PERSONAL INFORMATION

Lucia Seminara

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Sex F | *Date of birth* 27/09/1974 | *Nationality* Italian

Enterprise	University	EPR
☐ Management Level	☐ Full professor	☐ Research Director and 1st level Technologist / First Researcher and 2nd level Technologist
☐ Mid-Management Level	☒ Associate Professor	☐ Level III Researcher and Technologist
☐ Employee / worker level	☐ Researcher and Technologist of IV, V, VI and VII level / Technical collaborator	☐ Researcher and Technologist of IV, V, VI and VII level / Technical collaborator

WORK EXPERIENCE

November 2022 – Present

Associate Professor

"Connected Objects, Smart Materials, Integrated Circuits - COSMIC Laboratory", DITEN, University of Genoa, Genova, Italy.

Topic: Haptic interfaces for human-in-the-loop applications. See below for main activities.

December 2019 – October 2022

Researcher (RTDB)

"Connected Objects, Smart Materials, Integrated Circuits - COSMIC Laboratory", DITEN, University of Genoa, Genova, Italy.

Ricercatore a tempo determinato ai sensi dell'art. 24 comma 3, della Legge 30.12.2010, n.240, lettera b

Topic: Design and development of electronic skin systems for robotic and biomedical applications (eg neurorehabilitation). See below for main activities.

December 2018 – November 2019

Researcher (RTDA)

"Connected Objects, Smart Materials, Integrated Circuits - COSMIC Laboratory", DITEN, University of Genoa, Genova, Italy.

Ricercatore a tempo determinato ai sensi dell'art. 24 comma 3, della Legge 30.12.2010, n.240, lettera a

Topic: Design and development of electronic skin systems for robotic and biomedical applications (eg neurorehabilitation). See below for main activities.

May 2009 – November 2018

Research fellow

"Connected Objects, Smart Materials, Integrated Circuits - COSMIC Laboratory", DITEN, University of Genoa, Genova, Italy.

Topic: Design and development of electronic skin systems for robotic and biomedical applications (eg neurorehabilitation).

Main activities:

- Modeling, FEM simulations and experimental characterization of piezoelectric tactile sensors
- Development of algorithms for the reconstruction of contact information
- Electronics for acquisition and processing of tactile data.
- e-skin system development: haptic interfaces for the artificial reconstruction of the sense of touch for robotic and biomedical applications.

April 2005 – April 2009

R&D employee (companies)

- Selex Communications, Genova, Italy.
- LAB33, Genova, Italy.

Topic: intelligent nanostructured gas sensors.

Main activities:

- Coordination of the activities of three PhD students (in nanotechnology and bioengineering)
- Principal investigator for the NSS (Nano Smart Sensors) project.

EDUCATION AND TRAINING

2018 **Habilitation to Associate Professorship in Electronic Engineering**

2004 **PhD in Physics**
Physics Institute, EPFL, Lausanne, Switzerland
Topic (thesis): Study of the microscopic processes induced by the deposition of silver nanostructures on graphite (HOPG) and Platinum.

1999 **Master's degree (110/110) in Physics**
Topic (thesis): Study of the magnetism of thin films by optical methods.

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

Other languages	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2
French	B2	B2	B2	B2	B2
Spanish	A2	A2	A2	A2	A2

Job-related skills

Research activity: My research focuses on developing electronic systems to artificially restore the sense of touch in different applications (robotics, biomedical applications eg prosthetics, virtual reality). My experience in tactile data processing using model-based approaches resulted in an original and patented method for the reconstruction of contact force distributions starting from e-skin sensor data. My main interests are now focused on how to enable intuitive and effective communication between the wearable haptic devices and humans for neurorehabilitation mainly. I am coordinating the multidisciplinary consortium TACTA, involving different italian universities (University of Genoa, Milan, Florence, Pisa, Siena, Rome, Salento) in collaboration with local institutions towards opening an innovative centre of excellence in Genoa for combined artistic-scientific research in Haptics and AI to develop novel advanced communication paradigms based on the sense of touch.

