ESoA courses

2024

European School of Antennas and Propagation

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2024

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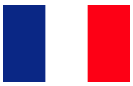
16	November 4-8	 Nice	ANTENNA AND RECTENNAS FOR IOT APPLICATIONS
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OBJECTIVES

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

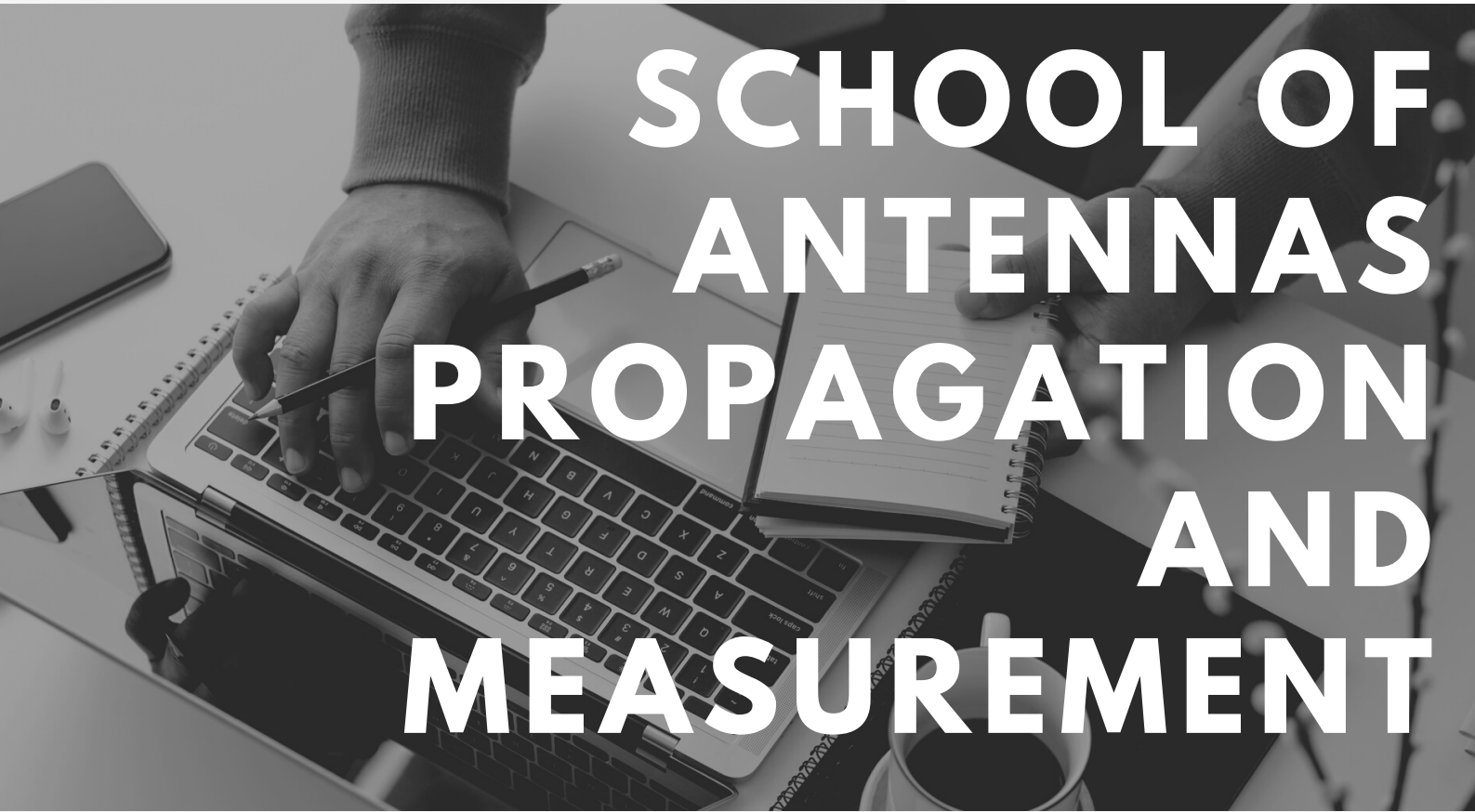
REGISTRATION FEE

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



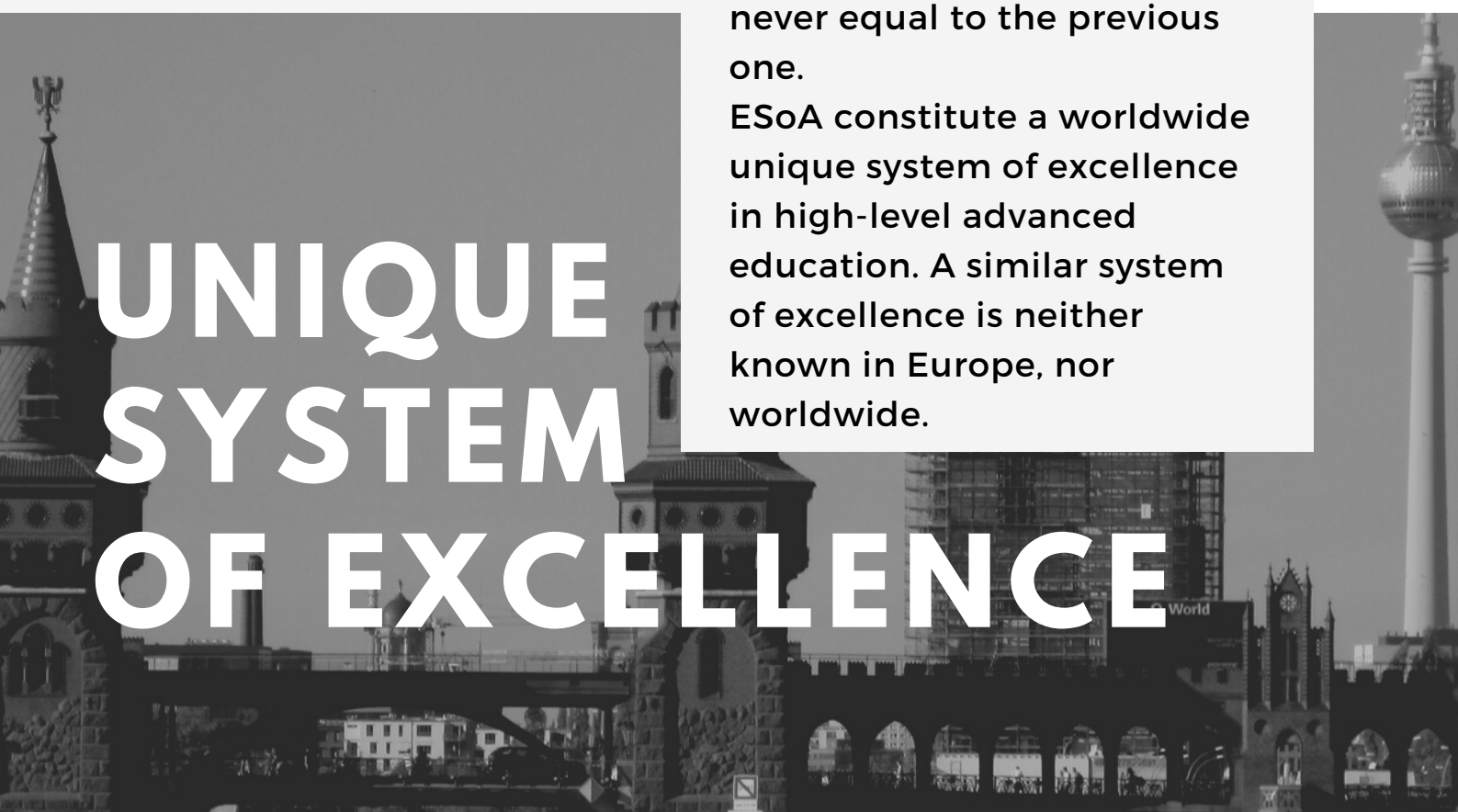
SCHOOL OF ANTENNAS PROPAGATION AND MEASUREMENT

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 290 students in 2012.

