

Matteo Bianchi, Eng PhD

CONTACT INFORMATION

“Research Center E. Piaggio” – Department of Information Engineering
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RESEARCH INTERESTS

My research focuses on developing and controlling haptic and tactile devices and sensing systems for human and robotic hands. My starting point is the study of the neuroscientific and perceptual aspects of human behavior, their mathematical modelling and finally hardware and software implementation. My main research topics are:

Haptic interface design, control and validation with applications in virtual reality, robotics/medical robotics (robot-assisted minimally invasive surgery and prosthetics) and assistive/affective human-robot interaction

Human and robotic hands: optimal sensing and control

Human-inspired control for (soft) robots

Grasping and manipulation analysis

SUMMARY OF RESEARCH CONTRIBUTIONS AND ACADEMIC ACHIEVEMENTS

My research mostly deals with **human-robot interfaces**. More specifically, it focuses on: (i) **haptic interface** design, realization, control and psychophysical validation, with applications to robotics and robot-assisted minimally invasive surgery (RMIS), rehabilitation and prosthetics; (ii) control and optimal sensing of **robotic and human hands**. The leading idea of my research is that **neuroscience and robotics can be profitably integrated**, with the twofold goal of increasing the comprehension of the functional and neuroanatomical organization of the human system and to derive the guidelines for a more effective development of robotic and haptic devices. For these reasons, my inspiration is multidisciplinary and I have always proactively stimulated and fruitfully developed collaborations with other research groups across the boundaries between different disciplines.

Regarding haptic interfaces, I have studied and modelled the neuroscientific principles underlying the psychophysics of **touch**, with the goal of finding suitable **mathematical reductions** able to provide a good trade-off between effectiveness and design simplicity of **artificial systems**. Among the others, I have developed and validated tactile sensors, tactile displays for softness rendering in tele-operation and RMIS, and wearable haptic systems for feedback in prosthetics. These displays were also used to increase the knowledge on human brain and to investigate human perceptual mechanism. Regarding point (ii), I have analyzed the problem of **hand posture estimation** from scarce and noisy measures provided by low-cost hand pose sensing devices. By using the information about how humans most frequently use their hands and coorganization schemes on hand joint angles, system performance is enhanced and optimal system design enabled. These ideas have been published in a series of papers on the most prestigious robotics journal, and have produced interesting applications. They have also been awarded IP protection, and possible spin-off products in low-cost, mass products for entertainment are envisaged. I have also pushed forward the analysis of human hand postures and biomechanics to investigate neural correlates for **human sensory-motor control, with applications to minimal sensing of soft robotic hands, reflex grasp primitives for robots, control of soft robots**.

I had the opportunity to develop my research during my PhD at the **University of Pisa**, with some important **international experiences** abroad as visiting student at the Laboratory for Computational Sensing and Robotics (LCSR) of the **Johns Hopkins University (JHU)**, under the supervision of Prof. Allison M. Okamura (now at Stanford University) and at **Arizona State University (ASU)** with Prof. Marco Santello.

Currently, I have the chance to profitably continue my research activities at the **University of Pisa - Research Center “E. Piaggio”, School of Engineering**, where I am working

as **Assistant Professor (RTD-A, SSD: ING/INF-04)**. In Pisa I am the **unit principal investigator of the EU-funded project SOFTPRO** and **leader of the WPs on fundamentals of synergy-based motor control and human-robot interfaces** for prosthetics and robotic rehabilitation of upper limb. Furthermore I have led and actually lead **research activities in the following EU funded projects**: THE (WPs on: technical integration (WP-LEADER); brain circuitry in hand use; psychophysics of the hand; modelling the manipulating hand; haptic interfaces), WEARHAP (WPs on: computational models of human touch; multisensory tracking and sensing; wearable and distributed multi-DoF haptic systems; wearable haptics for human robot interaction and cooperation); SOMA (WPs on: human grasping and manipulation; hand design; grasp and manipulation planning) and PACMAN (WP on: active haptic and visual information gathering under uncertainty). I also have a visiting scholar position at **ASU** and a **research appointment at Mayo Clinic (Rochester, US-MN)**. Beyond these experiences in **international project management**, I am also the **coordinator** of the open-source project **HandCorpus** (<http://www.handcorpus.org>) on open-access data sharing on human and robotic hands, and I have an active role within the **technical committee on Robotic Hands, Grasping and Manipulation**, e.g. as one of the organizers of the Workshop on Grasping and Manipulation Datasets at **ICRA 2016**. I have also international experience as **research project evaluator** in Europe.

