

# Enzo Mastinu

## Researcher & Engineer

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### PROFESSIONAL EXPERIENCE

- 01/12/2020 – now: **Post-doctoral Researcher**, Center for Bionics and Pain Research, Chalmers University of Technology & Sahlgrenska University Hospital, Göteborg, Sweden
- 01/09/2019 – now: **R&D Engineer (part-time)**, Integrum AB, Mölndal, Sweden
- 01/06/2019 – 30/11/2020: **Post-doctoral Researcher**, Biomechatronics and Neurorehabilitation Lab., Electrical Engineering dept., Chalmers University of Technology, Göteborg, Sweden
- 01/10/2014 – 29/05/2019: **Industrial Ph.D.**, Integrum AB, Mölndal, Sweden  
Doctoral project done in collaboration with an industry partner. The project regarded the design and the development of the Artificial Limb Controller (ALC), the only self-contained embedded system in the world that could allow closed-loop prosthetic control in daily life. The ALC allowed intuitive control of prosthetic robotic devices via pattern recognition algorithms, and included a neurostimulator for tactile sensory feedback purposes. The ALC, classified as an active medical device (class IIa), was developed from its concept towards its CE mark and FDA clearance, and designed according to IEC-60601, IEC-62304 and ISO-14971 directives. The ALC was used within the clinical investigation of an implanted neuromusculoskeletal system (e-OPRA, Integrum AB)
- 01/05/2014 – 30/09/2014: **Research Assistant**, Microelectronics and Bioengineering Lab., Electrical Engineering dept., Università degli Studi di Cagliari, Cagliari, Italy  
Winner of a research assistant grant titled “*Design and implementation of a microcontroller-based board for the acquisition of the outputs of a biosensor and to control a system of micropumps for the distribution of reagents*”
- 01/02/2013 – 30/06/2013: **Designer HW/FW**, TechOnYou spin-off, Cagliari, Italy  
HW/FW designer in the implementation of a microcontroller-based system with temperature sensors, vibration output, wireless battery charger, RFID and USB communication
- 01/03/2012 – 31/07/2012: **Intern**, N.e.x.u.s., Cagliari, Italy  
FW programmer for a microcontroller-based board for home automation applications

### EDUCATION

- 01/10/2014 – 29/05/2019: **Ph.D. in Biomedical Signals and Systems Engineering**  
Electrical Engineering dept., Chalmers University of Technology, Göteborg, Sweden  
Thesis supervised by Dr. Ortiz-Catalan and titled “*Towards clinically viable neuromuscular control of bone-anchored prosthetic arms with sensory feedback*”

In the first part of the project, it was developed the ALC, an embedded system capable of intuitive prosthetic control via pattern recognition applied to EMG signals. The ALC included a neurostimulator to provide direct neural feedback mediated by tactile sensors on the prosthesis. The ALC was provided to amputee subjects for home-use within the clinical investigation of the e-OPRA implanted neuromusculoskeletal system. For this reason, Enzo had (and still has currently) direct contact with the patients providing assistance, maintenance by taking part to the follow-ups related to the clinical trial. In the second part of the project, the ALC was used as a research platform to monitor prosthesis usage and training, machine learning based control algorithms, and neural stimulation paradigms for tactile sensory feedback. The findings and the technology developed during this project opened to the clinical use of a new class of prosthetic arms that are directly connected to the neuromusculoskeletal system, intuitively controlled and capable of tactile sensory feedback. Preliminary results from such neuromusculoskeletal implant system and its clinical trial were recently reported on the *New England Journal of Medicine*

- 01/09/2012 – 31/03/2014: **M.Sc. in Electronic Engineering** (top grade)  
Electrical Engineering dept., Università degli Studi di Cagliari, Cagliari, Italy  
Thesis supervised by Prof. Barbaro and titled “*Design and development of a wearable device for man-machine interaction based on EEG signals*”

#### **TEACHING AND MENTORING**

- Teaching Assistant for “Electric Circuits and Fields” in 2016, 2017, 2018
- Teaching Assistant for “Development of Medical Devices” in 2019, 2020
- Co-supervised 15 M.Sc. students and 9 interns/research assistants from 2014 till now  
5 of these students went into a Ph.D. project  
4 journal articles were published from some of the M.Sc. theses
- Co-supervised 2 Ph.D. students from 2019 till now