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
(Director of the European School of Antennas, ESoA)

The ESoA board is composed by 39 members; 34 for each affiliated institution, who are also coordinators of courses, plus other 5 members: one member from European Space Agency (ESA), one from European Microwave Association (EuMA) one from the Institution of Engineering and Technology (IET), one from IEEE Antennas and Propagation Society (IEEE AP-S) and one from the 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 for 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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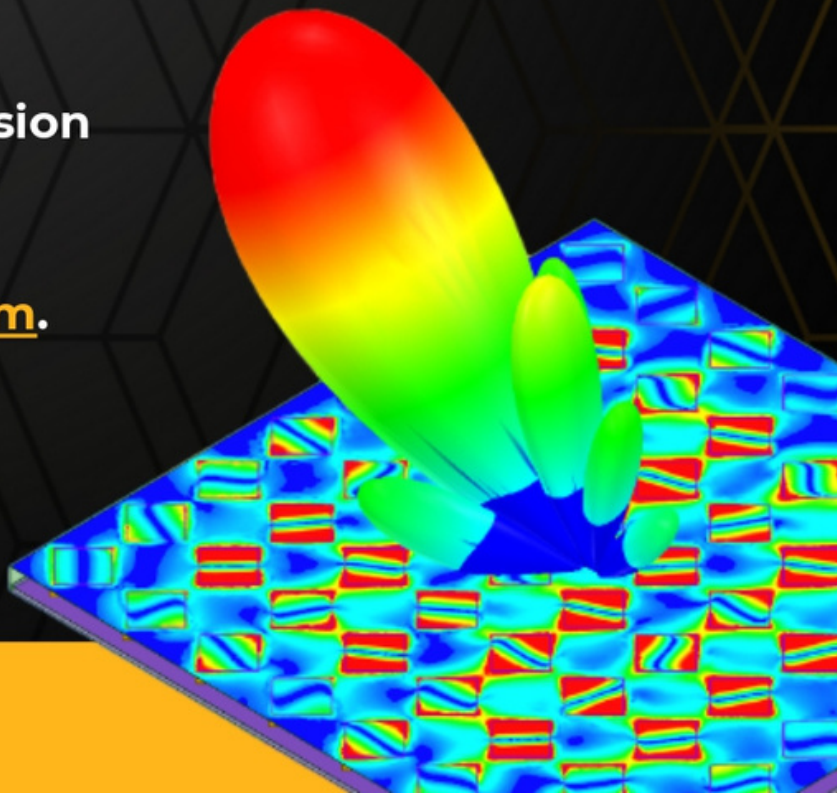
Seeking access to full-version licenses for your courses? Please contact Mauricio.Dwek@ansys.com.



Official Sponsor of ESoA

MVG is proud to sponsor the European School of Antennas and Propagation! With its renowned reputation as an excellent body of continued education in EM engineering with a focus on antennas, it effectively advances learning at an international level. Creating ties between university and industry R&D teams, and facilitating the interchange of ideas among researchers, trainers, and industry experts, the synergy has greatly enhanced the development of antenna technology for our increasingly mobile and connected world. For these reasons, MVG has been supporting ESoA for more than a decade! And we are proud to sponsor this year's courses and beyond.

Join the ESoA courses, grow your knowledge, then join our international team of skilled engineers aiming for excellence in antenna test and measurement. We are hiring!

Testing Connectivity for a Wireless World

The Microwave Vision Group offers cutting-edge technologies for the visualization of electromagnetic waves. With advanced test solutions for antenna characterization, radar signature evaluation and electromagnetic measurements, we support company R&D teams in their drive to innovate and boost product development.