My research findings have been published in prestigious **international journals** (such as International Journal of Robotics Research - IJRR, Nature Scientific Reports, Transactions on Haptics - TOH, Current Biology, Physics of Life Reviews, Transactions on Human Machine Systems) and **conferences** (such as IEEE/RSJ International Conference on Intelligent Robots and Systems - IROS, IEEE International Conference on Robotics and Automation - ICRA, IEEE WorldHaptics) and received **international awards**, such as the JCTF novel technology paper award at the IEEE/RSJ IROS Conference, the Best Paper Award at IEEE Haptics Symposium and at the Eurohaptics Conference, Best Oral Presentation Award at Automatica.it and as finalist for the Georges Giralt PhD award by EURON for the best European PhD thesis in Robotics. Furthermore, I have been **invited** to present my research outcomes in prestigious conference workshops and international schools worldwide and to publish a review article on haptic devices for the **Wiley Encyclopedia of Electrical and Electronics Engineering**. I also have a wide professional service experience, serving as **scientific program committee member and associate editor** for international conferences and journals (such as Robotics and Automation Letters, International Journal of Advanced Robotics, Frontiers, Robotics: Science and Systems Conference - RSS, IEEE International Conference on Rehabilitation Robotics - ICORR, IEEE International Conference on Biomedical Robotics and Biomechanics - BIOROB, International Congress on Ultra Modern Telecommunications and Control Systems, among the others). I also serve as **reviewer** for international journals (including IJRR, TOH, which awarded me with **the 2015 Meritorious Service Award** as reviewer, IEEE Transactions on Mechatronics - TMECH) and conferences. I am also the **Editor** of a book published by Springer series on Touch and Haptic Systems, which deals with the mutual inspiration between neuroscience and robotics to understand and model human and robotic hands, with special focus on technical implementation.

I also have good capabilities in **team building and leading**, having matured at the University of Pisa, since 2009, an extensive experience in supervising students (more than 30) in robotics projects and advising Phd (4), Master's thesis (15) and Bachelor's thesis (3) students in Automation and Robotics, Mechanical and Biomedical Engineering. These students are continuing their academic studies and/or are now involved in the research activities of Research Center "E. Piaggio" (as PhD students and research collaborators) or work as project managers and consultants with companies. Finally, beyond my research activities, I have been fortunate to obtain (since 2009) a wide range of **teaching experiences** at the School of Engineering of the University of Pisa as teaching assistant in courses of robotics, automatic controls and bioengineering, for students in Mechanical, Robotics and Biomedical Engineering, and now as a professor of System Theory and Automatic Control for BS students in Energy Engineering at the University of Pisa.

EDUCATION

University of Pisa, Pisa, Italy

PhD in Automatics, Robotics and Bio-Engineering with "International Doctorate" qualification, June 2012

- PhD dissertation: *On the Role of Haptic Synergies in Modelling the Sense of Touch and in Designing Artificial Haptic Systems*
- Advisers: Prof. Antonio Bicchi, Prof. Enzo P. Scilingo
- Area of study: haptics, robotics, bio-engineering, control engineering

National professional qualification as Engineer (Information Engineering), 2007

MS in Biomedical Engineering, July 2007

- *Magna cum laude*
- Electronic specialization (emphasis on biomedical electronics)
- Thesis topic: *Characterization of NO₂ Gas Sensors for Lab On Chip Systems*

BS in Biomedical Engineering, October 2004

- *Magna cum laude*
- Thesis topic: *Image Processing for Electrophoresis Gel Applications*

ACADEMIC
APPOINTMENTS

Assistant Professor (RTD-A - SSD: ING-INF/04) September 2016 – present
Department of Information Engineering, School of Engineering, University of Pisa
Research activity: Robotics, Haptics, Human-Robot Interaction.

Post-doctoral researcher January 2013 – September 2016
Advanced Robotics Department (ADVR), Italian Institute of Technology (IIT)
Research activity: computational and experimental models of tactile interaction and sensorimotor apparatus of the human hand, to develop haptic systems and sensing schemes for artificial and human hands. The final goal is to define sensing primitives for the realization of haptic interfaces and sensor nets. This activity is supported by the European Research Council under the ERC Advanced Grant no. 291166 “Soft-Hands (A Theory of Soft Synergies for a New Generation of Artificial Hands)”.

Research Affiliate Appointment February 2014 – under renewal
Mayo Clinic – Rochester, US - MN,
Research activity: within private funding grant (2014-2016): on the usage, testing and re-design of the Pisa/IIT SoftHand for prosthetic applications, and within NIH (National Institutes of Health) US grant: 1R21HD081938-01 Soft Synergy-Based Artificial Hand for Prosthetic Applications (2014- 2016), to develop and test novel prosthetic solutions for upper-limb amputees, including patient testing and haptic feedback.

Research Collaborator January 2013 – present
Research Center “E. Piaggio”, School of Engineering, University of Pisa
Research activity: analysis of human tactile perception and object manipulation to develop haptic interfaces for HRI and sense robotic hands within the European Commission Collaborative Projects: “WEARable HAPtics for Humans and Robots”, “PaCMan: Probabilistic and Compositional Representations of Objects for Robotic Manipulation”, “SOMA: Soft Manipulation” and “SoftPro: Synergy-based Open-source Foundations and Technologies for Prosthetics and Rehabilitation”.

