European School of Antennas and Propagation

2025

ESoA courses

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OBJECTIVES

ESoA was founded in 2004 by a group of institutions in the framework of the FP6 Network of Excellence "ACE" (Antenna Centre of Excellence) and it was afterwards financed in FP7 by a Marie Curie Action (MCA) project till 2007.

From 2008 ESoA is part of EuRAAP.

The ESoA courses are distributed in the most accredited European research centers on antennas and propagation in Europe.

Reinforcing the European excellence in EM engineering with emphasis on antennas;

Creating an effective advanced formative offer at international level to complete individual PhD curricula;

Increasing the ties in research and development between Universities and Industries on an European scale;

Facilitating the interchange of ideas among early-stage researchers and trainers as well as among young researchers, thus increasing the future mobility and synergy.

ENLARGE YOUR NETWORK

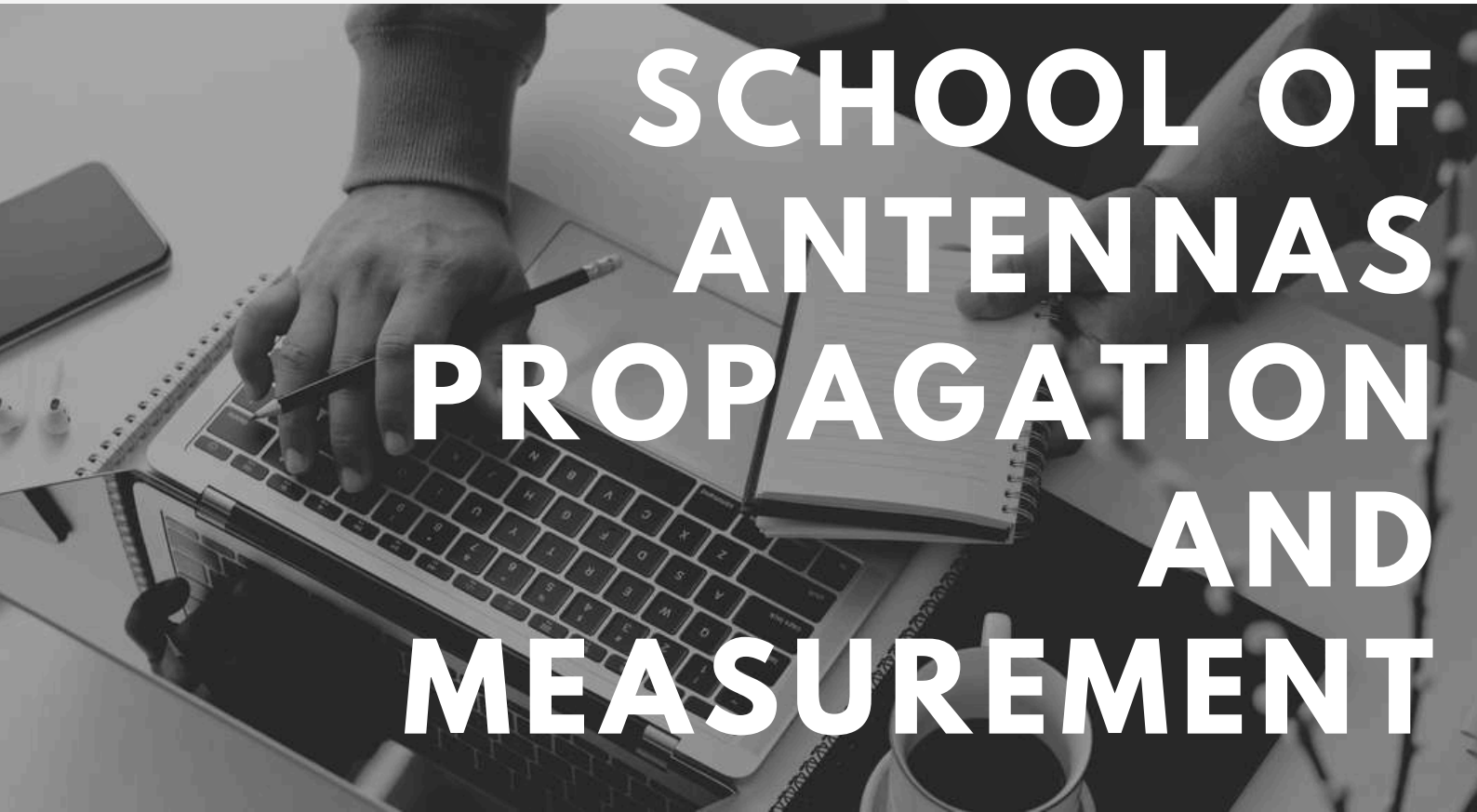
REGISTRATION FEE

The price is the same for all courses.

- 550 € for a full time university student
- 1100 € for others (lunch included in the price)

You will receive a certificate at the end of the course and an invoice with the information of the course for any accounting purpose.

