PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Andrea Cervone

XXXIII Cycle

Training and Research Activities Report – Third Year

Tutor: Gianluca Brando

1. **Informations**
   a. Andrea Cervone
   b. Master Degree in Electrical Engineering – Università di Napoli Federico II
   c. XXXIII Cycle- ITEE – Università di Napoli Federico II
   d. Tutor: Ing. Gianluca Brando

2. **Study and Training activities**
   a. Courses:
      i. Scientific Programming and Visualization with Python; Prof. Alessio Botta; (28-29/02/2020) 04-06/03/2020
   b. Seminars:
      i. How to Get Published with IEEE; Eszter Lukács (Online); 20/04/2020
      ii. Network Systems, Kuramoto Oscillators, and Synchronous Power Flow; Lecturer: Prof. Francesco Bullo (University of California Santa Barbara - U.S.A.); 03/12/2020
   c. External courses:
      i. Intensive School for Advanced Graduate Studies - A Smart Grid for Energy Management: the IoT approach (University of Pavia - Virtual Meeting) - Prof. Di Barba, Prof. Zaninelli, et al.; 08th-11th June 2020
   d. Workshops:
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3. **Research activity**
   a. Multilevel and Multiphase Power Converters: modulation, stabilization and equalization strategies
   b. Multiphase Permanent Magnet Synchronous Machines and Drives: mathematical model, control strategies and control algorithms
   c. Multiphase Synchronous Reluctances Machines and Drives: mathematical model, control strategies and control algorithms

4. **Products**
   a. Publications
      i. Published Journal Papers
         1. A. Cervone, M. Slunjski, E. Levi and G. Brando, "Optimal Third-Harmonic Current Injection for Asymmetrical Multiphase Permanent Magnet Synchronous Machines," in IEEE Transactions on Industrial Electronics, vol. 68, no. 4, pp. 2772-2783, April 2021, doi: 10.1109/TIE.2020.2982099.
         2. A. Cervone, G. Brando and O. Dordevic, "Hybrid Modulation Technique With DC-Bus Voltage Control for Multiphase NPC Converters," in IEEE Transactions on Power Electronics, vol. 35, no. 12, pp. 13528-13539, Dec. 2020, doi: 10.1109/TPEL.2020.2992226.
         3. A. Cervone, O. Dordevic and G. Brando, "General Approach for Modelling and Control of Multiphase PMSM drives," in IEEE Transactions on Power Electronics, doi: 10.1109/TPEL.2021.3063791.

      ii. Published Conference Papers
         1. A. Cervone, M. Slunjski, E. Levi and G. Brando, "Optimal Multi-Harmonic Current Injection Strategy for an Asymmetrical Nine-Phase PMSM," 2020 International Symposium on Power Electronics, Electrical Drives, Automation and Motion (SPEEDAM), 2020, pp. 787-792, doi: 10.1109/SPEEDAM48782.2020.9161890.
         2. G. Brando, A. Cervone, P. Franzese, S. Meo and L. Toscano, "Gain Scheduling control with minimum-norm pole-placement design of a Dual-Active-Bridge dc-dc converter," 2020 International Symposium on Power Electronics, Electrical Drives, Automation and Motion (SPEEDAM), 2020, pp. 846-851, doi: 10.1109/SPEEDAM48782.2020.9161846.

3. Cervone A., Brando G. (2020) Input-State Feedback Linearization of a Boost DC/DC Converter. In: Zamboni W., Petrone G. (eds) ELECTRIMACS 2019. Lecture Notes in Electrical Engineering, vol 615. Springer, Cham. https://doi.org/10.1007/978-3-030-37161-6_11

iii. Papers in Review

1. Energy saving in Battery Electric Vehicles equipped with Induction Machines and Modular Multilevel Converters
2. Optimized Control Strategy for Single-phase Multilevel Cascaded Converter in a Distributed PV-BESS System

iv. Books

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b. Patents

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5. Conferences and Seminars

a. **SPEEDAM 2020**
International Symposium on Power Electronics, Electrical Drives, Automation and Motion - 25th Edition
Virtual Meeting, June 24th - June 26th
Presentation of the paper "Optimal multi-harmonic current injection strategy for an asymmetrical nine-phase PMSM,"