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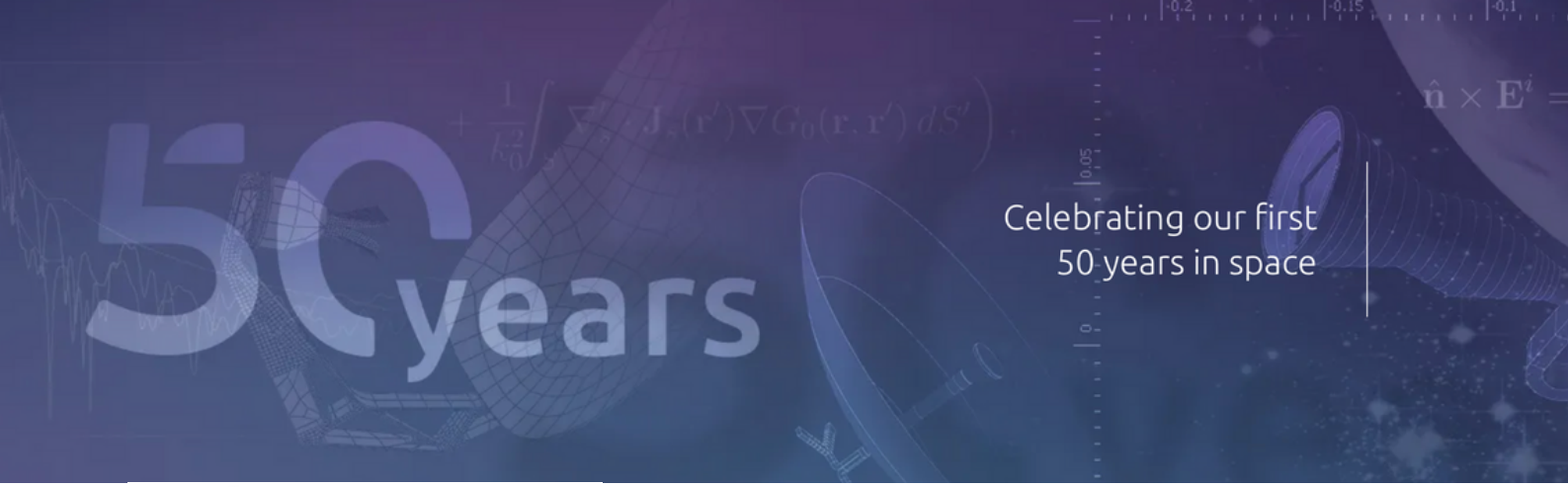

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It is crucial that your antenna designs can be optimised and validated in the shortest possible timeframe. That's why our reflector antenna and EM modelling software is trusted by every major player in the global satellite market.

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.

Our software and services are, among others, used by

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ESoA

A way to excellence

European School of Antennas and Propagation 2024

February
19-23

1 - COMBINATION OF SIMULATIONS AND MEASUREMENTS IN ANTENNA DESIGN

Paris

Coordinators	**E. Jehamy, J. Mollet, L. Foged, G. Vechi, M. Sierra Castañer**

Purpose of the course

Simulation and measurements are routine procedures in any antenna design, yet in different phases.

In this course you will learn how to integrate these two aspects to make the design process more efficient, and/or to reach higher goals (cost, speed, performance). This possibility has emerged recently from (applied) research and is now part of a streamlined procedure that can be based on commercially available tools.

The course is an intensive 5 day study that combines theoretical sessions with hands-on exercises; it includes experience of design down to 3D rapid manufacturing and testing.This allows participants to put newly acquired theory to practice and presents insight into all aspects of practical antenna measurements.

Prerequisites	basics of antennas and microwaves, basic knowledge of electromagnetics and mathematics
Course Duration	5 days = 30 hours
Expected speakers	Giuseppe Vecchi (Politecnico de Torino) Richard Cousin (Dassault Systems) Jerome Mollet (Dassault Systems) Manuel Sierra Castañer (UPMadrid) Lars Foged (MVG) Jean Charles Bolomey (Université Paris Sud – Emeritus)

European School of Antennas and Propagation 2024

Feb-March
26-1

2 - OPEN GRAND CHALLENGES IN INDUSTRIAL MODELLING AND APPLICATIONS OF ANTENNAS

Abu Dhabi

Coordinators	**F. Vega, B. Tlili, A. Shamim, F. Andriulli**

Purpose of the course

The Course aims to introduce the participants to the skills needed to address complex challenges in design, modelling and manufacturing of modern Antennas.
Throughout the program, participants will explore design and applications techniques, numerical methods and modern antenna optimization.

Prerequisites	Basic knowledge of electromagnetics
Course Duration	5 days = 30 hours
Expected speakers	Atif Shamin Francesco Andriulli Felix Vega Hakan Bagci Giuseppe Vecchi Stefano Maci

European School of Antennas and Propagation 2024

Feb-March
26-1

3 - METALENSES FOR ANTENNA APPLICATIONS

Seville

Coordinators	**O. Quevedo, A. Algaba, F. Mesa**

Purpose of the course

Lenses are used to increase the directivity of conventional antennas. New 5G/6G and satellite communications, as well as radars, are increasing their frequency of operation. When this frequency increases, lenses are ideal to reduce the complexity of the feeding networks, while keeping a moderate cost. Lenses can be implemented with conventional dielectric materials but also with periodic structures and geodesic shapes.
In this course, you will learn the fundamentals of lenses, including homogenous and graded-index lenses. Later, you will acquire knowledge on how modelling these lenses with ray-tracing techniques. You will implement your own ray-tracing codes in lab sessions. You will also learn how to design innovative lenses with transformation optics and geodesics. Furthermore, you will learn how to implement lenses with periodic structures, including those with higher symmetries. Finally, you will receive the industrial view about the prospective use of lenses for satellite communications, 5G/6G, and automotive radars.