PAST ACADEMIC
APPOINTMENTS

Advisory Board and Main Research Collaborator March 2014 – July 2015
Rehab Technologies Department, Italian Institute of Technology (IIT)
Research activity: advisory board and leader of the workpackage on human-machine interfaces for the development of a prosthetic hand within the project Project PPR1A, joint venture between Italian Institute of Technology (IIT) and INAIL (Istituto Nazionale per l’Assicurazione contro gli Infortuni sul Lavoro e le Malattie Professionali) - Italian Insurance and Rehabilitation Institute

Post-doctoral researcher June 2012 – January 2013
Research Center “E. Piaggio”, School of Engineering, University of Pisa
Research activity: investigation of human tactile interaction and manipulation to develop synergy-inspired robotic hands and artificial systems. This activity was supported by the European Commission Collaborative Project no. 248587, “THE Hand Embodied”, within the FP7-ICT-2009-4-2-1 program “Cognitive Systems and Robotics”.

Research collaboration

November 2007 – December 2008

Research Center “E. Piaggio”, School of Engineering, University of Pisa

Research activity: rendering softness, cutaneous and kinaesthetic cues in real and artificial touch. This activity was supported by the European Commission integrated Project “IMMERSENCE”, contract number: IST-2006-027141, Call FP6-2004-IST-4 FET (Presence II).

Supervisor: Prof. Antonio Bicchi.

AWARDS AND HONORS

2017: IEEE RAS Worldhaptics: Best Paper Award Finalist

Tactile Slip and Hand Displacement: Bending Hand Motion with Tactile Illusions

2017: IEEE RAS Worldhaptics: Best Student Paper and Best Paper Award Finalist

The Rice Haptic Rocker: skin stretch haptic feedback with the Pisa/IIT SoftHand

2016: IEEE-RAS Haptics Symposium: Best Paper Award

A wearable fabric-based display for haptic multi-cue delivery

2015: Meritorious Service Award for the work as a Reviewer for the IEEE Transactions on Haptics

2015: Automatica.it (Italian Conference of Researchers in Automation): Best Oral Presentation

From Natural to Artificial and Back Again: Human-oriented Approaches and Interfaces for Assistive and Rehabilitation Robotics

2015: International Conference on Computer-Aided Engineering: Best Poster Award

Finite Element Model of Human Fingertip

2014: Eurohaptics Conference: Best Paper Award (Category: Poster Presentation)

A change in the fingertip contact area induces an illusory displacement of the finger

2013: Georges Giralt PhD Award by EURON (European robotics research forum) for the best European PhD thesis in Robotics: Top 9 theses

On the Role of Haptic Synergies in Modelling the Sense of Touch and in Designing Artificial Haptic Systems

2013: Automatica.it (Italian Conference of Researchers in Automation): Best Oral Presentation Finalist

On the Role of Haptic Synergies in Modelling the Sense of Touch and in Designing Artificial Haptic and Robotic Systems

2012: IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS): JTCF Novel Technology Paper Award for Amusement Culture

Synergy-based Optimal Design of Hand Pose Sensing

2012: Automatica.it (Italian Conference of Researchers in Automation): Best Interactive Presentation Finalist

Synergy-Based Hand Pose Sensing

2010: IEEE Symposium on Haptic Interfaces for Virtual Environments and Teleoperator Systems: Best Student Paper and Best Paper Award Finalist

A new fabric-based softness display

2009: Shape Memory Award by SAES Getters - Italy

Project: *Shape Memory Alloys for hand rehabilitation (SMhAnd)*

SAES Getters Italia, SAES Group: Viale Italia 77, 20020 Lainate – Milano, Italy

GRANTS AND PARTICIPATION TO RESEARCH PROJECTS

On-going projects

- Research Center “E. Piaggio” – School of Engineering – University of Pisa

- **“SoftPro: Synergy-based Open-source Foundations and Technologies for Prosthetics and RehabilitatiOn”**, European Commission Collaborative Project no. 688857, within the Horizon 2020 Framework program
 - Role: Local Scientific Coordinator of University of Pisa (principal investigator); leader of work packages* on “Fundamentals of synergy-based motor control” and “Interfaces from artificial to natural”; co-writer of the project proposal
 - Budget (Responsible of): 1101565.93 Euros*
 - Duration: 2016 - 2020*
 - Starting Date: March 2016*
 - **“SOMA: Soft Manipulation”**, European Commission Collaborative Project no. 645599, within the Horizon 2020 Framework program
 - Role: co-writer of the project proposal and main research collaborator for the work packages: human grasping and manipulation and hand design*
 - Duration: 2015 - 2019*
 - **“WEARable HAPtics for Humans and Robots”**, European Commission Collaborative Project no. 601165, within the FP7-ICT-2011-9 program “Cognitive Systems and Robotics”
 - Role: co-writer of the project proposal and main research collaborator for the work packages: computational models of human touch; multisensory tracking and sensing; wearable and distributed multi-degree of freedom haptic systems; wearable haptics for human robot interaction and cooperation*
 - Duration: 2013 - 2017*
 - **“PaCMan: Probabilistic and Compositional Representations of Objects for Robotic Manipulation”**, European Commission Collaborative Project no. 600918, within the FP7-ICT-2011-9 program “Cognitive Systems and Robotics”
 - Role: main research collaborator*
 - Duration: 2013 - 2016*
 - Advanced Robotics Department (ADVR), Italian Institute of Technology (IIT):
 - **European Research Council Advanced Grant no. 291166 “Soft-Hands (A Theory of Soft Synergies for a New Generation of Artificial Hands)”**
 - Role: main research collaborator*
 - Duration: 2012 - 2017*
- Past projects**
- **“THE Hand Embodied”**, European Commission Collaborative Project no. 248587, within the FP7-ICT-2009-4-2-1 program “Cognitive Systems and Robotics”
 - Role: main research collaborator and scientific leader of the Project Technical Integration (Work Package 9)*
 - Duration: 2010 - 2014*
 - Ended: July 2014*
 - **“IMMERSENCE”**, contract number: IST-2006-027141, Call FP6-2004-IST-4 FET – Presence II (Research Center “E. Piaggio”, School of Engineering, University of Pisa) - Ended : 2008.
 - Rehab Technologies Department, Italian Institute of Technology (IIT):
 - **Project PPR1A, joint venture between Italian Institute of Technology (IIT) and INAIL (Istituto Nazionale per l’Assicurazione contro gli Infortuni sul Lavoro e le Malattie Professionali) - Italian Insurance and Rehabilitation Institute**
 - Title of the project: development of a prosthesis for the upper limb (prosthetic hand and wrist)*