6. Activity abroad

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7. Tutorship

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Credit Summary

	Credits year 1								Credits year 2								Credits year 3								PhD Extension					
		1	2	3	4	5	6			1	2	3	4	5	6			1	2	3	4	5	6		1	2				
	Estimated	bimonth	bimonth	bimonth	bimonth	bimonth	bimonth	Summary	Estimated	bimonth	bimonth	bimonth	bimonth	bimonth	bimonth	Summary	Estimated	bimonth	bimonth	bimonth	bimonth	bimonth	bimonth	Summary	bimonth	bimonth	month	Summary	Total	Check
Modules	30	0	0	3	15	9	9	36	10	0	0	4	0	6	0	10	10	0	3	0	0	0	0	3	0	0	0	0	49	30-70
Seminars	10	0,4	1,2	2	0	3	0,4	7	5	0	0,5	0,2	0	4	0	4,7	5	0	0,4	4,5	0	0	0,3	5,2	0	0	0	0	17	10-30
Research	20	5	0	5	0	20	0	30	40	5	7	8	10	5	5	40	40	10	10	5	10	10	5	50	3	3	2	8	128	80-140
	60	5,4	1,2	10	15	32	9,4	73	55	5	7,5	12	10	15	5	55	55	10	13	9,5	10	10	5,3	58	3	3	2	8	194	180

Third Year Activities

Year	Lecture/Activity	Type	Credits	Certification	Notes
3	Scientific Programming and Visualization with Python; Prof. Alessio Botta; (28-29/02/2020) 04-06/03/2020	Ad Hoc Module (Occasional)	3	x	Il corso, inizialmente previsto per il 27/28 Febbraio, è stato rimandato al 4/6 Marzo
3	How to Get Published with IEEE; Eszter Lukács (Online); 20/04/2020	Seminar	0,4	x	
	Network Systems, Kuramoto Oscillators, and Synchronous Power Flow; Lecturer: Prof. Francesco Bullo (University of California Santa Barbara - U.S.A.); 03/12/2020	Seminar	0,3	x	
3	Intensive School for Advanced Graduate Studies - A Smart Grid for Energy Management: the IoT approach; (Organized by University of Pavia); 8th -11th June 2020	Doctoral School	4,5	x	

SPEEDAM 2020

International Symposium on Power Electronics, Electrical Drives and Motion

Virtual Meeting, June 24th – June 26th

Certificate of Attendance

This is to certify that:

Mr. A. CERVONE

has attended the international Symposium SPEEDAM 2020, held remotely on June 24th – June 26th.

Mr. A. CERVONE has presented the following paper:

EMD1984 - Italy

Optimal multi-harmonic current injection strategy for an asymmetrical nine-phase PMSM

by: Cervone A., Slunjski M., Levi E., Brando G.

Prof. Andrea Del Pizzo
Symposium Chair

Andrea Del Pizzo

ID: 87

Università degli Studi di Napoli Federico II

Scuola Politecnica e delle Scienze di Base

Dipartimento di Strutture per l'Ingegneria e l'Architettura (DiSt)

Nei giorni **27-28 febbraio 2020**

Andrea Cervone

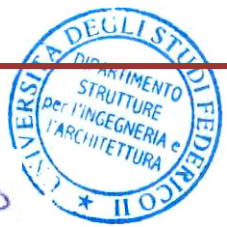
ha seguito il **corso breve**

Scientific Programming and Visualization with Python

ottenendo **3 crediti**

Il Coordinatore del Dottorato

Prof. Ing. Iunio Iervolino



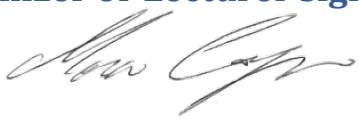
CREDITS ATTESTATION

PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

Seminar Title	Network Systems, Kuramoto Oscillators, and Synchronous Power Flow
Lecturer	Prof. Francesco Bullo (University of California Santa Barbara – U.S.A.)
Organizer	Dr. Ing. Marco Coraggio (Università degli Studi di Napoli Federico II) Prof. Mario di Bernardo (Università degli Studi di Napoli Federico II)
Date	03/12/2020
Student	Andrea Cervone
Cycle	XXXIII
Credits earned	0.3

Organizer or Lecturer signature



Above information are provided to attest that the student attended the seminar held in the indicated date.