Prerequisites	Engineering or physics background
Course Duration	5 days = 30 hours
Expected speakers	Prof. Matteo Albani, University of Siena, Italy Prof. Zvonimir Sipus, University of Zagreb, Croatia Prof. Tomas Tyc, Masaryk University, Czech Republic. Prof. Ronan Sauleau, University of Rennes I, France. Dr. Simon Horsley, University of Exeter, UK. Dr. Hervé Legay, Thales Alenia Space, France. Dr. Maria Papaioannou, Isotropic Systems, UK

European School of Antennas and Propagation 2024

April
22-24

4 - LEAKY WAVES AND PERIODIC STRUCTURES FOR ANTENNA APPLICATIONS

Rome

Coordinator	F. Frezza

Purpose of the course

The Course aims at giving a complete knowledge of the basic physical mechanisms involved, of the various suitable design techniques, and of the possible antenna applications of Leaky Waves and Periodic Structures.Contents of the Course: General features and applications. Fields of a leaky-wave source, leaky waves in open structures. Characterization of leaky-wave antennas: determination of the phase and attenuation constants, relation to the radiation properties. Mechanisms employed to produce leakage: apertures, asymmetries, use of suitable modes. Transverse equivalent networks, aperture admittance, transverse-resonance technique. Periodic Structures. Scanning behavior, phased arrays of leaky-wave line sources, unit-cell approach. Computation of periodic Green's functions. Higher symmetries. Periodically loaded structures. Radiation-pattern shaping, aperture distribution: tapering procedures for leaky-wave antennas. Examples of practical antennas: partially-open metallic waveguides, dielectric structures, printed lines. Feed, losses, manufacture issues. Measurement techniques. Metamaterial and graphene leaky-wave antennas. Antennas exploiting band-gap properties. Inhomogeneous plane waves in dissipative media: deep penetration, total transmission.

Prerequisites	Electromagnetics for graduate students
Course Duration	30 hours in 4 days
Expected speakers	P. Baccarelli T. Bertuch P. Burghignoli F. Frezza A. Galli D.R. Jackson J.L. Gómez Tornero G. Valerio

European School of Antennas and Propagation 2024

May
20-24

5 - METASURFACES FOR ANTENNAS

Siena

Coordinators	**S. Maci, Z. Sipus and C. Yepes**

Purpose of the course

Metasurfaces, a class of thin metamaterials, have shown unprecedented capabilities in the local manipulation of phase, amplitude and polarization of electromagnetic waves from microwave to optical frequencies by tailoring the geometry of building elements. At microwave frequencies, they are constituted by sub-wavelength size patches or pins printed on thin grounded dielectric substrates or realized as a texture in a metal surface. During this course the background and basic theory of different types of canonical metasurfaces will be explained, as well as how to realize such surfaces for different applications, and how to devise good theoretical models and implement them numerically.

Prerequisites	none
Course Duration	5 days = 40 hours
Expected speakers	Anthony Grbic Stefano Maci Nader Engheta Enrica Martini David Golzález Ovejero Eva Rajo-Iglesias Zvonimir Sipus Silvio Hrabar

European School of Antennas and Propagation 2024

May
27-31

6 - ANTENNAS FOR SPACE APPLICATIONS

Noordwijk

Coordinators	**G.Toso, E. Gandini**

Purpose of the course

Given every second year since 2006, the course “Antennas for Space Applications” provides an overview of design approaches, constraints and technical solutions for space antennas, addressing both theoretical and technological issues. The course includes application oriented lectures, focusing on the specific needs and antenna solutions for telecommunication, earth observation, science and satellite navigation missions. It also includes technology oriented lectures, covering topics such as beam forming techniques and technologies, large reflector antennas and periodic structures. While the course mostly addresses radio frequency aspects, dedicated lectures will also address manufacturing, as well as mechanical and thermal design aspects, as complex space antenna systems often require co-engineering involving multi-disciplinary expertise. The course will end with a visit to the ESTEC satellite and antenna test facilities.

