PERSONAL INFORMATION

Lorenzo Crocco

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IREA - Institute for Electromagnetic Sensing of the Environment
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Gender M | *Date* *Nationality* Italian

PhD date 10/01/2000	☐ **<10 years** from the date of the first PhD considered for the calculation of the eligibility period is the date of phd thesis defense (Cut-off date: PhD awarded from 15 March 2012)	■ **>10 years** from the date of the first PhD considered for the calculation of the eligibility period is the date of phd thesis defense Cut-off date: PhD awarded from 15 March 2012

Enterprise	University	EPR
☐ Management Level	☐ Full professor	■ Research Director and 1st level Technologist / First Researcher and 2nd level Technologist / Principal Investigator
☐ Mid-Management Level	☐ Associate Professor	☐ Level III Researcher and Technologist
☐ Employee / worker level	☐ Researcher	☐ Researcher and Technologist of IV, V, VI and VII level / Technical collaborator

EMPLOYMENTS

2020 - **Research Director**

National Research Council of Italy (CNR)

IREA - Institute for Electromagnetic Sensing of the Environment

- Electromagnetic Diagnostic Group, MeDEm (Medical Electromagnetics) Lab

The research activities of Lorenzo Crocco address the development of modelling, methodologies and computational tools for electromagnetic scattering applications, with a particular attention to microwave imaging for medical non-invasive diagnostics, possibly exploiting contrast agents, treatment monitoring and follow-up, synthesis of optimal exposure systems for therapeutic uses of electromagnetic fields and development of dual-use (diagnostic/therapeutic) devices. In the last years, a specific effort has been devoted to the development of novel microwave devices for brain stroke diagnostics and thermal ablation treatment monitoring. More recently, the research work is investigating the potential of microwave technology for diagnosis and treatment of Alzheimer's disease using ad-hoc designed systems and machine learning processing tools.

Besides research activities, LC is currently involved in several research management duties:

- **Member of the Delegate Assembly of the European Association for Antennas and Propagation (EurAAP)**, Delegate group3 Italy, San Marino, Vatican city (2024 -)
- **Member of the Scientific Board of DIITET-CNR** (Engineering, ICT e Technologies for Energies and Transportations Department of CNR) Elected member – representative of Researchers (2019 – 2023 and 2023 -)
- **Member of CNR-URSI commission** - Commission K – Electromagnetics in biology and medicine (2019 -)
- **Member of the IEEE MTT-28 TC -** Biological Effects and Medical Applications Committee (2018 -)
- **Member of the Scientific Board** (Consiglio Scientifico) of Italian Electromagnetic Society (SIEm) (2017 -)
- **Board Member at ESOA** – European School of Antennas (2014 -)

2010-2020 - **Senior Researcher**

National Research Council of Italy (CNR) - IREA - Institute for Electromagnetic Sensing of the Environment

2001-2010 - **Researcher**

National Research Council of Italy (CNR) - IREA - Institute for Electromagnetic Sensing of the Environment

2000-2001 - **Post-doc Research Assistant (Assegno di Ricerca)**

Federico II University of Naples, ITALY

- Applied Electromagnetics research group

EDUCATION AND ACADEMIC DEGREES

1996-2000 PhD in applied electromagnetics

University of Napoli, Federico II, Italy

- Advisors: prof. O.M. Bucci, prof. T. Isernia
- Title of thesis: "Microwave subsurface sensing: retrievable information and novel inversion approaches"
- degree at final exam: excellent
- The research activity was devoted to the development of solution approaches for both the forward and inverse scattering problems for subsurface imaging applications.
- University of Napoli, Federico II, Italy

1989-1995 Laurea Degree in Electronic Engineering

University of Napoli, Federico II, Italy

- 110/110 cum laude

ACHIEVEMENTS AND AWARDS

Awards

U.R.S.I. Young Scientist Award at XXVIII URSI General Assembly, New Delhi, India, 2005

National Research Council Award for the 100 best CNR young researchers (under 40), for the achievements obtained in 2005, (awarded in 2009).

