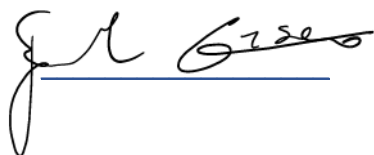

PhD in Information Technology and Electrical Engineering
Università degli Studi di Napoli Federico II

PhD Student: Emanuele Corsaro

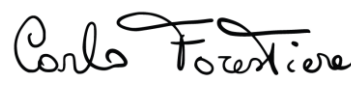
Cycle: XXXIX

Training and Research Activities Report

Year: First



Tutor: prof. Carlo Forestiere



Co-Tutor:

Date: October 31, 2024

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle:

Author:

1. Information:

- PhD student: Emanuele Corsaro
- DR number: DR997186
- Date of birth: 02/03/2000
- Master Science degree: Electrical Engineering University: Università degli Studi di Napoli “Federico II”
- Doctoral Cycle: XXXIX
- Scholarship type: DIETI PRIN
- Tutor: prof. Carlo Forestiere

2. Study and training activities:

Activity	Type ¹	Hours	Credits	Dates	Organizer	Certificate ²
How To Boost your PhD	PhD Course	18	5	10-17-24-31/01/24 7/02/24	Prof. Antigone Marino	Y
Scuola Nazionale dei Dottorandi di Elettrotecnica “Ferdinando Gasparini”, 26° Stage	PhD School	20	4	05/02/24 - 9/02/24	CREATE	Y
Can the Physics of Complex Systems Simplify Our Understanding of Seismic Occurrence?	Seminar	1	0.2	29/02/24	Scuola Superiore Meridionale	Y
Introduction to Parallel Computing with MPI and OpenMP	Ad hoc course	15	3	06/03/24 08/03/24	CINECA	Y
Introduction to FORTRAN for Scientific Computing	Ad hoc course	24	3	18/03/24 21/03/24	CINECA	Y
Stupor Quanti	Seminar	1.5	0.3	22/03/24	Dipartimento di Fisica Ettore Pancini	Y
Spline approximation and numerical solution of partial differential equations with Isogeometric Analysis	Seminar	1	0.2	04/04/24	Scuola Superiore Meridionale	Y
Activity	Type ¹	Hours	Credits	Dates	Organizer	Certificate ²

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle:

Author:

Plasmonica International School on Plasmonics and Nano-optics	PhD School	35	4	03/06/24 – 07/06/24	PLASMONICA	Y
IEEE Authorship and Open Access Symposium: Tips and Best Practices to Get Published from IEEE Editors	Webinar	1.5	0.4	07/05/24	IEEE	Y
On the single allocation hub location problems: new formulation and solving methods	Seminar	1	0.2	26/06/24	ITEE Proff.: C. Sterle, M. Boccia, A. Masone	Y
Using support vector machines for feature selection and outlier detection	Seminar	1	0.2	26/06/24	ITEE Proff.: C. Sterle, M. Boccia, A. Masone	Y
Real-Time resource management for adaptive embedded systems and application	Seminar	1	0.2	26/06/24	ITEE Prof. M. Cinque	Y
Resource management and orchestration for mixed-critically cloud/distributed systems	Seminar	1	0.2	27/06/24	ITEE Prof. M. Cinque	Y
Electromagnetic Metamaterials and Metasurfaces	Seminar	8	1	14/07/24	IEEE APS/URSI 2024 Prof. A. Alù	Y
Power and Analog Electronics: Design, Control and Architecture	Seminar	18	2	02/07/24 – 04/07/24	ST Microelectronics Ing. F. Bonavolotà	Y
Advanced Computational Electromagnetics	Course	40	3.5	16/09/24 – 20/09/24	European School of Antennas Politecnico di Torino	Y
Learning in Nonstationary Environments	Seminar	2	0.4	15/10/24	ITEE Prof. C. Sansone	Y

- 1) Courses, Seminar, Doctoral School, Research, Tutorship
- 2) Choose: Y or N

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle:

Author:

2.1. Study and training activities - credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	-	-	7	-	7
Bimonth 2	9	0.2	6	-	15.2
Bimonth 3	6	0.5	6	-	12.5
Bimonth 4	4	1.2	7	-	12.2
Bimonth 5	-	3	5	-	8
Bimonth 6	3.5	0.4	7	-	10.9
Total	22.5	5.3	38	0	65.8
Expected	30 - 70	10 - 30	80 - 140	0 - 4.8	

3. Research activity:

My research activity is focused on Theoretical and Computational Electrodynamics, specifically on metamaterials, metasurfaces, and nano-optics. Metasurfaces are collections of interacting subwavelength scatterers that are versatile in shaping and manipulating electromagnetic waves for various applications, including analog computing, biosensors, and imaging. Metalenses are one common class of metasurfaces, in which the unit cells are designed to impart a specific, position-dependent phase shift to transmitted light, resulting in a global focusing effect. The accurate simulation of metasurfaces and metalenses, with efficient use of time and memory, is essential for understanding their fundamental properties and optimizing performance. However, this poses significant challenges for general-purpose computational methods due to the large electric dimensions and multiscale nature of these structures. During my first PhD year, we introduced an efficient computational method specifically tailored for electromagnetic scattering by large metasurfaces. This method leverages the Poggio-Miller-Chang-Harrington-Wu-Tsai (PMCHWT) formulation, and combines the Multilevel Fast Multipole Algorithm (MLFMA) with a representation of the unknown equivalent surface current density using static modes, a set of entire domain basis functions dependent only on object shape but independent of the material and frequency.

4. Research products:

E. Corsaro, G. Miano, A. Tamburrino, S. Ventre, C. Forestiere, *Multilevel Fast Multipole Algorithm for Electromagnetic Scattering by Large Metasurfaces using Static Mode Representation*, IEEE Transactions on Antennas and Propagation, 2024.

Status: Submitted

5. Conferences and seminars attended

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle:

Author:

I presented the conference paper:

E. Corsaro, G. Miano, A. Tamburrino, S. Ventre, C. Forestiere, *Fast Multipole Algorithm for Electromagnetic Scattering from Particle Arrays using a Static Modes Basis*.

Conference: 2024 IEEE International Symposium on Antennas and Propagation and ITNC-USNC-URSI Radio Science Meeting. 14-19 July 2024 - Florence, Italy

6. Activity abroad:

7. Activity in partner companies:

8. Tutorship