Prerequisites	basics of antennas and electromagnetics
Course Duration	5 days = 35 hours
Expected speakers	E. Gandini G. Toso P. Angeletti I. Barbary P.M. Besso B. Byrne P. de Maagt A. Ihle V. Iza S. Mercader-Pellicer G. Rodrigues L. Rolo E. Saenz C. Tienda D. Trenta H. Nematollahi S. D’Addio E. Van Der Houwen M. van der Vorst

European School of Antennas and Propagation 2024

June
10-14

7 - OPTIMAL ANTENNAS: PERFORMANCE LIMITS AND INVERSE DESIGN

Prague

Coordinators	**M. Gustafsson, M. Capek**

Purpose of the course

Questions regarding the efficacy of electromagnetic devices and their optimal design are central to antenna and microwave technology, optics, and plasmonics. This edition of the European School of Antennas equips participants with both theoretical and practical tools to address these questions and ultimately create optimal devices. The term “optimality” is addressed first, determined from physical bounds formulated as optimization problems over electromagnetic quantities (surface current density, terminal voltages). These problems are solved using convex optimization techniques and contribute to understanding the trade-offs between studied metrics, electrical size, material parameters, or matching. The bounds are compared with classical and optimized designs and put into the context of historical attempts to demarcate various performance metrics. The course covers inverse design techniques, including topology optimization, surrogate modeling, machine learning, and heuristics. We also emphasize a recently developed technique based on topology optimization in a method-of-moments setting. This technique is computationally efficient and can often automatically design antennas with performance close to the physical bounds. Many figures of merit are to be defined and optimized: Q-factor, radiation efficiency, antenna gain, realized gain, directivity, capacity, focusing efficiency, and extinct power, to name a few. The participants will receive the presented codes and worksheets summarizing the theory. The course concludes with a discussion of open problems related to optimality in antenna design.

Prerequisites	basics of antennas and electromagnetics
Course Duration	5 days = 35 hours
Expected speakers	Mats Gustafsson, Lund University Miloslav Capek, CTU in Prague Oscar Borries, Ticra Owen Miller, Yale University Kurt Schab, Santa Clara University Rasmus Ellebæk Christiansen, DTU Niels Aage, DTU

European School of Antennas and Propagation 2024

June
17-21

8 - DIAGNOSTIC AND THERAPEUTIC APPLICATIONS OF ELECTROMAGNETICS

Turin

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

Purpose of the course

Electromagnetic (EM) technologies are nowadays an essential part of clinical practice: RF minimally-invasive tools and ablation treatments have drastically changed surgery rooms; Magnetic Resonance Imaging (MRI) is the gold standard of medical diagnostics and EM Hyperthermia is growing as an effective adjuvant anticancer treatment. In addition, other applications are rapidly emerging, such as microwave imaging, and the advent of nanotechnologies can lead to completely new developments, including remote control of drug delivery and biological processes.
This course aims at introducing this vibrant and interdisciplinary area into the Antenna (and Electromagnetic) Community, providing the ability to understand the issues of medical applications of EM fields. This year's edition will be focused on therapeutic applications, with lectures from academia, industry and clinicians. The course is primarily conceived for Doctoral students and researchers with an engineering or physics background.

Prerequisites	basics of antennas and microwaves, basic knowledge of electromagnetics and mathematics
Course Duration	4 days = 30 hours
Expected speakers	O.M. Bucci, Federico II Univ. Naples H. Crezee, Univ. Medical Centers, Amsterdam P. F. Pavoni, CEO, MED-LOGIX SRL N. Tosoratti, CEO, H.S. Hospital Service Spa G. Ruvio, CSO, Endowave Ltd S. Romeo, CNR-IREA, Italy

European School of Antennas and Propagation 2024

September
9-13

9 - ARRAYS AND REFLECTARRAYS

Louvain la-Neuve

Coordinator	**Christophe Craeye**

Purpose of the course

This course is aimed at postgraduate research students and industrial engineers who want to acquire insight into the physical behavior of antenna arrays and reflectarrays, as well as learn methodologies for array optimization.

The course will provide a global understanding of the electromagnetic behavior of antenna arrays and reflectarrays, with a special emphasis on wideband arrays, on the effects of mutual coupling, on optimization methods and on applications. A software for reflectarray analysis and design will be handed over to the students.