"Giorgio Barzilai" award for Young Researchers - Italian Electromagnetic Society (SIEm), 2004

U.R.S.I. Senior Member, 2020

National Scientific Habilitation - Full Professor, Electromagnetic Fields (09/F1), 2018

IEEE Senior Member, 2010

Fellow of the ElectroMagnetics Academy (TEA), 2007

Editorial activity

IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology, **Associate Editor (2017 -)**

Diagnostics, **Editorial board member (2017 -)**

International Journal of Antennas and Propagation, **Editorial board member (2012-2023)**

Guest Editor for Special Issues in ISI journals (2017 -)

- Near Surface Geophysics,

- Inverse Problems,
- IEEE Journal on Selected Topics in Advanced Remote Sensing,
- International Journal of Antennas and Propagation
- Diagnostics
- IEEE Antennas and Propagation Magazine
- Sensors

Technical Panel Committee Member at International Conferences

- IMBioC - IEEE International Microwave Biomedical Conference
- EUCAP – European Conference on Antennas and Propagation
- PIERS – Progress in Electromagnetic Research Symposium
- OSA Topical Meeting "Mathematics in Imaging"
- IGARSS – International Geoscience and Remote Sensing Symposium

Session Convener/Organizer at International Conferences

- EUCAP – European Conference on Antennas and Propagation
- PIERS – Progress in Electromagnetic Research Symposium
- URSI GASS – International Union of Radio Science General Assembly
- IGARSS – International Geoscience and Remote Sensing Symposium

Major invited presentations (2017-2023)

Invited presentation at the 2023 PhotonIcs and Electromagnetics Research Symposium (PIERS), Prague, Czech Republic, 2023: *Physics-assisted Deep-learning for Microwave Tomography: Merging Inverse Scattering Techniques with Artificial Intelligence*

Invited Speaker at the 2022 IEEE International Microwave Biomedical Conference (IMBioC), Suzhou, China, 2022: *On the Design of Microwave Imaging Devices for Medical Applications*

Invited presentation at 2022 International Workshop on Antenna Technology (iWAT): M. Wang et al. *A Microwave Imaging System Prototype for Liver Ablation Monitoring: Design and Initial Experimental Validation*

Invited presentation at 2021 15th European Conference on Antennas and Propagation (EuCAP), 2021: A. Yago, M. Cavagnaro and L. Crocco, *Deep Learning-Enhanced Qualitative Microwave Imaging: Rationale and Initial Assessment*

Invited Speaker at the Italian URSI Annual Meeting Pisa, Italy, 2019: *A portable microwave imaging device for brain stroke monitoring*

Invited presentation at 2018 IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting: M. T. Bevacqua, R. Palmeri, T. Isernia and L. Crocco, *Some Considerations on the Physical Meaning of Orthogonality Sampling Method*

Invited presentation at 2017 11th European Conference on Antennas and Propagation (EUCAP): M. N. Stevanovic, R. Scapaticci and L. Crocco, *Brain stroke monitoring using compressive sensing and higher order basis functions*

Grants (2017-2023)

"Broadband Electromagnetic Sensing Technologies for Food quality and security assessment" - Research Project of National Interest (PRIN2017, 2020-2023), **Principal Investigator**

H2020 Marie Slodowskwa-Curie Innovative Training Network "EMERALD - ElectroMagnetic imaging for a novel genERation of medicAL Devices" (2018-2022), **Principal Investigator for the IREA research unit**

"MIBRASCAN: Microwave Brain Scanner for Cerebrovascular Diseases Monitoring"

Research Project of National Interest (PRIN2015, 2017-2020), **Principal Investigator for the IREA research unit**

COST Action CA17115, MyWave "European network for advancing Electromagnetic hyperthermic medical technologies", **Management Committee Member** for Italy (2018-2023) and **Working group leader** (2018-2019)

ADDITIONAL INFORMATION

Publications

Lorenzo Crocco has authored more than 130 scientific publications on international peer review journals, as well as three book chapters. He has edited two books and several pecial issues on scientific journals as well as conference proceedings.

He is listed in the **August 2021 Updated science-wide author databases of standardized citation indicators** (single year 2020, career 2020).