All ESoA courses are conducted in person, and we are delighted to reunite with you face-to-face. Additionally, for certain courses, an online option may be accessible. If you have any inquiries, please don't hesitate to reach out to the respective coordinators



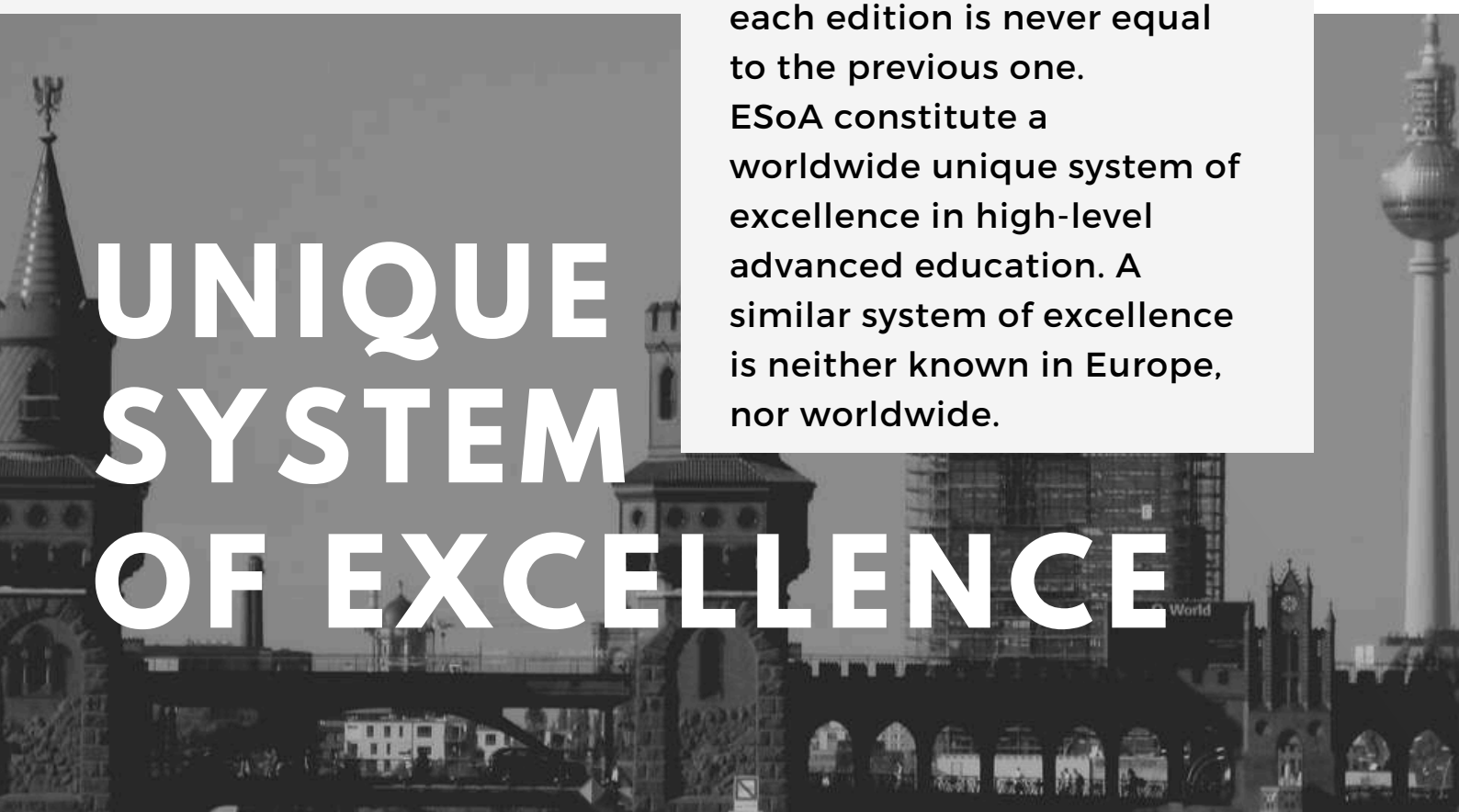
SCHOOL OF ANTENNAS PROPAGATION AND MEASUREMENT

FEATURES

The most attractive feature of ESoA is the fact that it is geographicall y distributed, giving the students a unique opportunity to attend courses in the most relevant Scientific Centers of Excellence, and to attend lectures from the best local and visiting instructors.

Simultaneously, the instructors learn from their colleagues different way to teach. ESoA includes the best 100 teachers in Europe, among which they are seventeen IEEE Fellows, and many other lecturers. ESoA is attended by an average of 220 students per year, with a peak of 450 students in 2023.

The courses are continuously updated and each edition is never equal to the previous one.
ESoA constitute a worldwide unique system of excellence in high-level advanced education. A similar system of excellence is neither known in Europe, nor worldwide.



UNIQUE SYSTEM OF EXCELLENCE

GOVERNANCE

Stefano Maci
European School of
Antennas Chair

The ESoA board is composed by 40 members. These members are from each affiliated institution, who are also coordinators of courses. Moreover, the ESoA board also includes members from European Space Agence (ESA), European Microwave Association (EuMA), the Institute of Engineering and Technology (IET), IEEE Antennas and Propagation Society (IEEE AP-S) and EurAAP Working Group of Propagation.

The ESoA Board meets two or three times per year and gets continuously stimulus to updating the courses and introducing new ones. The coordinators of the courses improve the content of each edition to maintain each course at the state-of-the-art level. Several new junior professors are included in the structure when they reach the right maturity, and in doing so, the ESoA board members perform a talent scouting action in conferences.