#### **REVIEWER** [<https://publons.com/researcher/1512678/enzo-mastinu>]

- Journal of NeuroEngineering and Rehabilitation
- IEEE Transactions on Neural Systems and Rehabilitation Engineering
- IEEE Transactions on Medical Robotics and Bionics
- IEEE Transactions on Biomedical Circuits and Systems
- Sensors
- Frontiers in Neuroscience
- Journal of Translational Engineering in Health and Medicine
- IEEE Journal of Biomedical and Health Informatics
- Journal of Bionic Engineering
- Computers in Biology and Medicine
- Plos One
- Journal of Disability and Rehabilitation
- IEEE Transactions on Cognitive and Developmental Systems
- Microprocessors and Microsystems
- Disability and Rehabilitation
- Prosthesis
- IEEE Consumer Electronics Magazine

## EDITORIAL APPOINTMENTS

- Guest Associate Editor in Frontiers in Neurorobotics
  - *Rising stars in Neurorobotics 2021*
- Topic Editor in Prosthesis (MDPI)

## ORGANIZATION OF CONFERENCES

- 01/10/2019 – now: Finance Manager for the 1st International Conference on Phantom Limb Pain, Aug 31<sup>st</sup>- Sept 2<sup>nd</sup> 2021, Göteborg, Sweden
- 01/09/2015 – now: within the Organization Committee of the yearly Bionic Limb Symposiums (2015, 2016, 2017, 2018, 2019)

## FUNDING RECEIVED

- 04/2021: from Chalmers Health Engineering Area of Advance ≈5000€ for changing the ICPLP2021 into a hybrid event
- 02/2021: from European Commission ≈185000€ for Marie Skłodowska-Curie Individual European Fellowship (with score 95.4%)
- 12/2020: from Wenner-Gren Stiftelserna ≈1400€ for travel refund
- 12/2019: from the Kungl och Hvitfeldtska Stiftelsen ≈10000€ for organizing the ICPLP2021
- 12/2019: from the IngaBritt och Arne Lundbergs Forskningsstiftelse ≈5000€ for organizing the ICPLP2021
- 09/2019: from the IEEE Brain Neurotech ≈300€ for travel refund
- 07/2018: from the IEEE Engineering in Medicine and Biology Society ≈500€ for travel refund
- 06/2016: from the Cybathlon organization committee ≈600€ for travel refund
- 11/2015: from the Chalmersska forskningsfonden ≈1700€ for travel refund

## PRIZES AND AWARDS

- 13/11/2020: **3rd and 7th place at the Cybathlon 2020** within the ARM race with the teams “*e-OPRA*” and “*x-OPRA*”
- 03/11/2018: **Swedish Embedded Award** at the Embedded Conference Scandinavia, Stockholm, Sweden  
Award assigned from the Swedish Electronics Association for the Artificial Limb Controller system
- 20/07/2018: **Student Paper Award** at the international conference EMBC2018, Honolulu, Hawaii, U.S.A.  
Award assigned from the IEEE Engineering in Medicine and Biology Society for the article “*Myoelectric signals and pattern recognition from implanted electrodes in two TMR subjects with an osseointegrated communication interface*”
- 08/10/2016: **3rd place at the Cybathlon 2016** within the ARM race with the team “*OPRA Osseointegration*”
- 25/09/2014: **Innovation Design Award** at the Innovation Design Contest, Milan, Italy  
Award assigned from Selezione di Elettronica and Politecnico di Milano for the EEG wearable amplifier developed during the M.Sc. thesis

## **OPEN SOURCE HW & SW**

- ADS\_BP: low-cost open source hardware and software package to acquire bioelectric signal  
**Mastinu E.** and Ortiz-Catalan M., (2016) [[https://github.com/biopatrec/ADS\\_BP/wiki](https://github.com/biopatrec/ADS_BP/wiki)]

## **PUBLICATIONS** [[https://www.researchgate.net/profile/Enzo\\_Mastinu](https://www.researchgate.net/profile/Enzo_Mastinu)]

### **Summary:**

- 11 Peer-reviewed journals (4 first author)
- 5 Peer-reviewed conferences – full papers (3 first author)
- 6 Peer-reviewed conferences – abstracts (5 first author)
- h-index = 12, 345 citations to 10-2021 (Google Scholar)

### **Journal papers (peer-reviewed):**

*“Self-contained Neuromusculoskeletal Arm Prostheses”* Ortiz-Catalan, M., **Mastinu, E.**, Sassu, P., Aszmann, O., and Brånemark, R., New England Journal of Medicine, 2020

*“Neural feedback strategies to improve grasping coordination in neuromusculoskeletal prostheses”*, **Mastinu, E.**, Engels, L., Clemente, F., Dione, M., Sassu, P., Aszmann, O., Brånemark, R., Håkansson, B., Controzzi, M., Wessberg, J., Cipriani, C., and Ortiz-Catalan, M., Scientific Reports, 2020

