

1 PhD position available in Soft Exoskeleton for Upper Limb Assistance/Augmentation at Nanyang Technological University (NTU, Singapore)

Robotic exoskeletons have been developed for a large number of applications and now they represent the new frontiers in human augmentation and assistive devices. Such kind of technology is mainly devoted to assist in activities of daily living or rehabilitation for people who suffer from neurological impairments of spinal cord injuries. Exoskeletons have been extensively designed for walking assistance, with stationary solutions, mounted over treadmill in hospitals and used to provide gait and retraining or rehabilitation. All these solutions were mainly focused on lower limb, while for the upper limb assistance at present few effective devices have been developed. The reason can be found in the complexity of the actions that a human arm/hand must perform, starting from a simple movement of the shoulder which involves multiple degrees of freedom, to a series of complex manipulation of objects that are usually made by using the hands. That's why the technologies for upper limb rehabilitation are bulky systems, usually designed for mobilization of elbow and shoulder, and deployed in hospitals for constrained induced motion therapy.

The present project aims at designing a new concept of assistive devices based on soft materials. The use of the system will be mainly devoted to provide assistance to arm movement for elders or neurologically impaired subjects, lacking of capacity of motion and arm/hand dexterity. Assisting individuals, able-bodied or patients with partial impairments poses particular challenges, especially when using robotic devices or exoskeletons. To work toward these goals, we propose a new paradigm in assistive device design, which we call soft clothing-like Exosuits. These are devices that use textiles to interface with the body and apply joint torques via tensile forces over the outside of the body in parallel with the muscles, using the bone structure to support compressive loads.

The scope of the project is merging two main expertise in mechatronics and smart clothing design and to develop a new wearable exoskeleton for human assistance. Furthermore the exoskeleton (or Exosuit) will be powered by a novel generation of actuators based on tendon driven transmission which will be integrated in the textiles such as new sensing technology using carbon nanotubes to detect muscles activity and motion from the user.

The long goal is to create a portable wearable Exosuit that assists or augments people with disabilities and lack of muscular control, by providing assistance and reducing metabolic expenditure when carrying or manipulating a load during activities of daily living.

The candidate will be enrolled in a vibrant and multidisciplinary environment and she/he will be asked to join the team working on the project by providing inputs and improvements in the design and characterization of the device, for both the engineering counterpart and the research related to smart wearable textiles. More specifically we aim at designing a new kind of device made by intelligent garments which will embed wearable instrumentations such as conductive materials, electromyography and biosignal sensors in general, and will allow to have a product based on high tech solutions, simplicity and superior ergonomics compared on pre-existing works

Your profile: We are looking for excellent applicants with a Bachelor or Master degree in Mechanical Engineering, Robotics, Computer Science, Applied Mathematics, Materials Science or a related area of study, who are motivated to carry out internationally leading research.

Knowledge in one or more of the following topics is mandatory: robotics and mechatronics, control design, computer-aided design (CAD), computational structural mechanics, computational design, applied computing and applied artificial intelligence.

What we are offering: The PhD positions are fully funded with a competitive salary (tuition fee is covered by NTU). You will be part of a highly motivated, international team at one of the most competitive universities in Asia and in the world. Besides working in our growing, ambitious team you will also have the chance to collaborate with numerous faculty, other labs and industrial partners co-funding the project.

Intakes:

PhD starting date August 2017 or January 2018.

Application: Please contact at first Asst Prof Lorenzo MASIA for further info by email:
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