H index: 38 (scopus); 45 (gs)

<selected publications>

- Electromagnetic Imaging for a Novel Generation of Medical Devices - Fundamental Issues, Methodological Challenges and Practical Implementation, Francesca Vipiana, Lorenzo Crocco (Eds.), Lecture Notes in Bioengineering, Springer Cham Switzerland AG 2023
- Yago Ruiz, Á; Nikolic Stevanovic M.; Cavagnaro, M.; Crocco, L., " A deep learning enhanced inverse scattering framework for microwave imaging of piece-wise homogeneous targets", Inverse Problems 40 045001, 2024
- Zappia S. *et al.*, "Nondestructive Characterization of Magnetic Polymeric Scaffolds Using Terahertz Time-of-Flight Imaging," IEEE Transactions on Terahertz Science and Technology, vol. 13, no. 4, pp. 305-315, July 2023
- Yago Ruiz, Á.; Cavagnaro, M.; Crocco, L. Hyperthermia Treatment Monitoring via Deep Learning Enhanced Microwave Imaging: A Numerical Assessment. Cancers 2023, 15, 1717
- Yago Ruiz, Á.; Cavagnaro, M.; Crocco, L. An Effective Framework for Deep-Learning-Enhanced Quantitative Microwave Imaging and Its Potential for Medical Applications. Sensors 2023, 23, 643
- Á. Yago Ruiz, M. Cavagnaro and L. Crocco, A Physics-Assisted Deep Learning Microwave Imaging Framework for Real-Time Shape Reconstruction of Unknown Targets, in IEEE Transactions on Antennas and Propagation, vol. 70, no. 8, pp. 6184-6194, Aug. 2022
- M. Ricci et al. Multi-Antenna System for In-Line Food Imaging at Microwave Frequencies, IEEE Transactions on Antennas and Propagation, vol. 70, no. 8, pp. 7094-7105, Aug. 2022
- M.C. Wang, L. Crocco and M. Cavagnaro, On the Design of a Microwave Imaging System to Monitor Thermal Ablation of Liver Tumors, IEEE Journal of Electromagnetics RF and Microwaves in Medicine and Biology, Vol. 5, pp. 231-237, 2021
- J.A. Tobon Vasquez et al., A Prototype Microwave System for 3D Brain Stroke Imaging. Sensors 2020, 20, 2607.
- G. G. Bellizzi, T. Drizdal, G. C. van Rhoon, L. Crocco, T. Isernia & M. M. Paulides Predictive value of SAR based quality indicators for head and neck hyperthermia treatment quality, International Journal of Hyperthermia, 36:1, 455-464, 2019
- M. Bevacqua, G. G. Bellizzi, T. Isernia, and L. Crocco, "A Method for Effective Permittivity and Conductivity Mapping of Biological Scenarios via Segmented Contrast Source Inversion," Progress In Electromagnetics Research, Vol. 164, 1-15, 2019.
- R. Scapaticci, J. Tobon, G. Bellizzi, F. Vipiana and L. Crocco, "Design and Numerical Characterization of a Low-Complexity Microwave Device for Brain Stroke Monitoring," in IEEE Transactions on Antennas and Propagation, vol. 66, no. 12, pp. 7328-7338, 2018
- O. M. Bucci, L. Crocco, R. Scapaticci and G. Bellizzi, "On the Design of Phased Arrays for Medical Applications," in Proceedings of the IEEE, vol. 104, no. 3, pp. 633-648, 2016
- R. Scapaticci, O. M. Bucci, I. Catapano, L. Crocco, "Differential Microwave Imaging for Brain Stroke Follow-up", International Journal of Antennas and Propagation, vol. 2014, Article ID 312528, 11 pages, 2014.
- D. A. M. Iero, L. Crocco and T. Isernia, "Thermal and Microwave Constrained Focusing for Patient-Specific Breast Cancer Hyperthermia: A Robustness Assessment," in IEEE Transactions on Antennas and Propagation, vol. 62, no. 2, pp. 814-821, 2014
- R. Scapaticci, L. Di Donato, I. Catapano, and L. Crocco, "A Feasibility Study on Microwave Imaging for Brain Stroke Monitoring," Progress In Electromagnetics Research B, Vol. 40, 305-324, 2012.

Napoli 10-03-2024

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