



Michele Francesco Penna

WORK EXPERIENCE

01/10/2020 – CURRENT

PHD STUDENT IN BIOROBOTICS THE BIOROBOTICS INSTITUTE, SANT'ANNA SCHOOL OF ADVANCED STUDIES

During my PhD, I am investigating hardware and software solutions for upper-limb exoskeletons, with the goal of increasing the use of robotic assistive devices in daily life. I am mainly working within the framework of the BioARM project (grant n° PR19-RR-P3), promoted by Inail (Italian institute against accidents at work). In particular, I am carrying out the following tasks.

- Development of high-level control algorithms to infer the user's upper-limb movement intentions, using kinematics and electromyographic signals. These algorithms exploit the synergic activations occurring during upper-limb movements, known as movement primitives.
- Mechatronic design, development, and testing of a portable exoskeleton for the upper-limb.
- Certification of a portable upper-limb exoskeleton as a class IIa medical device.
- Design of clinical protocols and submission to the Ethical Committee.
- Management and coordination of projects consortium meetings, documents and deadlines, as a support of the Coordination Group.
- Dissemination of research activities during public events.
- Tutoring of M.Sc. students during their theses.

EDUCATION AND TRAINING

25/06/2021 Rome, Italy

LICENSED PROFESSIONAL ENGINEER Ordine degli Ingegneri della Provincia di Roma

Field of study Section A, Industrial Engineering Sector | **Final grade** 45/50

01/10/2018 – 23/10/2020 Rome, Italy

M.SC. BIOMEDICAL ENGINEERING Campus Bio-Medico University of Rome

The thesis was developed within the framework of the Rehabilitation Engineering course. The main contributions of the thesis were:

- development of an adaptive controller for an upper-limb exoskeleton inferring the movement intentions of subjects executing reaching movements. I implemented the algorithm using the adaptive Dynamic Movement Primitives (aDMP) approach and designed a movement phase estimator based on Gaussian Process Regression.
- offline testing of the developed controller on a dataset of reaching movements executed by healthy subjects wearing a four active degrees of freedom shoulder-elbow exoskeleton.

Field of study Curriculum of Robotics | **Final grade** 110/110 |

Thesis Design and development of an aDMP-based control system for a shoulder-elbow exoskeleton

The thesis was developed within the framework of the Statistics and Probability course. The main contributions of the thesis were:

- development of two algorithms for the estimate of a stochastic, discrete-time, non-linear system. The first method was an optimal estimate based on the *virtual measurements* approach, while the second one was an Extended Kalman Filter.
- testing of the two developed algorithms in the case study of a estimating the position of target executing unknown planar movements.

Field of study Curriculum in Biomedical Engineering | **Final grade** 103/110 |

Thesis Estimation algorithms for planar tracking problems

● LANGUAGE SKILLS

Mother tongue(s): **ITALIAN**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	C1	C1	C1	C1	C1
FRENCH	A2	A2	A2	A2	A2

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

● DIGITAL SKILLS

Microsoft Office | LaTeX

Engineering Software

Python | C++ | MATLAB | Simulink | NI LabVIEW

● ADDITIONAL INFORMATION

CONFERENCES AND SEMINARS

12/07/2022 – 15/07/2022 – Lecco (Italy)

ICCHP-AAATE 2022 Presentation and publication on the conference proceedings of the work "Design and administration of a questionnaire for the usercentered design of a novel upper-limb assistive device for brachial plexus injury and post-stroke subjects"

09/09/2021 – Volterra (Italy)

Symposium on new technologies for rehabilitation Attendance at the symposium organized by the Sensory Motor System Laboratory of ETH Zurich.

20/05/2023 – Pisa (Italy)

Robotics Festival I attended the 2023 Robotics Festival of Pisa and gave a talk titled: "Exoskeletons to assist, rehabilitate, or augment human motor functions: the experience of the BioRobotics Institute".

HONOURS AND AWARDS

30/09/2020

Winner of a fully-funded scholarship for a PhD in BioRobotics – Sant'Anna School of Advanced Studies

26/05/2020

SOC challenge champion – Exprivia I participated and won a cybersecurity competition whose aim was to identify cyber attacks.

PUBLICATIONS

Design and administration of a questionnaire for the usercentered design of a novel upper-limb assistive device for brachial plexus injury and post-stroke subjects

– 2022

Penna, M.F. *et al.* (2022). Design and Administration of a Questionnaire for the User-Centered Design of a Novel Upper-Limb Assistive Device for Brachial Plexus Injury and Post-stroke Subjects. In: Miesenberger, K., Kouroupetroglou, G., Mavrou, K., Manduchi, R., Covarrubias Rodriguez, M., Penáz, P. (eds) Computers Helping People with Special Needs. ICCHP-AAATE 2022. Lecture Notes in Computer Science, vol 13342. Springer, Cham. https://doi.org/10.1007/978-3-031-08645-8_49

A fully integrated FBG-based wearable device and protocol for breathing monitoring – 2021

M. Filosa, J. D'Abbraccio, G. D'Alesio, M.F. Penna, et al., A fully integrated FBG-based wearable device and protocol for breathing monitoring, 10th International IEEE/EMBS Conference on Neural Engineering (NER 21), 2021

MANAGEMENT AND LEADERSHIP SKILLS

Management of project documents, meetings, and deadlines During my PhD, I developed skills of management of the activities of research projects as a support of the coordination group. In particular, my activities focused on:

- writing of deliverables and minutes of periodic meetings,
- management and organization of periodic meetings and preparation of the related materials and agenda,
- review of deliverables, documents, and presentations produced by the consortium of the project,
- management of presentation and documents, and organization of events related to the dissemination of the reserach activities of the project.

Tutoring of M.Sc. Theses During my PhD I tutored two M.Sc. students during their theses in (i) Bionics Engineering (Sant'Anna School of Advanced Studies, July 2022) and (ii) Biomedical Engineering (University of Naples Federico II, June 2023).

Consapevole che le dichiarazioni false comportano l'applicazione delle sanzioni previste dall'art. 76 del D.P.R. 445/2000, dichiaro che le informazioni riportate nel curriculum vitae corrispondono a verità.

Pisa, Italy , 06/2023

Michele Francesco
Penna