Role: advisory board member. Leader of the haptic interface area and co-leader of human - robot interaction and electronic control area
Duration: 2014 - 2017

RESEARCH
EVALUATIONS

2016. Expert Evaluator. Agence Nationale de la Recherche, France
2016. Expert Evaluator. Estonian Research Council (ETAg), Estonia

INTERNATIONAL
EXPERIENCE

Research Appointment

April 2015

Mayo Clinic, Rochester (MN, USA)

Research activity: technical support and clinical trials for the evaluation of a novel prototype of hand prosthesis

Visiting scholar

March 2014

School of Biological and Health Systems Engineering (sbhse), Arizona State University (ASU)

Research activity: Workshop on Rehabilitation Robotics. Research planning and experiments with ASU faculty members (Prof. Marco Santello) and MayoClinic (Rochester, USA) members for the usage of the Pisa/IIT robotic SoftHand for prosthetic applications. Responsible of the haptic feedback system and the safety evaluation of the device.

Visiting student

January 2011 – June 2011

Laboratory for Computational Sensing and Robotics (LCSR), The Johns Hopkins University

Research activity: characterization and design of an air-jet lump display for Robot-assisted Minimally Invasive Surgery (RMIS)

Supervisor: Prof. Allison M. Okamura

Visiting student

March 2009

School of Biological and Health Systems Engineering (sbhse), Arizona State University (ASU)

Research activity: analysis of anticipatory modulation of digit forces and position with Virtual Reality Environment (VRE) applications.

Supervisor: Prof. Marco Santello

EDITORIAL
ACTIVITY

Editor

Springer series on Touch and Haptic Systems

Human and Robot Hands - Sensorimotor Synergies to Bridge the Gap Between Neuroscience and Robotics

DOI: 10.1007/978-3-319-26706-7

Editorial Board

Associate Editor for Robotics and Automation Letters

International Journal of Advanced Robotic Systems – *Topic:* Medical Robotics;

Review Editor in Bionics and Biomimetics, part of the Frontiers in Bioengineering and Biotechnology and Robotics and AI– *Topic:* Human-Robot Interaction

Guest Editor in Bionics and Biomimetics, part of the Frontiers in Bioengineering and Biotechnology and Robotics and AI– *Topic:* Mapping Human Sensory-Motor Skills for Manipulation onto the Design and Control of Robots

REVIEWER ACTIVITY

International Journals

- IEEE Transactions on Robotics
- IEEE Transactions on Haptics
- International Journal of Robotics Research
- IEEE Robotics and Automation Magazine
- Robotics and Autonomous Systems

- IEEE Transactions on Biomedical Engineering
- PLOS ONE
- IEEE Transactions on Mechatronics
- Journal of Biomechanics
- IEEE Transactions on Human-Machine Systems
- Journal of Human–Robot Interaction
- IEEE Robotics and Automation Letters
- Computers in Biology and Medicine
- International Journal of Advanced Robotic Systems
- Soft Robotics
- Sensors
- Probabilistic Engineering Mechanics

International Conferences

- IEEE World Haptics Conference
- IEEE Haptics Symposium
- EuroHaptics Conference
- Robotics: Science and Systems Conference (RSS)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE/RAS International Conference on Humanoid Robots (Humanoids)
- IEEE International Conference on Biomedical Robotics and Biomechanics (BioRob)
- IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR)
- International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)
- Myoelectric Controls Symposium
- EAI International Conference on Wireless Mobile Communication and Healthcare - MobiHealth

STUDENT ADVISING

PhD students

- Edoardo Battaglia, (Expected Date: 2018):
PhD in Information Engineering at the University of Pisa
- Simone Ciotti, (Expected Date: 2019):
PhD in Information Engineering at the University of Pisa
- Simone Fani, (Expected Date: 2020):
PhD in Information Engineering at the University of Pisa
- Giuseppe Averta, (Expected Date: 2020):
PhD in Information Engineering at the University of Pisa