*“Embedded System for Prosthetic Control Using Implanted Neuromuscular Interfaces Accessed Via an Osseointegrated Implant”*, **Mastinu, E.**, Doguet, P., Botquin, Y., Håkansson, B., and Ortiz-Catalan, M., IEEE Transactions in Biomedical Circuits and Systems, 2017

*“An Alternative Myoelectric Pattern Recognition Approach for the Control of Hand Prostheses: A Case Study of Use in Daily Life by a Dysmelia Subject”*, **Mastinu, E.**, Ahlberg, J., Lendaro, E., Hermansson, L., Håkansson, B., and Ortiz-Catalan, M., IEEE Journal of Translational Engineering in Health and Medicine, 2018

*“Chronic use of a sensitized bionic hand does not remap the sense of touch”*, Ortiz-Catalan, M., **Mastinu, E.**, Greenspon, C., and Bensmaia, S., Cell Reports, 2020

*“Grip control and motor coordination with implanted and surface electrodes while grasping with an osseointegrated prosthetic hand”*, **Mastinu, E.**, Clemente, F., Sassu, P., Aszmann, O., Brånemark, R., Håkansson, B., Controzzi, M., Cipriani, C., and Ortiz-Catalan, M., Journal of NeuroEngineering and Rehabilitation, 2019

*“Patterned Stimulation of Peripheral Nerves Produces Natural Sensations With Regards to Location but Not Quality”*, Ortiz-Catalan, M., Wessberg, J., **Mastinu, E.**, Naber, A., and Brånemark, R., IEEE Transactions on Medical Robotics and Bionics, 2019

*“Stationary wavelet processing and data imputing in myoelectric pattern recognition on a low-cost embedded system”*, Naber, A., **Mastinu, E.**, and Ortiz-Catalan, M., IEEE Transactions on Medical Robotics and Bionics, 2019

*“Real-time classification of non-weight bearing lower limb movements using EMG to facilitate phantom motor execution: engineering and case study application on phantom limb pain”*, Lendaro, E., **Mastinu,**

E., Håkansson, B., and Ortiz-Catalan, M., Journal of Frontiers in Neurology (section Neuroprosthetics), 2017

*“Evaluation of Computer-Based Target Achievement Tests for Myoelectric Control”*, Gusman, J., **Mastinu, E.**, and Ortiz-Catalan, M., IEEE Journal of Translational Engineering in Health and Medicine, 2017

*“Assessment of an automatic prosthetic elbow control strategy using residual limb motion for transhumeral amputees with socket or osseointegrated prostheses”*, Merad, M., de Montalivet, E., Legrand, M., **Mastinu, E.**, Ortiz-Catalan, M., Touillet, A., Martinet, N., Paysant, J., Roby-Brami, A., and Jarrassé, N., IEEE Transactions on Medical Robotics and Bionics, 2020

#### **Conference full-papers (peer-reviewed):**

*“Analog Front-Ends comparison in the way of a portable, low-power and low-cost EMG controller based on Pattern Recognition”*, **Mastinu, E.**, Ortiz-Catalan, M., and Håkansson, B., Proceedings of the 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, August 25-29, 2015, Milano, Italy, vol. 64, no. 4, pp. 2263-2269, 2015

*“Low-cost, open source bioelectric signal acquisition system”*, **Mastinu, E.**, Håkansson, B., and Ortiz-Catalan, M., Proceedings of the 14th Annual International Conference on Wearable and Implantable Body Sensor Networks of the IEEE Engineering in Medicine and Biology Society, May 9-12, 2017, Eindhoven, Netherlands, vol. 26, no. 4, pp. 261-263, 2017

*“Myoelectric signals and pattern recognition from implanted electrodes in two TMR subjects with an osseointegrated communication interface”*, **Mastinu, E.**, Brånemark, R., Aszmann, O. and Ortiz-Catalan, M. Published on Proceedings of the 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, July 18-21, 2018, Honolulu, U.S.A., pp. 5174-5177, 2018

*“Crosstalk Reduction in Epimysial EMG Recordings from Transhumeral Amputees with Principal Component Analysis”*, Matran-Fernandez, A., **Mastinu, E.**, Poli, R. Ortiz-Catalan, M., and Citi, L., Published on Proceedings of the 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, July 18-21, 2018, Honolulu, U.S.A., pp. 5174-5177, 2018