I set up the following main international collaborations:

- **Fraunhofer, Berlin, Germany**: Developing smart textiles for e-skin
- **Groups of Prof. Farina at Imperial College, London (UK) and Prof. Dosen at the Center for Sensory-Motor Interaction (SMI) of Aalborg University, Denmark**: The ultimate goal of this fruitful collaboration is to close the sensorimotor control loop in prosthetics, equipping smart prostheses with a robotic skin and processing tactile information for advanced human-robot interaction. Among other publications, this collaboration generated a journal paper that has been selected as one of the 3 best papers published in 2016 on IEEE Transactions on Haptics.
- **JOANNEUM Research Forschungesellschaft mbH, Graz, Austria:** Developing tactile sensors for e-skin applications.
- **Visual Space Perception Lab, Bangor University, Wales, UK:** Our main research question related to neurorehabilitation systems based on e-skin is: "Does the brain treat the stimulation derived from the artificial skin as if it originated from contact on the (missing) hand?"
- **Institute of Neurorehabilitation Systems at the University Medical Center Göttingen, Georg-August University, Germany:** We laid the foundations of restoring the sense of touch for biomedical and robotic applications.
- **All people involved in TACTA www.tacta.it**

- Strahinja Dosen, **Department of Health Science and Technology, Aalborg University**, Aalborg, Denmark
  Fulvio Mastrogiovanni, **Department of Informatics, Bioengineering, Robotics, and Systems Engineering, University of Genoa**, Italy
  Matteo Bianchi, **Research Center "E. Piaggio" and Department of Information Engineering, University of Pisa**, Italy
  Simon Watt, **School of Human and Behavioural Sciences, Bangor University,** United Kingdom
  Philipp Beckerle, **Department of Electrical Engineering and Department of Artificial Intelligence in Biomedical Engineering, Friedrich-Alexander Universität Erlangen-Nürnberg**, Germany
  Thrishantha Nanayakkara, **Dyson School of Design Engineering, Imperial College London**, United Kingdom
  Knut Drewing, **Department of Experimental Psychology, HapLab**, University of Giessen, Germany
  Alessandro Moscatelli, **Laboratory of Neuromotor Physiology, Fondazione Santa Lucia IRCCS**, Rome, Italy and **Department of Systems Medicine and Centre of Space Biomedicine, University of Rome Tor Vergata**, Rome, Italy
  Roberta L. Klatzky, **Department of Psychology and Human-Computer Interaction Institute, Carnegie Mellon University**, Pittsburgh, PA, United States of America
  Gerald E. Loeb, **Department of Biomedical Engineering, University of Southern California**, Los Angeles, CA, United States of America
  Collaboration oriented to write a paper now published on Science Robotics and entitled "A hierarchical sensorimotor control framework for human-in-the-loop robotic hands".

Editorial activity:

- **Member of the editorial board for the Special issue entitled** "Towards a transdisciplinary approach to the development and control of haptic devices for human-in-the-loop applications" for the journal IEEE Transactions on Haptics (2023)
- **Associate Editor:** IEEE International Conference on Intelligent Robots and Systems (IROS), IEEE International Conference on Artificial Intelligence Circuits and systems (AICAS), New Generation of Circuits And Systems (NGCAS)
- **Reviewer for different journals such as:** Robotics and Autonomous Systems, IEEE Robotics and Automation Letters, Advanced Robotics, Mechatronics, IEEE Sensors, Sensors and Actuators: A. Physical, Sensors (MDPI).