EsoA also constitutes a strong tool for improving the dialogue between the universities and the industries, giving thereby employment opportunities to students.

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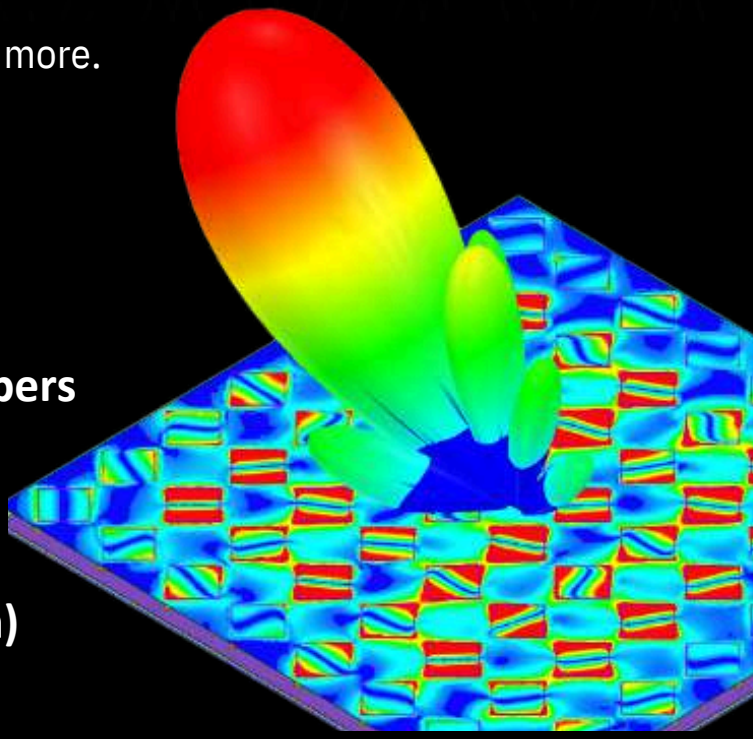

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Contact Mauricio Dwek.(Mauricio.Dwek@ansys.com)

Thank You

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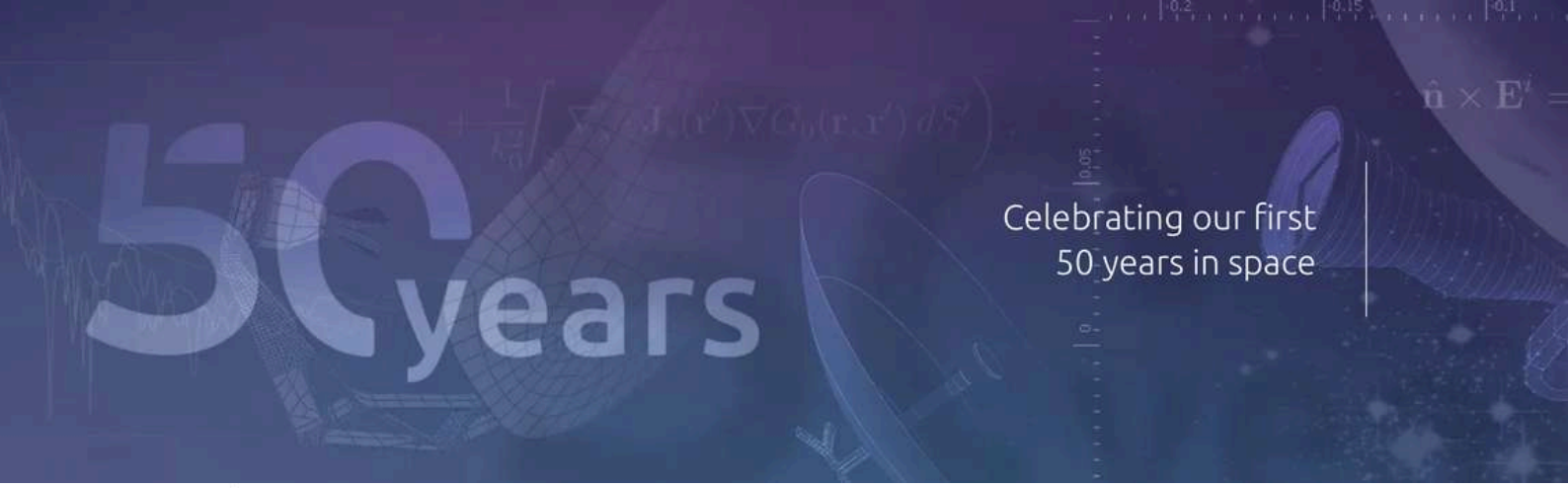

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TICRA Foundation

TICRA is organised as a commercial foundation, the TICRA Foundation. The TICRA Foundation supports the electro-technical engineering science community by distribution of grants. As examples, the TICRA Foundation has distributed grants to research projects and test equipment as well as travel grants for university students and staff.

TICRA Foundation Grant Policy

The objectives of the Foundation are to offer engineering consultancy and related services and to support higher education and research within the electro technical engineering sciences in Denmark or abroad.

The Board of Directors distributes grants according to the TICRA Foundation objectives. Each year, the provision for distribution equals at least 10% of the net profit of the year (before tax) with a minimum amount of DKK 10,000 annually.