*“A Wide-band and User-friendly EEG Recording System for Wearable Applications”*, Bioni, L., **Mastinu, E.**, and Barbaro, M., Proceedings of the 8th International Conference on Biomedical Electronics and Devices, January 12-15, 2015, Lisbon, Portugal, 2015

#### **Conference abstracts (peer-reviewed):**

*“Digital Controller for Artificial Limbs fed by Implanted Neuromuscular Interfaces via Osseointegration”*, **Mastinu, E.**, Ortiz-Catalan, M., and Håkansson, B., Proceedings of the 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, August 16-20, 2016, Orlando, U.S.A., 2016

*“Digital Controller for Artificial Limbs fed by Implanted Neuromuscular Interfaces via Osseointegration”*, **Mastinu, E.**, Håkansson, B., and Ortiz-Catalan, M., Proceedings of the Trent International Prosthetic Symposium, September 28-30, 2016, Glasgow, Scotland, 2016

*“Direct Neural Sensory Feedback and Control via Osseointegration”*, Ortiz-Catalan, M., **Mastinu, E.**, Brånemark, R., and Håkansson, B., Proceedings of the 16th World Congress from the International Society for Prosthetics and Orthotics, May 8-11, 2017, Cape Town, South Africa, 2017

*“Embedded Controller for Pattern Recognition and Neural Stimulation via Osseointegration”*, **Mastinu, E.**, Håkansson, B., and Ortiz-Catalan, M., Proceedings of the 16th World Congress from the International Society for Prosthetics and Orthotics, May 8-11, 2017, Cape Town, South Africa, 2017

*“Embedded controller for prosthetic control and neural stimulation via osseointegration”*, **Mastinu, E.**, and Ortiz-Catalan, M., Proceedings of the 2nd International Symposium on Innovations in Amputation Surgery and Prosthetic Technologies, May 10-12, 2018, Vienna, Austria, 2018

*“Motor coordination in closed-loop prosthetic control via implanted electrodes and osseointegration”*, **Mastinu, E.**, Engels, L., Clemente, F., Dione, M., Sassu, P., Aszmann, O., Brånemark, R., Håkansson, B., Controzzi, M., Wessberg, J., Cipriani, C., and Ortiz-Catalan, M., Proceedings of the 17th World Congress from the International Society for Prosthetics and Orthotics, October 5-8, 2019, Kobe, Japan, 2019

## **EVENTS ATTENDED**

### **Conference oral presentations:**

37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, August 25-29, 2015, Milano, Italy

Trent International Prosthetic Symposium, September 28-30, 2016, Glasgow, Scotland

40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, July 18-21, 2018, Honolulu, U.S.A.

17th World Congress from the International Society for Prosthetics and Orthotics, October 5-8, 2019, Kobe, Japan

### **Conference poster presentations:**

38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, August 16-20, 2016, Orlando, U.S.A.

14th Annual International Conference on Wearable and Implantable Body Sensor Networks of the IEEE Engineering in Medicine and Biology Society, May 9-12, 2017, Eindhoven, Netherlands

40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, July 18-21, 2018, Honolulu, U.S.A.

Cyathlon symposium 2020, September 17-18, 2020, online

### **Attended without presentation:**

DEMOVE symposium, November 4-6, 2014, Gottingen, Germany

Restoration of Sensory and Motor Function Symposium, May 26-27, 2016, Gottingen, Germany

Cyathlon Symposium, October 6, 2016, Zurich, Switzerland

23rd International Conference on Pattern Recognition, December 4-8, 2016, Cancun, Mexico

IEEE Neurotech Entrepreneurs Workshop, December 13-15, 2019, Phoenix, Arizona, U.S.A.

NeuTouch International School on Touch for Prosthetics, September 21-28 2020, online

## **TRAININGS**

- 01/2021: **EU Medical Device Regulation (MDR 2017/745)** provided by the *Swedish Institute for Standards*

- 11/2018: **Research Utilization** provided by *Chalmers University*
- 02/2018: **Applied Project Management** provided by *Wenell*
- 11/2017: **Academic Writing** provided by *Chalmers University*
- 03/2017: **Research Ethics & Sustainable Development** provided by *Chalmers University*
- 11/2016: **Advanced Communication & Popular Presentations** provided by *Chalmers University*
- 10/2016: **ISO-14971, Application of risk management to medical devices** provided by *Knightec*
- 09/2016: **Teaching, Learning and Evaluation** provided by *Chalmers University*
- 05/2016: **IEC 60601-1 ed.3, General requirements for basic safety and essential performance of medical electrical equipment** provided by *Intertek Academy*