Prerequisites	Masters level course on antennas
Course Duration	5 days = 38 hours
Expected speakers	Prof. Sean Hum Prof. Manuel Arrebola Prof. Daniele Cavallo Prof. Giacomo Oliveri Dr. Nicola Anselmi Dr. Hervé Legay Prof. Raphaël Gillard Prof. Christophe Craeye

European School of Antennas and Propagation 2024

September
16-20

10 - ADVANCED COMPUTATIONAL EM (MCSA COMPETE)

Turin

Coordinators	**F.P. Andriulli, G. Vecchi**

Purpose of the course

This course addresses frequency-domain, integral-equation based computational techniques for the analysis of challenging antenna problems, including recent metamaterials issues. The challenges come from the need to apply computational electromagnetics to real-life antenna and antenna platform design. The course will give a working knowledge of a number of topics that allow to solve complex antenna problems. While addressing advanced topics, it is structured so as to give attendees a practical understanding of problems, the techniques to solve them, and of how to implement them when "back at home".

Attendees willing to participate actively in practical sessions are asked to come equipped with a laptop and a WiFi connection.

Prerequisites	First and Second year calculus
Course Duration	5 days = 40 hours
Expected speakers	Francesco P. Andriulli Giuseppe Vecchi

European School of Antennas and Propagation 2024

September
23-27

11 - MOBILE RADIO PROPAGATION FOR 5G AND BEYOND

Braunschweig

Coordinators	**T. Kürner, V. Degli-Esposti**

Purpose of the course

The course will cover propagation aspects for 5G and beyond cellular and vehicular communications. Starting with the basics of propagation, modern methods used in cellular network planning as well as aspects relevant for future 5G networks, e. g. MIMO, multi-link aspects, localisation, car2X and railway communications, drones, are taught. The course includes also computer-based exercises.

Prerequisites	basics in electromagnetics and communications
Course Duration	5 days = 37 hours
Expected speakers	Thomas Kürner Vittorio Degli-Esposti Claude Oestges Werner Wiesbeck Conor Brennan Vasilii Semkin

European School of Antennas and Propagation 2024

Sept-Oct

30-4

12 - RECONFIGURABLE INTELLIGENT SURFACES FOR SMART RADIO ENVI-RONMENT (MSCA METAWIRELESS)

Siena

Coordinators	**S. Maci, F. Bilotti, A. Massa, C. Yepes**

Purpose of the course

The sixth-generation (6G) system, to be deployed in the upcoming years, is expected to fully support artificial intelligence. To go “beyond 5G” there are some fundamental issues which need to be addressed concerning with higher system capacity, higher data rate, lower latency, and improvement of quality of service (QoS). This course presents the vision of future wireless communication. The reflecting intelligent metasurface (RIS) technology is one of the most interesting candidate technologies.
This course includes the fundamental properties and limits of RISs; its analysis, sensing and design; capacity/data rate analyses, power/spectral optimizations, channel estimation, deep learning-based design, etc. The teaching team includes well-recognized worldwide researchers in academia and industry

Prerequisites	Basic knowledge on antennas and electromagnetism
Course Duration	5 days = 30 hours
Expected speakers	Andrea Abrardo Andrea Alú Filiberto Bilotti Bruno Biscontini Marco Di Renzo Nader Engheta Renato Lombardi Stefano Maci Andrea Massa Sergei Tretyakov

European School of Antennas and Propagation 2024

October
7-11

13 - FREQUENCY DOMAIN TECHNIQUES : FROM INHOUSE TO COMMERCIAL EM SOLVERS

Florence

Coordinators	**A. Freni, J. Mosig**

Purpose of the course

The course aims to give the student an appreciation of the uses and limitations of frequency domain computational techniques applied to scattering and antenna problems. The module gives the student a thorough background in the methodology of these techniques from a fundamental standpoint, while giving a grasp of the practical applications. Emphasis will be given to the practical problems encountered in the implementation of the integral equation techniques (Method of Moments, linear systems, integration techniques, Green's functions, stratified media, convergence, singularities, periodic problems). Simple problems are considered to give an understanding of how the choices made in designing the algorithms translate into the real strengths and limitations of the software.