If the Board of Directors, in any given year, does not find the need to distribute the entire provision available, the excess amount is transferred for distribution in the following years. Grants may be awarded without application, why postings of any kind under this Foundation are not required prior to the distribution of grants.

It is possible to send an application to the TICRA Foundation. The application must be submitted by email to ticra@ticra.com and marked "Application to the TICRA Foundation". The application will be evaluated within 3 months. The result of the evaluation, i.e. whether a grant is awarded or not, is sent by email to the applicants within two weeks after the evaluation.

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ESoA

A way to excellence

European School of Antennas and Propagation

1 DIAGNOSTIC AND THERAPEUTIC APPLICATIONS OF ELECTROMAGNETICS

10-14 February *Turin, Italy*

Coordinators	**G. Vecchi, L. Crocco**

Purpose of the course

Electromagnetic (EM) fields are increasingly used in the clinical practice both in diagnostics and therapeutic applications. Examples include Magnetic Resonance Imaging for the diagnosis, and electromagnetic hyperthermia and thermal ablation for therapies. Additionally, new applications are under developments, as e.g., radar-based monitoring and microwave tomography. All these applications need to understand and exploit the interaction of the electromagnetic fields with the human body. This course aims at introducing this interdisciplinary area to the interested audience in the electromagnetic community, providing the basis of bioelectromagnetics, the ability to understand the issues of medical applications of EM fields and the overlie of the specific challenges faced by EM engineerings in the design of the devices. The course is primarily conceived for Doctoral students and early-career researchers with an engineering or physics background.

Prerequisites	basics of antennas and microwaves, basic knowledge of electromagnetics and mathematics
Course Duration	5 days = 40 hours
Expected speakers	A. Arduino, INRIM (IT) F. Andriulli Politecnico di Torino (IT) S. Romeo, IREA-CNR (IT) G. Tiberi, UBT srl /UBT Ltd (IT/UK) J. Tobon, Wavision srl (IT)

2025

European School of Antennas and Propagation

2 ANTENNA AND RECTENNAS FOR IOT APPLICATIONS

24-28 February *Nice, France*

Coordinator	**L. Lizzi**

Purpose of the course

The course provides a deep insight on antenna and RF energy harvesting systems for IoT applications. It presents the latest developments on this topic leveraging on internationally recognized antenna experts. The course contents include physical bounds of miniature antennas based on stored energy, antenna miniaturization and integration techniques, low-power antenna reconfiguration techniques, design and measurements of RF harvesters, measurement techniques for miniature integrated antennas. The course addresses both theoretical and experimental aspects giving the students the abilities and competences to design, realize and measure a miniature IoT wireless terminal powered with an RF harvester. The course includes both lectures and labs/project sessions. State-of-the art measurement facilities will be used for the experimental labs.

Prerequisites	none
Course Duration	4,5 days = 30 hours
Expected speakers	Leonardo Lizzi, Université Côte d'Azur (UCA) Fabien Ferrero, Université Côte d'Azur (UCA) Lars Jonsson, KTH Royal Inst. of Technology Joseph Costantine, American Univ. of Beirut Youssef Tawk, American Univ. of Beirut (AUB)

2025

European School of Antennas and Propagation

3 MICROWAVE IMAGING AND DIAGNOSTICS

10-14 March *Genoa, Italy*

Coordinators	**A. Randazzo, L Crocco, T. Isernia, A. Massa**

Purpose of the course

The exploitation of electromagnetic field data as a sensing tool paves the way to a number of interesting engineering applications: antenna testing and characterization, biomedical diagnostics, humanitarian demining, archeological prospection, through-the-wall imaging, non-destructive testing of transport infrastructures and buildings, and many others.

This course, after reviewing fundamental equations and main difficulties of inverse problems, will focus on classical and recently introduced solution procedures and algorithms, discussing capabilities, limitations, and perspectives of both approximate and 'exact' reconstruction methods. Applicative examples, including exercises, laboratory activities and lessons regarding specific applications, will corroborate the developed concepts.

Prerequisites	Basics of antennas and microwaves, basic knowledge of electromagnetics and mathematics
Course Duration	5 days = 30 hours
Expected speakers	Lorenzo Crocco Benjamin Fuchs Tommaso Isernia Joe LoVetri Maokun Li Andrea Massa

2025

European School of Antennas and Propagation

4 INDUSTRIAL ANTENNA DESIGN

7-11 April *Kamp-Lintfort, Germany*

Coordinators	**W. Simon, D. Manteuffel**

Purpose of the course

The design of antennas for commercial applications like mobile phones, laptop computers, WLAN mobile devices and antennas for automotive communication and 5G systems is driven by many more issues in addition to the antenna concept. In such industrial projects the antenna design is one part in the whole chain of development. Therefore, the antenna designer has to collaborate with teams from many other disciplines like mechanical design, compliance testing, etc. in order to arrive at a good product. During the design of the product, the antenna designer should be able to anticipate the influence of possible changes in the product specifications and be flexible to adapt his antenna concept to the next design step. Furthermore, the designer has to ensure that his design is reliable and cost efficient. As last point the designer has to present his solution to the customer.
This course on “Industrial Antenna Design” aims to prepare the participants for this kind of work. The course will cover lectures, practical work and team-based project work using state of the art design tools and applications.
This year’s edition of the “Industrial Antenna Design“ course will focus on the design of automotive radar and 5G antennas.

