



UNIVERSITÀ DI PISA
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE
Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

“Electroactive polymer devices for biomedical and bioinspired mechatronic systems”

Dr Federico Carpi

Queen Mary University, London UK

Short Abstract: The course will first provide an overview on electroactive polymer actuators (EAP), describing key aspects of the different electroactive polymer actuation technologies. Then, the course will provide a detailed description of dielectric elastomer actuators, as the most performing EAP technology. Presented topics will include fundamentals, materials, devices and applications, as well as standards. The course will be closed with lab sessions, showing demos of prototype applications.

Course Contents in brief:

- Introduction to electroactive polymer actuators
- Overview on fundamentals, materials, devices and applications of the different electroactive polymer actuation technologies
- Dielectric elastomer actuators: fundamentals, materials, devices and applications
- Dielectric elastomer actuators: standards for material characterisation and device testing
- Demo 1: Finger-tip wearable tactile displays for virtual interactions with soft bodies (for master-slave tele-operation and/or surgical training).
- Demo 2: Artificial muscles for electrically stretchable membrane bioreactors for tissue engineering.
- Demo 3: Bioinspired electrically tuneable optical lens.
- Brainstorming of bioinspired designs

Total # of hours: 9 (2 credits)

References:

- [1] Galantini F, Carpi F and Gallone G (2013). Effects of plasticization of a soft silicone for dielectric elastomer actuation. *Smart Materials and Structures* vol. 22, (10)
- [2] Carpi F, Frediani G and Rossi DD (2012). Contractile hydrostatically coupled dielectric elastomer actuators. *Ieee/Asme Transactions On Mechatronics* vol. 17, (5) 987-994.
-

[3] Carpi F and De Rossi D (2012). Small-strain modeling of helical dielectric elastomer actuators. *Ieee/Asme Transactions On Mechatronics* vol. 17, (2) 318-325.

[4] Wang H, Cai S, Carpi F and Suo Z (2012). Computational model of hydrostatically coupled dielectric elastomer actuators. *Journal of Applied Mechanics, Transactions Asme* vol. 79, (3)

CV of the Teacher

Federico Carpi was born in Pisa in 1975. He received the Laurea degree in Electronic Engineering, the Ph.D. degree in Bioengineering and a second Laurea degree in Biomedical Engineering from the University of Pisa, Italy, in 2001, 2005 and 2008, respectively. From 2000 to 2012, he has been with the University of Pisa, Interdepartmental Research Centre "E. Piaggio", School of Engineering, Italy. Since 2012, he serves as a Reader in Biomedical Engineering and Biomaterials at Queen Mary University of London, School of Engineering and Materials Science.

Dr Carpi is the Programme Director of the MSc in Medical Electronics and Physics (www.sems.qmul.ac.uk/pgadmissions/programmes/medicalelectronicsandphysics) and he is a member of the Institute of Bioengineering at Queen Mary College (www.bioengineering.qmul.ac.uk).

He is the President of "EuroEAP - European Society for Electromechanically Active Polymer Transducers & Artificial Muscles" (www.euroeap.eu) and he coordinates the 'European Scientific Network for Artificial Muscles - ESNAM (www.esnam.eu)', focused on transducers and artificial muscles based on electroactive polymers.

He organizes the annual 'EuroEAP: International Conference on Electromechanically Active Polymer Artificial Muscles & Transducers' (www.euroeap.eu)

He is an Editorial Board member of four international journals, and member of the scientific committees of several conferences. His publications include some 60 articles in international journals, 2 edited books and several contributions to books and conferences

Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor* (please do the reservation yourself)

Schedule:

Day1 – Friday 10 April 2015, time 10.00 – 13:00

Day2 – Friday 17 April 2015, time 10:00 – 13:00

Day3 – Friday 24 April 2015, time 10:00 – 13:00