Organization of scientific meetings:

- **Organizing Committee Member**
  - 2022 6th International Conference on System-Integrated Intelligence. Intelligent, flexible and connected systems in products and production (SYSINT), September 07-09, 2022 in Genoa, Italy
  - 2020 5th International Conference on System-Integrated Intelligence (SYSINT), November 11-13, 2020 in Bremen, Germany
  - 2020 workshop THUMB (AcTive Haptic hUMans and Robots) at EuroHaptics 2020, September 6 – 9, Leiden, Netherlands
  - 2019 IEEE International Conference on Electronics Circuits and Systems (ICECS), November 27 - 29, 2019, Genoa, Italy
  - 2018 Electronic Skin Workshop 2018, February 20, 2018, Bangor University, UK
- **Chair**
  - Track: Human-Machine Interaction. SYSINT, September 07-09, 2022, Genoa, Italy
  - Special Session - Human-in-the-loop control of haptic devices: now and the future, SYSINT, September 07-09, 2022, Genoa, Italy
  - Best student paper competition, SYSINT, September 07-09, 2022, Genoa, Italy
  - Track: Tutorial - Biomedical technologies and applications / Virtual and augmented reality. ICECS, November 27 - 29, 2019, Genoa, Italy
  - Track: Tutorial - Human-Machine Interaction. ICECS, November 27 - 29, 2019, Genoa, Italy
  - Special Session - Sensors and Systems for the Restoration of the Sense of Touch in Prosthetics. NGCAS, September 6-9, 2017, Genoa, Italy
- **Reviewer (selected)**
  - Biomedical Circuits& Systems Conference (BIOCAS)
  - IEEE International Conference on Robotics and Automation (ICRA)
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

Participation to scientific meetings:

- **Workshop Keynote speech**
  - e-skin systems. 2018 Electronic Skin Day organized with Prof. Farina (Chair in Neurorehabilitation Engineering), February 14, 2018, Imperial College, London, UK
  - A system perspective on human and artificial tactile sensing. Electronic Skin Workshop 2018, February 20, 2018, Bangor University, UK
- **Invited speech**
  - L. Seminara " A hierarchical sensorimotor control framework for human-in-the loop robotic hands", INVITED LECTURER – INTUITIVE PhD School https://www.robotact.de/intuitive-springschool-2023 – Malta, 17-20 April, 2023
  - L. Seminara, "How I became a STEM scientist", INVITED LECTURE – IEEE Women in Engineering (WIE) International Leadership Summit, Genoa, Italy, December 2-3, 2021.
  - L. Seminara, "A system for electrotactile feedback using electronic skin and flexible matrix electrodes". Transactions on Haptics Featured Session. IEEE World Haptics 2017, Fürstenfeldbruck, Germany, June 6-9, 2017
  - L. Seminara, "Tactile data processing method for the reconstruction of contact force distributions". Special Session on "Recent advances in modeling skin mechanics and tactile afferent responses", IEEE World Haptics 2017, Fürstenfeldbruck, Germany, June 6-9, 2017
- **Speaker (selected)**
  - A new concept of haptic interface for the reconstruction of the sense of touch. WORKSHOP on INNOVATION IN REHABILITATION TECHNOLOGIES, Genoa, Italy, March 5, 2019
  - Sensitive electronic skin for prosthetics. Restoration of Sensory and Motor Function Symposium, Goettingen, Germany, May 26-27, 2016.
  - Piezoelectric polymer transducer arrays for flexible tactile sensors. IEEE Sensors 2012, Special Session on Bendable and Stretchable Sensors and Systems, 28-31 October 2012, Taipei, Taiwan
  - Bending response of PVDF piezoelectric sensors. IEEE Sensors 2012 Conference, Special Session on Bendable and Stretchable Sensors and Systems, 28-31 October 2012, Taipei, Taiwan
  - Design, fabrication and test of arrays of piezoelectric transducers for robotic tactile sensors - Workshop on Advances in tactile sensing and touch based human-robot interaction, 7th ACM IEEE International Conference on Human-Robot Interaction March 5-8, 2012 Boston, USA
  - Discrete solutions of inverse contact problems on large area robotic skin - Workshop on Advances in tactile sensing and touch based human-robot interaction, 7th ACM IEEE International Conference on Human-Robot Interaction March 5-8, 2012 Boston, USA
- **Participation to Summer Schools and Courses (selected)**
  - 2022 8th International Summer School of NeuroEngineering "Massimo Grattarola", "Artificial and augmented sensing for humans and humanoids", July, 18-22, Genova, Italy
  - 2020 PhD Course on "Spectral Analysis in Practice", PhD Course in Genova, Italy February 17-20 2020.
  - 2019 Summer School on Neurorehabilitation (SSNR 2019), September, 15-20, Baiona, Spain
  - 2014 Regularization Methods for Machine Learning (RegML) - ML PhD Summer Course in Genova, Italy 30 June - 4 July 2014.