Master's thesis students

- Alessandro Serio, 2009:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Progetto e sperimentazione di un'interfaccia uomo macchina per l'interazione optica*
PhD in Automatics, Robotics and Bio-Engineering at the University of Pisa
Now: Project Manager at ROBOT SYSTEM AUTOMATION SRL, Perignano (Pisa) – Italy
- Stefano Mastria, 2011:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Metodo per la ricostruzione della postura della mano da misure parziali*
Now: IT Consultant at Reply
- Mattia Poggiani, 2014:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Development of a tactile display for softness and texture rendering, in human-robot and tele-operation applications*
Now: Research Collaborator at University of Pisa

- Edoardo Battaglia, 2014:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Thimble-Sense: an individual-digit wearable tactile sensor for experimental grasp studies*
Now: PhD student in Information Engineering at University of Pisa
- Simone Fani, 2015:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Design and Assessment of a Myoelectric Controller for Prosthetics and Assistive Applications*
Now: Collaborator at Research Center “E. Piaggio” of University of Pisa
- Simone Ciotti, 2015:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Technologies and algorithms for the development of distributed intrinsic tactile sensors*
Now: PhD student in Information Engineering at University of Pisa
- Brigida Viggiano, 2015:
Master's thesis in Biomedical Engineering, School of Engineering, University of Pisa – Thesis title: *Sviluppo di un'interfaccia sensorizzata per la mano secondo criteri di design ottimo*
- Alba Russo, 2015:
Master's thesis in Biomedical Engineering, School of Engineering, University of Pisa – Thesis title: *Riconoscimento dei movimenti funzionali della mano attraverso sistemi indossabili sotto-sensorizzati*
- Federica Barontini, 2016:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Wearable Technologies and algorithms for the guidance of blind people*
- Nicoletta Colella, 2016:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Design and characterization of a wearable haptic system for assistive applications*
- Giuseppe Averta, 2016:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Mathematical modeling and analysis of human upper limb kinematics*
- Franco Angelini, 2016:
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Trajectory Tracking with Flexible Joint Robots for Robust Interaction via Iterative Learning Control*
- Visar Arapi, (Expected Date: July 2017):
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Supervised machine learning methods for automatic human hand pose recognition for robotics and human robot interaction*
- Gemma Carolina Bettelani, (Expected Date: July 2017):
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Surface haptics and tactile illusions*
- Davide Doria, (Expected Date: September 2017):
Master's thesis in Automation and Robotics Engineering, School of Engineering, University of Pisa – Thesis title: *Wearable haptic interfaces for robot-assisted surgery*

Bachelor's thesis students

- Massimiliano Abbinante, 2015:
Bachelor's thesis in Mechanical Engineering, School of Engineering, University of Pisa
Now: Master student in Automation and Robotics Engineering, School of Engineering, University of Pisa
- Marco Baracca, 2016:
Bachelor's thesis in Biomedical Engineering, School of Engineering, University of Pisa
Expected date: September 2016
- Armando Aveta, 2016:
Bachelor's thesis in Biomedical Engineering, School of Engineering, University of Pisa
Expected date: September 2016

Master's student projects (2009–present)

- Supervisor of student design projects (more than 30) for: visual and non visual hand tracking, haptic interfaces for grasping analysis, tactile displays, VRE programming to study visuo-haptic integration in human manipulation and haptic interactions, mechatronic devices for softness rendering and vibrational cue delivery in tele-operation, haptic feedback for assistive technologies, prosthetics and rehabilitation; analysis of kinematic data of upper limb in manipulation tasks
- Master's degree in Automation and Robotics Engineering, School of Engineering, University of Pisa
- Master's degree in Mechanical Engineering, School of Engineering, University of Pisa
- Course of Robotics
- Prof. Antonio Bicchi

TEACHING EXPERIENCE

University of Pisa - School of Engineering

Teacher (Professor):

- Bachelor's degree in Energy Engineering
- Course: *System Theory*
- March 2017 – present

Teaching assistant:

- Bachelor's degree in Mechanical Engineering
- Course: *Regulation and Control of Mechanical Systems (Control Engineering)*
- October 2009 to February 2010; March 2012 to August 2012; December 2012 to February 2013; June 2013 to December 2013
- Prof. Antonio Bicchi

Teaching assistant:

- Master's degree in Robotics and Automation Engineering
- Master's degree in Mechanical Engineering
- Lectures on Haptic Interfaces and Rendering – Course: *Robotics*
- Spring 2010; Spring 2012
- Prof. Antonio Bicchi

Teaching assistant and lab instructor:

- Bachelor's degree in Biomedical Engineering
- Lectures on Haptic Interfaces and Rendering – Course: *Bio-Engineering Lab*
- Spring 2010; Spring 2012
- Prof. Enzo Pasquale Scilingo

PANELIST AND REVIEWER OF PHD THESIS

- *Candidate:* Manish Chauhan
- *PhD Program:* PhD Program in Bioengineering and Robotics
- *Institution(s):* Istituto Italiano di Tecnologia, Università degli studi di Genova
- *Year:* 2017

