

## **05/6401      Strain sensors inspired by campaniform sensilla**

**Type of activity: Medium Study (4 months, 25 KEUR)**

### **Background**

Insects are able to control their posture and movements using proprioceptive sensors. Biological sensitive mechanoreceptors are inherently small, light and embedded in insect bodies. In particular, campaniform sensilla are used by insects as natural strain sensors. They are able to sense strain deformations and cockroaches, for example, use them to determine both load and muscle forces.

Research on campaniform sensilla began around 1960s and preliminary electron microscope images showed that sensilla are connected to bipolar neurons. When the sensor is strained, a train of impulses is propagated to the central nerve system and insects can use these signals as feedback for their locomotion control.

### **Space Applications**

Embedded strain sensors are of interest for many space applications especially when slender structures are used (solar panels, booms, solar sails etc.) or structural frames must be monitored during hazardous mission phases such as during launch and landing. Strain sensors can also be used as force sensors especially when they are embedded in cantilevers. Therefore, they are suitable to be used in unlocking systems, docking mechanisms, limit switch devices, robotic arms, etc.

### **Study objectives**

This study is aimed at assessing the feasibility of a strain sensor inspired by campaniform sensilla of insects. After a careful review on campaniform sensillum natural sensors, the study should focus on the design of a new-engineered strain sensor which synthesizes the main characteristics of the natural sensor. During the study, the following tasks should be covered:

- Review of studies related to campaniform sensilla.
- Identification of campaniform sensillum elements which allow insects to sense strains and convert deformation signals to electrical signals.
- Investigate which technologies could be used to develop a bio-inspired strain sensor.
- Propose a design of a novel strain sensor which employs the functionalities of a campaniform sensillum to sense deformations.

### **References**

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