Teaching activity:

- **Sensing Systems**
- **Integrated Electronics**

Master Degree: Electronic Engineering, University of Genoa, Genova, Italy

- **Electronics**

Bachelor Degree: Electronic Engineering, University of Genoa, Genova, Italy

Participation to research projects

- HORIZON EU, **IntelliMan (AI-Powered Manipulation System for Advanced Robotic Service, Manufacturing and Prosthetics**) - Call. HorizonEU-ICT-2022
- EU H2020 RIA, **Tactility (TACTIle feedback enriched virtual interaction through virtual reality and beyond)**, Call. H2020-ICT-2018
- Principal Investigator: **Innovative ICT system to restore the sense of touch in patients with sensory deficit.** Project funded by Compagnia San Paolo, grant no.: 2017.0559, ID ROL: 19795 (https://compagniadisanpaolo.it/)
- **Roboskin: Skin-based Technologies and Capabilities for Safe, Autonomous and Interactive Robots**, call for proposals 7th Framework Programme for Theme 3 - Information and Communication Technologies, FP7-ICT-2007-3-2-2 – Cognitive Systems, Interaction, Robotics. Project ID: 231500.

PhD committees:

- Teaching Board of the Ph.D. program of national interest in Robotics and Intelligent Machines (PhDRIM)
- Teaching Board of the JOINT DOCTORATE IN INTERACTIVE AND COGNITIVE ENVIRONMENTS (JD ICE) - University of Genova / Queen Mary University, London
- Teaching Board of the PhD program in Science and Technology for Electronic and Telecommunication Engineering at the University of Genova

Scientific awards

- Best Paper Award - A system for electrotactile feedback using electronic skin and flexible matrix electrodes: Experimental evaluation, one of the three best papers published in 2016 on IEEE Transactions on Haptics
- Best Oral presentation - Sensitive electronic skin for prosthetics, presented at the 48th Annual Meeting of the Associazione Gruppo Italiano di Elettronica (GE), Brescia, Italy, June 22-24, 2016

Patents

- 001429044, Approved: 30/06/2017, Title: “Metodo per la ricostruzione della distribuzione delle forze di contatto agenti sulla superficie di uno strato elastico sensorizzato". Inventors: L. Seminara, M. Capurro.

Digital skills

- Microsoft operating systems: Windows 10, 7, XP…
- Web browsers: Google Chrome, Mozilla Firefox, etc.
- Image editing software: Photoshop, Paint, GIMP
- Microsoft Office, WinEdt
- Programming languages: Matlab, Labview
- Numerical analysis: Maple
- Multiphysics simulations: ANSYS, Comsol Multiphysics

ADDITIONAL INFORMATION

Selected journal Publications

L. Seminara, Dosen, S., Mastrogiovanni, F., Bianchi, M., Watt, S., Beckerle, P., ... & Loeb, G. E. (2023). A hierarchical sensorimotor control framework for human-in-the-loop robotic hands. Science Robotics, 8(78), eadd5434.

Yahya Abbass, Strahinja Dosen, **Lucia Seminara**, and Maurizio Valle. “Full-hand electrotactile feedback using electronic skin and matrix electrodes for high-bandwidth human-machine interfacing”. In: Phil. Trans. R. Soc. A. 380.2228 (2022), http://doi.org/10.1098/rsta.2021.0017

Sara Nataletti, Fabrizio Leo, **Lucia Seminara**, Carlo Trompetto, Maurizio Valle, Strahinja Dosen, and Luca Brayda. “Temporal asynchrony but not total energy nor duration improves the judgment of numerosity in electrotactile stimulation”. In: Frontiers in bioengineering and biotechnology (2020), p. 555.

