**Lecturer.** Prof. Dr. Calogero Maria Oddo

*Head of the Neuro-Robotic Touch Laboratory
The BioRobotics Institute and Department of Excellence in Robotics & A.I., Sant'Anna School of Advanced Studies, Pisa, Italy*

<http://www.santannapisa.it/en/personale/calogero-maria-oddo>

<http://www.santannapisa.it/en/neuro-robotic-touch-laboratory>

**Title of the lecture.** Artificial touch: from science and technology for bionics towards applications to collaborative robotics in industry 4.0

**Abstract.** A neuro-robotic approach has been systematically pursued during a long-term research strand at The BioRobotics Institute of Scuola Superiore Sant’Anna in order to endow a generation of bionic hand prostheses with an artificial sense of touch. The ambition is the restoration of natural tactile sensation and perception in upper-limb amputees.

This lecture will introduce selected case-studies representing the milestones towards the targeted objective, requiring the exploration of an understanding-generation loop by means of a close integration between neuroscience and robotics.

This pathway was pursued through three main research actions: first, the development of tools enabling neuroscientific measurements and analyses on the human somatosensory system, such as mechatronic tactile stimulators suitable for electrophysiological recordings and for behavioral studies with psychophysical methods; second, the development of a biomimetic artificial touch technology that codes tactile information in a neuromorphic fashion, i.e. with sequences of spikes, and its integration in the distal phalanx of underactuated robotic hands, so to allow its experimental assessment under both passive-touch and active-touch motion control strategies and to evaluate neuroscientific hypotheses on the human somatosensory system; third, the porting of the developed artificial tactile sensing technology to the afferent pathways of the amputee.

This body of neuroscientific knowledge and artificial touch sensors converge in a key application domain in bionics limb prosthetics, rehabilitation and assistive robotics, while in parallel the developed artefacts are being translated as key enabling technologies for tele-presence in medical robotics and safe human-machine co-work with collaborative robots in Industry 4.0.