Prerequisites	basic radio frequency electromagnetic knowledge
Course Duration	5 days = 32 hours
Expected speakers	Dirk Manteuffel, University Hannover Marta Martinez, Renesas Electronics Europe GmbH (tbc) Abderrahim Moumen, EPO (tbc) Aline Friedrich, IMST Winfried Simon

2025

European School of Antennas and Propagation

5 BODY CENTRIC WIRELESS COMMUNICATION : FROM DEVICES, SYSTEMS TO APPLICATIONS

28 April - 2 May *London, UK*

Coordinators	**A. Alomainy, Y. Hao**

Purpose of the course

The course addresses the main issues related to body-centric wireless communications from antennas and radio propagation prospective including measurement techniques, statistical analysis, analytical and numerical studies and system-related aspects of such communication networks.

The course will introduce the current state-of-the-art and potential development in the area including challenges and theoretical limitations of applying conventional concepts at higher frequencies for 5G and beyond including Terahertz bands. Concepts such as diversity antennas, textile electronics, mm-wave systems, wideband communications, etc. will be covered in this course with relation to theoretical and practical aspects.

Prerequisites	Basic knowledge on antennas, electromagnetism and radio propagation
Course Duration	5 days = 25 hours
Expected speakers	John Batchelor, Professor, University of Kent, UK Maxim Zhadobov,0Profssor, IETR, France Hendrik Rogier, Professor, Ghent University, Belgium Yang Hao, Professor, QMUL, UK Koichi Ito, Professor, Chiba University, Japan John Volakis, Professor, Florida International Univ., USA

2025

European School of Antennas and Propagation

6 ANTENNA MEASUREMENTS FOR MILLIMETER AND SUBMILLIMETER WAVELENGTHS

5-9 May *Espoo, Finland*

Coordinators	**T. Zachary**

Purpose of the course

- The lectures include the following: (1) mm- and submm-wave instrumentation, (2) near-field scanning, (3) near-field to far-field transformation, (4) compact antenna test range (CATR), (5) CATR realizations based on reflectors, lens, or holograms, (5) quiet-zone testing and antenna testing in a CATR, (6) antenna pattern correction techniques, and (7) testing of small integrated antennas.
- The laboratory demonstrations (exercises) include the following: (1) vector measurements up to 1THz, (2) scanning of near-field – computation of the far-field pattern, (3) antenna measurement in a hologram CATR, (4) elimination of disturbing scatterer effect in a CATR, and (5) on-wafer antenna measurement through reflection coefficient measurement.

Participants have a choice to study a related specific topic prior to the short course, write a brief report, and present that to other participants during the course.

Prerequisites	basics of antennas and microwaves, basic knowledge of electromagnetics and mathematics
Course Duration	5 days
Expected speakers	Zachary Taylor Ville Viikari Juha Ala-Laurinaho Juha Mallat Aleksi Tamminen Manuel Sierra Castañer Thomas Crowe Sergiy Pivnenko

2025

European School of Antennas and Propagation

7 ANTENNA SYSTEMS FOR NEXT GENERATION COMMUNICATION (FROM 5G TO 6G)

12-16 May — Gothenburg, Sweden

Coordinators	**R. Saleau, J. Yang, S. Maci**

Purpose of the course

The 5G communication technology will bring new experiences including higher bandwidth, higher data rate or greater capacity, security, and lower latency and will create new opportunities for society, businesses. The 5G technologies under development include novel multiple access strategies, ultra-dense networking, all-spectrum access, massive MIMO, full digital beamforming or hybrid beam forming etc. The realization of these high level technologies brings about new challenges for the physical infrastructure designers in which the antennas play a key role.

This course presents the latest research results on 5G antenna systems, where some significant and promising results relevant from industrial perspective are covered. The teaching team includes well-recognized worldwide researchers in academia and industry, covering the area of 5G antenna systems research and developments.

Prerequisites	Basic knowledge on antennas and electromagnetism
Course Duration	5 days = 25 hours
Expected speakers	Jian Yang, Chalmers, Sweden Antonio Clemente, France Shuai Zhang, Denmark Nima jamaly, Switzerland Roberto Flamini, Italy Ashraf Zaman, Sweden Halim Boutayeb, Canada

2025

European School of Antennas and Propagation

8 COMPACT ANTENNAS FOR SENSOR SYSTEMS

26 - 30 May *Barcelona, Spain*

Coordinators	**L. Jofre, A. Skrivervik**

Purpose of the course

Wireless small antenna systems for pervasive sensing are becoming a critical part of the growing world of the IoT for applications covering communication and sensing purposes. The course will cover from the modeling and designing principles of compact antennas to the fabrication technologies for communications and sensing applications. Special emphasis will be placed on:

a) the concepts (radiation principles, dielectric parameters and environment characterization) relevant for the design of electrically compact antennas from microwaves to millimeter-wave,
b) the fabrication constrains in terms of materials and fabrication (tolerances and techniques, specific antenna environments like biological tissues), and
c) applications covering wireless small antenna systems for pervasive sensing for the growing world of the IoT, for applications ranging from smart city, urban mobility, new industry or medical care covering the ISM (Industrial, Scientific and Medical) fields. A special emphasis will be given to applications requiring implantable antennas. The participants will design antennas, with different analytical and software tools and asses their directivity, efficiency, and wireless link performance with both experimental and computational methods and a realistic.