Hoda Fares, Yahya Abbass, Maurizio Valle, and **Lucia Seminara**. “Validation of screen-printed electronic skin based on piezoelectric polymer sensors”. In: Sensors 20.4 (2020), p. 1160.

Lucia Seminara, Hoda Fares, Marta Franceschi, Maurizio Valle, Matija Štrbac, Dario Farina, and Strahinja Dosen. “Dual-parameter modulation improves stimulus localization in multichannel electrotactile stimulation”. In: IEEE Transactions on Haptics 13.2 (2019), pp. 393–403.

Lucia Seminara, Paolo Gastaldo, Simon J Watt, Kenneth F Valyear, Fernando Zuher, and Fulvio Mastrogiovanni. “Active haptic perception in robots: a review”. In: Frontiers in neurorobotics (2019), p. 53.

M. Osta, A. Ibrahim, **Lucia Seminara**, H. Chible, M. Valle, “Low Power Approximate Multipliers for Energy Efficient Data Processing”. Journal of Low Power Electronics 14 (2018), p. 110-117

Lucia Seminara. “Modeling electronic skin response to normal distributed force”. In: Sensors 18.2 (2018), p. 459.

Marta Franceschi, **Lucia Seminara**, Strahinja Dosen, Matija Strbac, Maurizio Valle, and Dario Farina. “A system for electrotactile feedback using electronic skin and flexible matrix electrodes: experimental evaluation”. In: IEEE transactions on haptics 10.2 (2016), pp. 162–172.

A. Spanu, L. Pinna, F. Viola, **Lucia Seminara**, M. Valle, A. Bonfiglio, P. Cosseddu, “A high-sensitivity tactile sensor based on piezoelectric polymer PVDF coupled to an ultra-low voltage organic transistor”. In: Organic Electronics 36 (2016), p. 57-60. doi:10.1016/j.orgel.2016.05.034

Lucia Seminara, Luigi Pinna, Ali Ibrahim, Luca Noli, Stefano Caviglia, Paolo Gastaldo, and Maurizio Valle. “Towards integrating intelligence in electronic skin”. In: Mechatronics 34 (2016), pp. 84–94.

Lucia Seminara, Marco Capurro, and Maurizio Valle. “Tactile data processing method for the reconstruction of contact force distributions”. In: Mechatronics 27 (2015), pp. 28–37.

Paolo Gastaldo, Luigi Pinna, **Lucia Seminara**, Maurizio Valle, and Rodolfo Zunino. “A tensor-based approach to touch modality classification by using machine learning”. In: Robotics and Autonomous Systems 63 (2015), pp. 268–278.

Paolo Gastaldo, Luigi Pinna, **Lucia Seminara**, Maurizio Valle, and Rodolfo Zunino. “Computational intelligence techniques for tactile sensing systems”. In: Sensors 14.6 (2014), pp. 10952–10976.

Paolo Gastaldo, Luigi Pinna, **Lucia Seminara**, Maurizio Valle, and Rodolfo Zunino. “A tensor-based pattern-recognition framework for the interpretation of touch modality in artificial skin systems”. In: IEEE Sensors Journal 14.7 (2014), pp. 2216–2225.

Lucia Seminara, Luigi Pinna, Maurizio Valle, Laura Basiricò, Alberto Loi, Piero Cosseddu, Annalisa Bonfiglio, Alberto Ascia, Maurizio Biso, Alberto Ansaldo, et al. “Piezoelectric polymer transducer arrays for flexible tactile sensors”. In: IEEE Sensors Journal 13.10 (2013), pp. 4022–4029.

Lucia Seminara, Marco Capurro, Paolo Cirillo, Giorgio Cannata, and Maurizio Valle. “Electromechanical characterization of piezoelectric PVDF polymer films for tactile sensors in robotics applications”. In: Sensors and Actuators A: Physical 169.1 (2011), pp. 49–58.

Genoa, May 30, 2023