Prerequisites	Basic electromagnetic theory, Basic antenna theory
Course Duration	5 days = 25 hours
Expected speakers	Juan Mosig Anja Skrivervik Zvonomir Sipus Angelo Freni Agnese Mazzinghi

European School of Antennas and Propagation 2024

October
14-18

14 - ANTENNAS AND MICROWAVE PHOTONICS

A gap for joining guided and radio very high data rate communications

Madrid

Coordinator	**D. Segovia-Vargas**

Purpose of the course

Microwave photonics is becoming a mature, but still emerging, technology that tries to fill the gap for very high-speed and very high data-rate communications. It is well known that optical fiber communications offer very high bandwidths for the current very-high data rate communication systems. It is also well known that wireless and antennas is the only way to provide mobility and flexibility to any communication system. For the first time the European School of Antennas propose a course trying to overcome these two complementary technologies: antennas and microwave photonics. The purpose of the course is to open the knowledge on antennas, optics and communication communities to a set of essential knowledge for future communication services.

Prerequisites	knowledge on antennas, waveguides and basic communication theory
Course Duration	5 days = 30 hours
Expected speakers	*Prof. Daniel Segovia-Vargas (GREMA-UC3M group)* *Prof. Elliot Brown (Wright University)* *Dr. Alejandro Rivera-Lavado* *Prof. from GOTL-UC3M group (tbc)* *Prof. from GREMA-UC3M (tbc)* *Prof. expert on microwave photonics metasurfaces (tbc)*

European School of Antennas and Propagation 2024

October
21-25

15 - TERAHERTZ ANTENNAS AND IMAGING SYSTEMS

Delft

Coordinators	**A. Neto, N. Llombart, L. Joffre**

Purpose of the course

In the cm-wavelength regime, digital signal processing can be used, in connection to ad hoc front end designs, to increase the signal to noise ratios. In the mm and sub-mm wave regimes only analogue antenna techniques can be used to obtain high signal to noise ratios at reasonable costs.

The Tera Hertz Antennas and Imaging Systems course will take place in Delft at the end of October 2022.
The course will discuss the antenna theory and techniques most widely used in the design of imaging systems aimed to operate in the sub-mm wave regime. Examples will consider on going state of the art research in a number of application domains in which sub-mm wave antenna imaging is truly key to the developments: these include space science radiometry, security, medical imaging, no destructive testing, automotive Radars and Telecommunications. The course will involve every day, theoretical lectures as well as exercises in the advanced TU Delft laboratories.

Prerequisites	Basic Electromagnetics and Antenna Theory
Course Duration	5 days = 32 hours
Expected speakers	Prof. Andrea Neto Prof. Nuria Llombart Prof. Luis Jofre Prof. Jochem Baselmans Prof. Angelo Freni Dr. Maria Alonso

European School of Antennas and Propagation 2024

November
4-8

16 - ANTENNA AND RECTENNAS FOR IOT APPLICATIONS

Nice

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)

European School of Antennas and Propagation 2024

December
9-13

17 - QUANTUM-EM: MODELING THE NANOSCALE IN THE REAL WORLD

Madonna di Campiglio

Coordinators	**P. ROCCA, A. BOAG**

Purpose of the course

Quantum science and technology have been steadily growing in relevance and impactin the last two decadesand have already brought significant developments in several areas, such as quantum communications, sensing, imaging, and computing.
In this course, starting from a brief introduction to the theoretical foundations of the quantum electromagnetics (QEM), thelectures will focus on the study of the quantized EM field and radiation, their description through quantum Maxwell's equation, and the modeling of the real world at the nanoscale throughquantum numerical methods. In addition,selected examples of quantum technology as applied to real world applications will be overviewed, such as quantum radar/lidar, quantum key distribution, and quantum algorithms for imaging, as well as antenna analysis and design.
The course is targeted to PhD students, Researchers,Scientists, and Engineers who are willing to learn about the basics of QEM, the modeling of the QEM sources and effects, and the most recent applications of QEM in academic and industrial frameworks.

Prerequisites	Good knowledge of Electromagnetism, Physics, and Math
Course Duration	5 days = 30 hours
Expected speakers	Prof. ALÙ Andrea Prof. BOAG Amir Prof. CHEW Weng C. Prof. HAUKE Philipp Prof. PAVESI Lorenzo Prof. ROCCA Paolo

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