Prerequisites	Basic and applied electromagnetics
Course Duration	5 days = 37 hours
Expected speakers	Prof. Luis Jofre Prof. Anja Skrivervik Denys Nikolvev Sema Dumanli Prof. J. Romeu Prof. J.M. Rius Prof. S. Blanc

2025

European School of Antennas and Propagation

9 SATELLITE MW REMOTE SENSING – From the basic techniques to the end-to-end system design

2-6 June

Noordwijk, Netherlands

Coordinators	**C-C Lin; S. D'Addio**

Purpose of the course

The satellite microwave (MW) remote sensing uses the electromagnetic spectral domain from the medium radio-frequency to the sub-millimeter-wavelength region. MW sensors on board the low-Earth-orbiting meteorological satellites deliver crucial data for the numerical weather prediction applications. Europe's Copernicus/Sentinel satellites provide operational ocean, land and air quality information services to multitude of institutional and commercial users. Earth science missions address specific questions associated with the bio- and geo-physical Earth system for better understanding the underlying mechanisms leading to the climate change.

This is a practice-oriented course aimed at introducing the participants to the design of various MW instruments used for satellite-based Earth observations. It also covers the design, development and operations of a complete satellite system for them to gain an understanding of the overall end-to-end process and of strong inter-dependencies between the payload and the system, all driven by corresponding mission objectives

Prerequisites	Basic knowledge of electromagnetic theory and microwave engineering
Course Duration	4,5 days = 35 hours
Expected speakers	Chung-Chi Lin Salvatore D'Addio Alberto Tobias Michel Tossaint Nicolas Floury Maarten van der Vorst

2025

European School of Antennas and Propagation

10 ADVANCED MATHEMATICS FOR ANTENNA ANALYSIS

2-6 June

Dubrovnik, Croatia

Coordinators	**S. Maci, Z. Sipus**

Purpose of the course

The objective of this course is to explain the mathematical methods used in computational antenna analysis and to provide students with mathematical background necessary for advanced antenna engineering and electromagnetic software development. This course can also serve as a mathematical introduction to other ESoA courses. The course will cover different approaches to solving wave equations, various wave representations, and mathematical theorems used to simplify the original electromagnetic problem. In this sense, the aim of this course is to help students gain a deeper understanding of which field representation is suited for a given complex electromagnetic problem.
The topics of the course are:
(1) Fundamental theorems framed in the antenna analysis, (2) Complex analysis, (3) Construction of solutions, (4) Waves: scalar wave equation, (5) Fields: vector wave equation, (6) Asymptotic evaluation of integrals, and (7) Periodic structures.

Prerequisites	No prerequisites needed.
Course Duration	5 days (40 hours)
Expected speakers	Angelo Freni Stefano Maci Anja Skrivervik Giuseppe Vecchi Zvonimri Sipus

2025

European School of Antennas and Propagation

11 CHARACTERISTIC MODES: THEORY AND APPLICATIONS

9-13 June *Lund, Sweden*

Coordinators	**D. Manteuffel, BK Lau, M. Ferrando-Bataller, P. Hazdra**

Purpose of the course

Characteristic mode (CM) theory has received a great deal of attention in the field of antenna engineering in recent years and is one of the best choices to gain thorough physical insight to explain antenna (generally scaterrer) operating mechanism. The antenna analysis, based on CM framework, provide a set of characteristic modes which are dependent only on antenna shape, material and frequency, but not on actual feeding.Its attractive features are mainly useful in terms of the designs of small antennas and reconfigurable antenna systems. This course cover both theoretical and practical aspects of the CMs as well as individual work with in-house and commercial software tools.

- http://esoa.elmag.org
- www.antennatoolbox.com

Prerequisites	Good knowledge of EM theory
Course Duration	5 days = 30 hours
Expected speakers	Marta Cabedo Fabrés, UP Valencia Eva Antonino Daviu, UP Valencia Dirk Manteuffel, Uni Hannover Buon Kiong Lau, Uni Lund

2025

European School of Antennas and Propagation

12 ANTENNA MEASUREMENTS

16 - 20 June *Madrid, Spain*

Coordinators	**M. Sierra, L. Foged**

Purpose of the course

The course offers a comprehensive introduction to the measurement of antennas and antenna systems. It covers classical techniques such as open field testing, compact ranges, and near-field systems, while also exploring the latest advancements in the field. Participants will gain valuable insights into innovative technologies for microwave, millimeter, and submillimeter bands, OTA measurements, MIMO system measurement procedures, and advanced post-processing techniques for enhancing measurement accuracy and diagnosing antenna or measurement system performance. Designed for PhD-level students and engineers in the antenna industry, the course is delivered by leading academic and industry experts, providing unparalleled knowledge of the latest trends and breakthroughs in antenna measurement.

