B4 ROBOSKIN[1] — Skin-based technologies and capabilities for safe, autonomous and interactive robots

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Tactile sensing is a strategic issue for achieving safe interaction between robots and humans or objects, especially when operating in unstructured environments. As a matter of fact, tactile sensing provides the most important and direct feedback to control contact phenomena both in case of voluntary and reactive interaction tasks. Advanced interaction tasks require complex forms of contact modelling well beyond classical literature examples. For instance, in case of whole hand grasping and manipulation or whole arm contact, the exact location and the main characteristics of the contact can not be predicted or easily modelled in advance.

These new issues must be faced using system-level solutions, both at control and perceptive levels. Novel sensory systems must be designed and developed to measure contact phenomena over large robot body parts, like the arms or the torso. Appropriate perceptive and cognitive strategies must be designed at the representation level and implemented as software data structures and algorithms that are based on the underlying sensing infrastructure. These must be used to ground the necessary information to operate on robot control modules in such a way to guarantee safe interaction with the environment.

The main objective of ROBOSKIN is to enforce robot capabilities efficiently and safely operating in unconstrained environments during tasks involving forms of human-robot interaction. To this aim, the project focuses on two key issues: 1) the study of sensing technologies and real-world methodologies for the development of distributed and modular components for building general-purpose large-scale robot skin; 2) the study of perception and control tasks required to develop tactile-based cognitive algorithms to enrich human-robot interaction processes. The objective of this talk is to present the main results achieved during the first year of the project.

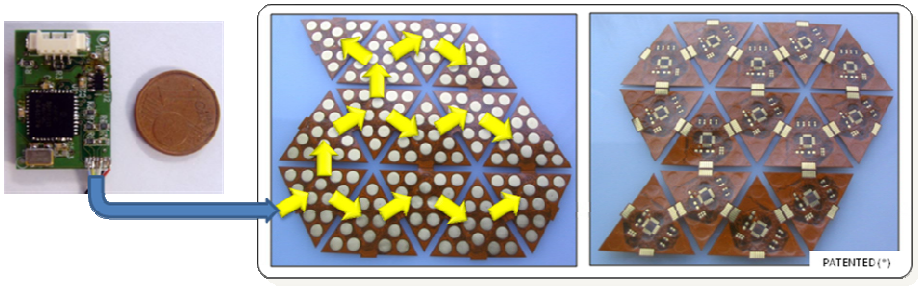
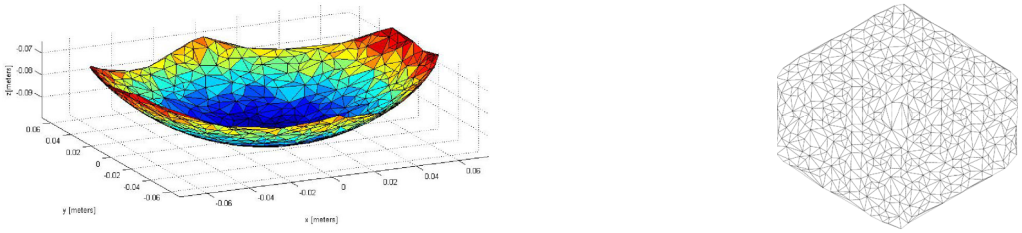


Figure 1 - The skin system. Triangular modules composed into networked patches.



a) b)

Figure 2 - Different steps for computing artificial somatosensory maps: a) a 3D representation of the skin, b) an equivalent cognitive 2D representation.

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