Earned Credits depend on the student performance in the seminar activities and are provided and certified by the organizer or the lecturer. The standard number of earned credits is usually of 0.2 credits per seminar hour and are credited providing the student actively participated to the seminar. Extra activities subsequently performed by the student and related to the seminar content can lead to extra credits up to 1 credit per seminar hour. If the case, the organizer is kindly requested to shortly motivate the number of extra earned credits.

University of Pavia
PhD School of Electrical and Electronics Engineering and Computer Science
PhD School of Microelectronics

Intensive School for Advanced Graduate Studies
A Smart Grid for Energy Management: the IoT approach

Certificate of Attendance

I hereby certify that. Mr/Ms. Andrea Cervone, PhD student of XXXIII cycle, of University of Naples Federico II, has attended the following online course:

"A Smart Grid for Energy Management: the IoT Approach"

June 8-11, 2020 according to the enclosed program.

The course director
Prof. Paolo Di Barba
(Digitally signed document)

University of Pavia
PhD School of Electrical and Electronics Engineering and Computer Science
PhD School of Microelectronics

8th – 11th June 2020 – online sessions

	Monday, June 8, 2020	Tuesday, June 9, 2020	Wednesday, June 10, 2020	Thursday, June 11, 2020
09.00 10.45	09.00 Paolo Di Barba University of Pavia Introduction 09.30 Dario Zaninelli Politecnico di Milano Opening lecture	Piero Malcovati University of Pavia Measurement processes in electrical power networks 1	Slawomir Hausman Lodz University of Technology 5G and Industrial IoT 1	Maria Evelina Mognaschi University of Pavia Enviromental compatibility and human body exposure
11.00 12.30	Francesco Benzi University of Pavia Power network definition and tools 1	Piero Malcovati University of Pavia Measurement processes in electrical power networks 2	Slawomir Hausman Lodz University of Technology 5G and Industrial IoT 2	Francesco Gnesotto University of Padova The future of energy: smart grid and nuclear fusion
14.00 15.30	Ezio Bassi University of Pavia Power network definition and tools 2	Antonella Ferrara University of Pavia Control and state estimation in modern power networks	Pericle Zanchetta University of Nottingham and University of Pavia Smart transformers and power electronics for the smart grid 1	Virginia Canazza REF-E Srl, Milano Electricity market 1
16.00 17.30	Francesco Benzi University of Pavia Industrial IoT and smart metering	Andrea Mazzanti University of Pavia Synchronization with the Phase-Locked Loop (PLL)	Pericle Zanchetta University of Nottingham and University of Pavia Smart transformers and power electronics for the smart grid 2	Virginia Canazza REF-E Srl, Milano Electricity market 2

Abstract

Nowadays, the availability of renewable and innovative energy sources along with the standard thermal ones makes the bidirectional energy flow between the grid and distributed sources a key concept, thus requiring a smarter control (Smart Grid). In this respect, the course aims at giving a general overview of systems and devices, characterizing the smart grid, as well as an insight on models, algorithms and strategies for the optimal distribution of energy resources. This issue is of very current interest and in evolution, thanks to recent enabling technologies (IoT approach, cloud data, novel control strategies). On the other hand, however, all these topics are not yet fully considered in engineering curricula, so that the proposed Course aims at bridging the gap. The approach must include, as a primary goal, such relevant issues as a safe energy provision and environment sustainability, also asking for a systematic use of economic issues implied with the energy market. Therefore, the course covers a large spectrum of disciplines, asking for a coordinated approach and merging different skills covered in this proposal by expert speakers.
The course is mainly addressed to a broad audience including PhD students and young researcher, but also professional engineers operating in the industry area.

Organizing Committee
Francesco Benzi (Chair)
Paolo Di Barba
Roberto Galdi (Secretary)
Piero Malcovati

PhD Chairs
Paolo Di Barba
Piero Malcovati

Click **here** for the registration form

Info: info.cirste@unipv.it

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Advancing Technology for Humanity

Certificate of Completion

This is to certify that

Andrea Cervone

has successfully completed training for:

How to Get Published with IEEE

IEEE Client Services Team
www.ieee.org

Date: 04/20/2020
Time: 10:00
Duration: 2 hours