- *Candidate*: Mariacarla Memeo
- *PhD Program*: PhD Program in Bioengineering and Robotics
- *Institution(s)*: Istituto Italiano di Tecnologia, Università degli studi di Genova
- *Year*: 2017

PROFESSIONAL
SERVICE

Conference Service

- **Eurohaptics Conference**. Pisa (Italy), June 13–16, 2018: *Member of the Organizing Committee: Student Volunteer Chair*
- **International Congress on Ultra Modern Telecommunications and Control Systems – ICUMT 2017**. Munich (Germany), November 6–8, 2017: *Program Committee – Control Systems TPC Chair*
- **IEEE International Conference on Rehabilitation Robotics – ICORR 2017**. London (UK), July 17–20, 2017: *Associate Editor*
- **Worldhaptics 2017**. Munich (Germany), June 6–10, 2016: *Associate Editor*
- **International Congress on Ultra Modern Telecommunications and Control Systems – ICUMT 2016**. Lisbon (Portugal), October 18–20, 2016: *Program Committee – Control Systems TPC Chair*
- **IEEE International Conference on Robotics and Automation –ICRA 2016** – Stockholm, Sweden, May 16–21, 2016: *main organizer of the Workshop on “Grasping and Manipulation Datasets” – co-organized with Yu Sun (University of South Florida), Aaron Dollar (Yale University) and Jeannette Bohg (Max Planck Institute for Intelligent Systems (MPI-IS))*
- **IEEE Haptics Symposium 2016** – Philadelphia (PA, US), April 8–11, 2016: *co-chair of the regular session “Tactile Sensing and Perception” and main organizer of the Workshop on “Human and Robot Hands, Human and Robot Touch: Sensorimotor Synergies to Bridge the Gap Between Neuroscience and Robotics” – co-organized with Alessandro Moscatelli (University of Rome Tor Vergata)*
- **IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechanics - BioRob 2016** – Singapore (SGP), June 26–29, 2016: *Associate Editor*
- **IEEE International Conference on Rehabilitation Robotics – ICORR 2015**– Singapore (SGP), June 23–28, 2015: *Scientific Committee member, Associate Editor*
- **IEEE International Conference on Biomedical Robotics and Biomechanics - BioRob 2014** – São Paulo (Brazil), August 12–15, 2014: *Associate Editor*
- **Robotics: Science and Systems Conference – RSS 2014** – University of Berkeley (CA, US), July 12–16, 2014: *Program Committee (PC) member*
- **Eurohaptics Conference 2014** – Versailles (France), June 24–27, 2014:
 - *main organizer of the Workshop on “Haptics in Rehabilitation, Prosthetics and Neural Engineering : Robotic Aspects and Neuro-scientific Principles ” – co-organized with Marcia O’Malley (Rice University), Antonio Frisoli (Scuola Superiore Sant’Anna) and Lorenzo Masia (Nanyang Technological University);*
 - *main organizer of the Workshop on “Multisensory Softness ” – co-organized with Massimiliano Di Luca (University of Birmingham) and Gabriel Baud Bovy (Istituto Italiano di Tecnologia)*
- **IEEE Haptics Symposium 2014** – Houston (TX, US), February 23–26, 2014: *main organizer of the Workshop on “Artificial Softness: Design and Perception” – co-organized with Massimiliano Di Luca (University of Birmingham)*
- **IEEE/RSJ International Conference on Intelligent Robots and Systems – IROS 2012** – Vila Moura, Algarve (Portugal), October 7–12, 2012: *co-chair of the Regular Session “Human Performance Augmentation”*

PROFESSIONAL MEMBERSHIPS

Technical Committee on Robotic Hands, Grasping and Manipulation, Co-chair: 2017 – present. Member: 2016 – present.
Institute for Electrical and Electronics Engineers (IEEE), Member: 2012 – present
IEEE Robotics and Automation Society, Member: 2015 – present
Technical Committee on Haptics, Member: 2013 – present
Eurohaptics Society, Member: 2014 – present

HARDWARE AND SOFTWARE SKILLS

Analog Electronics

- instrumentation, control, data acquisition, test and measurements

Computer Programming:

- C, C++, UNIX shell scripting, MATLAB, and others

CAD Design:

- Autocad

MATLAB skill set:

- Linear algebra, Fourier transform, polynomials, statistics, visualization
- Toolboxes: control systems, optimization procedures, data clustering, statistics, curve fitting
- Simulink, Sisotool

Finite Element Design:

- Abaqus, Ansys

Productivity Applications:

- \TeX (\LaTeX , \BibTeX , most common productivity packages for Windows and Linux platforms)

Operating Systems:

- Microsoft Windows family, Linux

PRESENTATIONS AND SEMINARS

Invited Talks/Public Speeches

- 2017 IEEE-RSJ International Conference on Intelligent Robots and Systems (IROS). Workshop on: *Morphological Computation in Soft Robotics*. Title of the talk: *From soft robotics to soft haptics: sensing principles and wearable tactile displays*. Vancouver, BC- Canada. September 2017.
- 2017 Summer School on Soft Manipulation 2017. Supported by RAS-TCs on: Robotic Hands, Grasping and Manipulation; Mobile Manipulation; Soft Robotics. Invited Lecture. Title of the talk: *Modeling hand kinematics and the sense of touch for grasping and environmental constraints exploitation: from humans to robots and back again*. Lake Chiemsee, Germany. July 2017.
- 2017 IEEE-RAS Worldhaptics Conference. Workshop on: *Wearable haptic systems: design, applications, and perspectives*. Title of the talk: *Wearable haptics and affective computing: towards a novel paradigm for HRI*, Furstenfeldbruck (Munich), Germany, June 2017.
- 2017 IEEE-RAS Worldhaptics Conference. Workshop on: *Haptics interfaces for accessibility*. Title of the talk: *Augmented white cane performance with wearable haptics and navigation*, Furstenfeldbruck (Munich), Germany, June 2017.
- 2017 Toscana Technologica. Title of the talk: *Wearable Haptic Systems*, Firenze (Italy), February 2017
- Title of the talk: *From Sensory-Motor Synergies to Haptic Interfaces: Applications in Assistive Robotics and Human Robot-Interaction*, Department of Mechanical Engineering - Rice University - Houston (TX, USA), January 2017
- 2016 IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN). Workshop on: *2nd Workshop on human-oriented approaches for assistive and rehabilitation robotics* – Title of the talk: *Sensory-motor synergies for human-robot interaction and assistive robotics*, Columbia University – Teachers College, New York (NY, USA), August 2016

- 2016 Fondazione Santa Lucia, Rome (Italy). Invited talk on: *Sensory-motor synergies and robotics research: a mutual inspiration*, July 2016
- 2016: Robotics Research Jam Sessions - 2016 – Title of the talk: *Sensory-motor synergies for the design of robotic and haptic systems*, University of Pisa (Pisa, Italy), July 2016
- 2016 International Society of Motor Control. Invited Lecture. *Motor Control Summer School - XIII* – Title of the talk: *Sensory-motor synergies: An Inspiration for the Design of Robotic and Artificial Haptic Systems*, Kibbutz Tzuba (Israel), June 2016
- 2016 Robotics: Science and Systems Conference. Workshop on: *Minimality and Design Automation* – Title of the talk: *Fast prototyping of soft robots and human-robot interfaces: methods, applications and open platforms*, Ann Arbor (MI, USA), June 2016
- 2016 Robotics: Science and Systems Conference. Workshop on: *Robot Makers: The future of digital rapid design and fabrication of robots* – Title of the talk: *Minimality and Under-Sensing: A human-inspired Approach*, Ann Arbor (MI, USA), June 2016
- IEEE International Conference on Robotics and Automation (ICRA 2016): Workshop on: *Grasping and Manipulation Datasets* – Title of the talk: *An open-access repository to share data and tools for the study of human and robotic hands: the Hand Corpus initiative*, Stockholm (Sweden), May 2016
- IEEE Haptics Symposium 2016: Workshop on *Human and Robot Hands, Human and Robot Touch: Sensorimotor Synergies to Bridge the Gap Between Neuroscience and Robotics* – Title of the talk: *Sensorimotor Synergies for the Design of Haptic, Sensing and Robotic Systems*, Philadelphia (PA, USA), April 2016
- IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR 2015): Workshop on *Human-Oriented Approaches for Assistive and Rehabilitation Robotics* – Title of the talk: *Human Hands and SoftHands: from neuroscientific studies to assistive applications*, Singapore (SGP), August 2015
- Eurohaptics Conference 2014: Workshop on *Haptics in Rehabilitation, Prosthetics and Neural Engineering : Robotic Aspects and Neuro-scientific Principles* – Title of the talk: *Tactile feedback for the Pisa/IIT SoftHand*, Versailles (France), June 2014
- IEEE Haptics Symposium 2014: Workshop on *Wearable haptics: from neurophysiology foundations to new wearable haptic designs and exoskeletons* – Title of the talk: *Sensing the Human Hand: Simplicity and Optimality Criteria for Wearable Systems*, Houston (TX, USA), February 2014
- IEEE Haptics Symposium 2014: Workshop on *Artificial Softness: Design and Perception* – Title of the talk: *Which(fabric – based) approach for softness displays?*, Houston (TX, USA), February 2014
- AMARSi European project Symposium: *Adaptive Motor Primitives in Brain and Machines* – Title of the talk: *Haptic Synergies, i.e. How to Cope with Hand Sensorimotor Complexity*, University Clinic Tübingen (Germany), Medical Clinic-Lecture Hall, November 2012
- Title of the talk: *A New Paradigm for Haptic Display Design: Mathematical Modelling and Applications*, Laboratory for Computational Sensing and Robotics (LCSR) - The Johns Hopkins University - Baltimore (MD, USA), February 2011