Prerequisites	Basics of antennas and microwaves, basic knowledge of electromagnetics and mathematics
Course Duration	5 days = 30 hours
Expected speakers	Lars J. Foged, Scientific Director MVG Manuel Sierra-Castaner, Prof. UPM Francesco Saccardi, Eng. MVG Olav Breinjberg, Research Consultant, ElMaReCo Sergiy Pivnenko, Technical Director, Asysol

2025

European School of Antennas and Propagation

13 MILLIMETER WAVE ANTENNAS

30 June - 4 July *Rennes, France*

Coordinators	**O. Lafond**

Purpose of the course

In the framework of the European School of Antennas (ESoA), we are pleased to announce the eighth edition of the course "Millimeter-Wave Antenna Design and Technologies" scheduled from the 26th of June to 30th of June, 2023 in Rennes (France). The first part of the course provides the attendees with an overview of Millimeter Wave Industrial applications, specific antenna Technologies and integrated antennas for millimeter wavelength range.

The second part is devoted to millimeter wave antennas structures to achieve radiation pattern reconfigurability and high efficiency antennas. Special focus are done concerning materialCharacterization and near Field Imaging and also planar and compact beamformers (SIW..), lens antennas and reflect/transmit arrays. The course will be completed by Labs (measurement of antenna radiation patterns in MM Waves, material characterization..).

Prerequisites	Knowledge of antennas and microwave circuits
Course Duration	5 days = 30 hours
Expected speakers	M. Himdi C. Karnfelt L. Marnat J. Schur D. Gonzales-Ovejero G. Ducournau

2025

European School of Antennas and Propagation

14 ANTENNA SYNTHESIS

1-5 September *Capri, Italy*

Coordinators	**Amedeo Capozzoli**

Purpose of the course

The Course deals with the main topics of Antenna Synthesis, and the related implementation issues. The key points of the Antenna Synthesis problem are faced, providing a general, sound, and unitary mathematical framework, discussing the role of field properties, degrees of freedom, trapping into false solutions and ill-position. Then, after introducing optimization in Antenna Synthesis, the general issues of local and global algorithms are discussed, and the numerical issues related to the electromagnetic modelling of complex structures. Canonical synthesis approaches are illustrated, and specific topics in Antenna Synthesis connected to the use of evolutionary algorithms and unconventional advanced systems. The Course hosts Sessions on the numerical implementation of Synthesis techniques on standard as well as HPC (GPUs) platforms. The use of HPC releases highly accessible computing resources enabling the Synthesis of large and complex antennas. Each Student will lay his hands-on the implementations of the Synthesis algorithms.

Prerequisites	Basics of electromagnetics and mathematics
Course Duration	37 hours in 5 days
Expected speakers	Prof. O.M. Bucci Prof. A. Capozzoli Prof. T. Isernia Prof. A. Massa Prof. Y. Rahmat-Samii Dr. G. Toso Prof. G. Vecchi Dr. C. Curcio Prof. A. Liseno Dr. A. Morabito

2025

European School of Antennas and Propagation

15 EXPLOITING SYMMETRIES IN ARTIFICIAL MATERIALS FOR ANTENNAS APPLICATIONS

8 - 11 September *Paris, France*

Coordinators	**G. Valerio, E. Martini, O. Quevedo-Teruel**

Purpose of the course

The course, co-organized with the MSCA Doctoral Network GENIUS, will present the properties of artificial materials exhibiting special symmetries and their applications to antennas and microwave devices.
The topics will cover:

- Theory of glide- and twist-symmetric metamaterials and metasurfaces
- Analytical and computational methods for the analysis of metamaterials (mode matching, circuit models, integral-equation methods)
- Spatio-temporal symmetries (PT and PTD symmetries ...) and topological states
- Applications to lens antennas (wideband flat lenses, compressed lenses, magnetic materials, ...) and to guided-wave applications (EBG for gap waveguides, flanges, filters, matching layers).
- Tutorial with Ansys HFSS to simulate and design glide-symmetric metamaterials for application to lens antennas.

Prerequisites	Wave propagation, basic properties of metamaterials, basic antenna theory
Course Duration	4 days = 24 hours
Expected speakers	Francisco Mesa, Universidad de Sevilla, Spain Zvonimir Sipus, University of Zagreb, Croatia Eva Rajo-Iglesias, Universidad Carlos III de Madrid, Spain Astrid Algaba Brazalez, Polytechnic University of Cartagena, Spain Simon Horsley, University of Exeter, United Kingdom

2025

European School of Antennas and Propagation

16 SHORT RANGE RADIO PROPAGATION: Theory, Models and Applications

15-19 September *Dublin, Ireland*

Coordinators	**C. Brenan, T. Kürner**

Purpose of the course

The purpose of the course Short Range Propagation: theory, models and applications is to give an overview of propagation theory and channel modelling for medium/short range wireless systems and networks, including millimetre wave and Terahertz radio propagation, as well as aspects related to MIMO and UWB technologies, wireless onbody communication, medical and short range radar applications. Some of the most important present and future applications of short range propagation will be presented and discussed. One hour of interactive exercises and demo will be provided at the end of each teaching day. The course will be held in the Cesenatico Campus of the University of Bologna.

