Title (tentative): Tactile sensorization of hand prosthesis: devices, characterization and functions

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Motivation and application domain
One of the challenges in hand prosthetics is closing the sensing/actuating loop bringing it under the control of the patient's brain. This would permit to an amputee to recover the proprioception of the limb. To do that a kind of artificial skin is needed, consisting in arrays of tactile sensors which provide and transmit information on contact events occurring in some parts of the prosthesis (fingers, palm, etc.).

General objectives and main activities
The general objective of the thesis is the assessment of a validation protocol of tactile sensor arrays, which are the main constituents of an artificial skin for hand prostheses. The task of such devices is essentially the reconstruction of the force distribution in the area of the skin which is touched by external objects. The group of prof. Valle (Cosmiclab DITEN) has a yearlong experience and international collaborations in the field and is working on piezoelectric polymer sensor arrays which have been already tested in application to a hand prosthesis at the University of Goettingen. At the moment a validation protocol of the devices is still lacking. The activity of the thesis focusing on this important issue, will include: 1. analysis of single sensor response to static and dynamic excitation by an indenter of given shape; 2. check on undesired cross talking effect between adjacent sensors and electric lines; 3. implementation of the validation procedure in a robotic equipment.

Training Objectives (technical/analytical tools, experimental methodologies)
1. Materials characterization, including measurements of piezoelectric moduli of PVDF sensors, elastic moduli of skin coating layers and substrates.
2. Sensor array validation by means of a 3-axes robot

Place(s) where the thesis work will be carried out: Cosmiclab (DITEN), Laboratory of Materials Engineering (DICCA)

Additional information
Maximum number of students: 1