Conference Presentations

- IEEE-RAS Worldhaptics 2017. Furstentfeldbruck (Munich), Germany, June 2017. (Oral Presentation): **Best Best Paper Award Finalist.**
- IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), Columbia University – Teachers College, New York (NY, USA), August 2016 (Oral Presentation)
- IEEE Haptics Symposium, Philadelphia (PA, USA), April 2016. (Oral Presentation). **Best Paper Award**
- Automatica.it (Italian Conference of Researchers in Automation), Bari (Italy), September 2015. (Oral Presentation). **Best Oral Presentation**
- IEEE/RAS-EMBS International Conference on Rehabilitation Robotics, Singapore (SGP), August 2015. (Oral Presentation).
- IEEE Worldhaptics Conference, Evanston (IL, USA), June 2015. (Oral and Demo Presentation).
- Eurohaptics Conference, Versailles (France) – (Poster and Teaser Presentation). June

2014. **Best Paper Award (Category: Poster Presentation)**
- IEEE Haptics Symposium, Houston (TX, USA) – (Poster, Teaser and Demo Presentation). February 2014
 - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Tokyo (Japan), November 2013. (Oral Presentation).
 - Automatica.it (Italian Conference of Researchers in Automation), Palermo (Italy), September 2013. (Oral Presentation). **Best Oral Presentation Finalist**
 - Automatica.it (Italian Conference of Researchers in Automation), Benevento (Italy), September 2012. (Poster Presentation). **Best Interactive Presentation Finalist**
 - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vila Moura, Algarve (Portugal), October 2012. (Oral Presentation). **JTCF Novel Technology Paper Award for Amusement Culture**
 - IEEE Haptics Symposium, Vancouver (BC, Canada), March 2012. (Oral Presentation).
 - IEEE Symposium on Haptic Interfaces for Virtual Environments and Teleoperator Systems - Waltham (MA, USA), March 2010. (Oral and Demo Presentation). **Best Student Paper and Best Paper Award Finalist**
 - IEEE EuroHaptics, Amsterdam (The Netherlands), June 2010. (Oral Presentation).
 - Workshop on Human Friendly Robotics (HFR) - Symposium, Sestri Levante (Italy), December 2009. (Oral Presentation).
 - IEEE World Haptics, Salt Lake City (UT, USA), March 2009 – (Poster and Demo Presentation)

REFEREES

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- (J2) S. Fani, S. Ciotti, E. Battaglia, A. Moscatelli, and **M. Bianchi**. W-FYD: a Wearable Fabric-based Display for Haptic Multi-Cue Delivery and Tactile Augmented Reality. In: *IEEE Transactions on Haptics*. Accepted.
- (J3) P. Beckerle, G. Salvietti, R. Unal, D. Prattichizzo, S. Rossi, C. Castellini, S. Hirche, S. Endo, H. Ben Amor, M. Ciocarlie, F. Mastrogiovanni, B.D. Argall, and **M. Bianchi**. A Human–Robot Interaction Perspective on Assistive and Rehabilitation Robotics. In: *Front Neurobot*, 11: 24, 2017.

- (J4) C. Della Santina, **M. Bianchi**, G. Grioli, F. Angelini, M.G. Catalano, M. Garabini and A. Bicchi. Feedback and Feedforward Control for Soft Robots. In: *Robotics and Automation Magazine*. 2017.
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OTHER PROJECTS/
INTERNATIONAL
COLLABORATIONS

- Collaboration with MayoClinic (USA) within private funding grant (2014-2016): on the usage, testing and re-design of the Pisa/IIT SoftHand for prosthetic applications, and within NIH (National Institutes of Health) US -grant: 1R21HD081938-01 Soft Synergy-Based Artificial Hand for Prosthetic Applications (2014- 2016).
- Collaboration with Prof. Marco Santello (ASU): on the study of haptic feedback and control of the Pisa/IIT SoftHand for prosthetic applications (NIH (National Institutes of Health) US -grant: 1R21HD081938-01 Soft Synergy-Based Artificial Hand for Prosthetic Applications (2014 - 2016)); human motor control and wearable sensing
- Collaboration with Prof. Vincent Hayward (UPMC-ISIR) and Prof. Marc Ernst (University of Bielefeld) on the study of cutaneous perception
- Collaboration with Prof. Allison M. Okamura (Stanford University) on the development of tactile displays for robot-assisted minimally invasive surgery
- Together with Dr. M.V. Liarokapis (Yale University), I am the coordinator of the project HandCorpus.

The **HandCorpus** (<http://www.handcorpus.org>) is an open access repository for sharing datasets, tools and experimental results about human and robotic hands. The HandCorpus was originally created in 2011, within the European Project “The Hand Embodied (THE)”, with the objective of making data collections and analyses about human hand publicly available. Today (April 2016), the HandCorpus repository contains human hand kinematic data, with suitably provided tools for data visualization, related publications and videos. Furthermore, 5 European Research Council/European Commission funded projects sponsor the HandCorpus, and the HandCorpus community consists of 21 international research groups from 17 universities and 4 research institutes, across Europe and United States of America.

PERSONAL

Born in 1982, Grosseto (Italy) - Citizenship: Italian

MORE INFORMATION More information and the pdf files of the publications are available at

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