chen**

The public defense will take place on **Tuesday 26th August 2025 at 4 pm** in room **D.2.01** (Building D, VUB Main Campus)

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DEVELOPMENT OF ELECTRICAL IMPEDANCE TOMOGRAPHY ARTIFICIAL SKIN FOR WEARABLE ROBOTS

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Abstract of the PhD research

Rehabilitation devices, prosthetics, exoskeletons, and other wearable robots connect to the human body through physical interfaces such as cuffs and sockets to transfer support and power. Understanding how pressure is distributed between the user and these interfaces is essential to assess whether the interaction is appropriate and to prevent excessive pressure that could cause pain or injury.

To achieve this, this research utilizes Electrical Impedance Tomography (EIT), a non-invasive technique that measures variations in the electrical conductivity of materials. By fabricating a piezoresistive surface for the interface and measuring its conductivity changes with pressure using EIT, this research achieves spatially continuous imaging of the pressure distribution between the human body and the interface without blind spots. Furthermore, this research combines EIT with 3D printing to create customized interfaces that can inherently measure pressure, even for complex designs. Anisotropic EIT is employed to mitigate the effects of the anisotropic conductivity of 3D-printed components on imaging performance.

This research also addresses the limitations of EIT pressure sensors. Specifically, it designs a multimodal EIT sensor to measure complementary aspects of pressure information. Multimodal Artificial Intelligence (AI) is then used for information fusion and enhancement, which improves measurement accuracy, particularly for pressure magnitude. Another aspect is enabling the EIT sensor with self-healing capabilities, which enhances durability and long-term reliability. With a structural design, the self-healing EIT sensor can also effectively detect damage and is truly selective in identifying areas under pressure and those that are damaged.