Mechatronic Systems Based on Smart Materials
Dielectric Elastomers & Shape Memory Alloys
Gianluca Rizzello
Intelligent Material Systems Lab, Saarland University, Germany

May, 15th 2019
Seminar Room, h. 14:00
Polo scientifico-tecnologico Fabio Ferrari – via Sommarive 9 - Trento

Abstract: In many fields of engineering, ranging from industry to bio-inspired systems, the need for electro-mechanical devices showing features such as lightweight, compactness, energy efficiency, and accurate controllability of position/force is becoming more and more prominent. In recent years, many design solutions based on smart materials have been proposed. These include, e.g., piezoelectric ceramics, shape memory alloys, and electro-active polymers, which have the ability to react to an external stimulus (e.g., electrical, magnetic, thermal) by modifying their mechanical characteristics. By properly exploiting the properties, a new generation of mechatronic devices can be developed, in order to complement or even improve the performance of current transduction technologies in a number of fields.

This presentation aims at providing an overview of smart materials in mechatronic applications, by focusing on two recent classes of transducers, i.e., Dielectric Elastomers (DEs) and thermal Shape Memory Alloys (SMAs). Both materials can be used to generate actuation stroke or force by means of a controllable stimulus (voltage and temperature, respectively). However, they also exhibit a complex nonlinear response, which makes their design, modeling, and control highly challenging. An overview of the main characteristics and challenges raised by each material will first be illustrated. Issues related to material system design, modeling, and control will be addressed, and several applications of smart material systems will be presented.

Biosketch: Gianluca Rizzello received the master’s (Hons.) degree in control engineering from the Polytechnic University of Bari, Bari, Italy, in 2012. He received his Ph.D. in Information and Communication Technologies from Scuola Interpolitecnica di Dottorato, a joint program between Polytechnic Universities of Torino, Bari, and Milano, Italy, in 2016. During his Ph.D. studies he has been a Visiting Research Scholar with the University of Saarland, Saarbrücken, Germany, where he is currently working as a post-doc researcher with the role of Group Leader Smart Material Modeling and Control. His research interests involve modeling, control, and self-sensing of innovative actuators based on smart materials, and control of high-speed electrical motors and generators for aerospace applications.

Info: Dott. Marco Fontana
0461 283722 marco.fontana@unitn.it