The teachers will be from Technische Universität Braunschweig, University of Bologna, Dublin City University, Karlsruhe Institute of Technology and Université Catholique de Louvain

Prerequisites	No prerequisites needed.
Course Duration	5 days = 34 hours
Expected speakers	Vittorio Degli Esposti Thomas Kürner Claude Oestges Conor Brennan Werner Wiesbeck

2025

European School of Antennas and Propagation

17 ACTIVE ANTENNAS

15-19 September *Noordwijk, Netherlands*

Coordinators	**G. Toso, P. Angeletti**

Purpose of the course

Active Antennas (AAs) combine antennas with active electronic components and are becoming key elements for the development of high performance and flexible communication systems. AAs are expected to play a disruptive role in the development of advanced antenna systems for Onboard and Ground applications including 5G and MIMO. They can be implemented with direct radiating arrays, possibly magnified by reflectors, with lens antennas, etc. Despite their advantages, AAs are extremely complex in terms of design, manufacturing and testing.
The course is providing a detailed overview on Design and Technology aspects of AAs.Main topics presented:- AAs Definition and Introduction;- Payload Aspects;- AAs Architectures;- Arrays;- Broadband Arrays;- Multibeam Antennas;- Technology for Transmit Back End;- AAs for Earth Observation;- Beam Forming Network and Digital Beam Forming;- AAs for Receive and Interference Localization;- AAs for Telecommunications;- Emerging MIMO and 5G Applications.

Prerequisites	Basic knowledge on Antennas and Electromagnetism
Course Duration	5 days = 40 hours
Expected speakers	G. Toso, P. Angeletti, S. D'Addio, V. Valenta, I. Davies, P. Jankovic.

2025

European School of Antennas and Propagation

18 REFLECTORS AND LENS ANTENNAS

7-11 October *Gothenburg, Sweden*

Coordinators	**M. Ivashina and J. Yang**

Purpose of the course

To learn a modern approach to the design of reflector and lens antennas for applications in (5G/6G) telecommunication, radars, satellites, the next-generation radio telescopes and space science instruments. Prof. S. Maci will present the high-frequency modeling methods used to analyze reflection, diffraction, and scattering from reflectors. Dr. P. Meincke and Prof. D. De Villiers will teach modeling techniques through examples using the world-class commercial software GRASP from TICRA. Profs. A. Kishk and J. Yang will teach different types of reflector antenna feed design, including ultra-wideband feeds. Profs. M Ivashina and R. Maaskant will cover beamforming phased-array feeds and focal plane arrays including effects of strong array element coupling on system analysis and optimization. Prof. R. Sauleau will teach lens antenna design for millimeter and sub-millimeter wave applications. The course represents the equivalent of 1 week of study, giving 2 ECTS credit units.

Prerequisites	A master's level degree in Electrical Engineering or similar. Knowledge of electromagnetic fields, microwave and antenna engineering is required
Course Duration	5 days = 40 hours
Expected speakers	Peter Meincke Jian Yang Ahmed Kishk Marianna Ivashina Rob Maaskant Stefano Maci Ronan Sauleau Dirk De Villiers

2025

European School of Antennas and Propagation

19 COMPRESSIVE SENSING IN ELECTROMAGNETICS

13 - 17 October Trento, Italy

Coordinators	**G. Oliveri and T. Isernia**

Purpose of the course

Compressive sensing (CS) is an interdisciplinary topic with interplay between applied/pure mathematics and engineering, and whose impact goes far beyond compression and classical signal processing. Whenever acquiring/inverting data/information is difficult, dangerous, or expensive, CS has been used to overcome canonical information acquisition theorems and processes. Such a possibility has been rapidly and successfully exploited in a wide range of practical electromagnetic problems. After reviewing the fundamentals of CS, the course will focus on classical and recently introduced CS paradigms, discussing their capabilities, limitations, and perspectives in antenna design, imaging, non-destructive testing, and sensing and diagnosis applications. The course is targeted to PhD students, Researchers, Scientists, and Engineers who are willing to (a) learn about the basics of CS; (b) enhance their background on CS in Electromagnetics; (c) know about the leading edge on CS algorithms as applied to ill-posed synthesis and inverse problems; (d) take an overview on the applications of CS in academic and industrial frameworks.

Prerequisites	Basics of Electromagnetism and Mat
Course Duration	5 days = 30 hours
Expected speakers	Mats GUSTAFFSON Yang HAO Tommaso ISERNIA Ivan LAHAIE José MARTINEZ LORENZO Andrea MASSA Marco Donald MIGLIORE Andrea F. MORABITO Giacomo OLIVERI

2025

European School of Antennas and Propagation

20 FUNDAMENTALS ON ANTENNA

hybrid course

20-24 October

Madrid, Spain

Coordinators	Daniel Segovia-Vargas

Purpose of the course

From the European antenna community (i.e., ESoA & EurAAP) it has been seen that there are other scientific and industrial communities that may find problems when dealing with antenna topics, for instance, in the development of global projects. The spectrum of these communities is quite broad: Microwave engineers, Communication (i.e. mobile communication) engineers, Signal Processing engineers, Terahertz engineers and other applications, i.e., bio or medical professionals.

This antenna course is devoted to explaining the fundamentals on antennas to those communities and to offering them some help on dealing with antennas. In addition, application examples will be given, as well as industrial lectures on integrated antennas (i.e. mobile or GPS), base station antennas, space application antennas and terahertz antennas.

Prerequisites	Knowledge on Electromagnetic Fields
Course Duration	5 days = 32 hours
Expected speakers	Daniel Segovia-Vargas Luis Enrique García-Muñoz Luis Emilio García-Castillo Milos Mazanek (tbc) Zbynek Raida David González-Ovejero

2025

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