European School of Antennas

EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

announce the second Edition of the PhD School on

Microwave Imaging and Diagnostics:

Theory, Techniques, and Applications

Taormina, Italy

10-14 October 2016

Course Coordinators:

Prof. Tommaso Isernia
LEMMA Research Group
Università Mediterranea of Reggio Calabria

Prof. Andrea Massa
ELEDIA Research Center
Università di Trento

EuMA
European Microwave Association
EuCoM – European Courses on Microwaves

MiMed
Cost Action TD1301

Microwave Imaging and Diagnostics – Course Overview

Introduction

The exploitation of electromagnetic field data as a sensing tool paves the way to a number of interesting engineering applications including 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 in high-frequency electromagnetics, 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 and lessons regarding specific applications, with focus on the topics of relevant COST Actions (Medical Imaging: http://cost-action-td1301.org; GPR: www.gpradar.eu), will corroborate the developed concepts.

Course Contents

- Motivations and Basics of Microwave Imaging and Diagnostics
- Inverse Source Problems : difficulties, basic tools, applications
- Qualitative and approximate methods for inverse scattering
- 'Full wave' methods for quantitative imaging: difficulties, tools, examples
- Applications:
  - Antenna diagnostics
  - Medical imaging : present and perspective
  - Applications in Civil Engineering

Teachers:

Dr. Lorenzo CROCCO
Prof. Tommaso ISERNIA
Prof. Panagiotis KOSMAS
Prof. Fernando LAS-HERAS
Prof. Joe LO VETRI
Prof. Andrea MASSA
Prof. Paolo ROCCA

Dr. Loreto DI DONATO
Dr. Andrea MORABITO
Prof. Giacomo OLIVERI

Course Info:

35.5 hours of classes:
- 28 hours of theoretical lectures
- 5.5 hours of guided software exercises
- 2 hours of final exam

Registration fee:

440 EUR for non-profit institutions
880 EUR for companies

Grants are available (see below)

All information on registration, transportation, lodging, and else @:
http://www.antennasvce.org/Community/Education/Courses?id_folder=654

Microwave Imaging and Diagnostics – Course Schedule

Monday	**INTRODUCTION**			
		09.30 - 11.00	T. Isernia, A. Massa	Introduction to inverse source and inverse scattering problems: formulations and relevance
		11.00 - 11.15		*Coffee break*
		11.15 - 13.00	A. Massa	Mathematical issues of inverse scattering problems
		13.00 - 14.00		*Lunch*
		14.00 - 16.00	T. Isernia	Radiated field properties and basic limitations in inverse source and inverse scattering problems
		16.00 - 16.15		*Coffee* break
		16.15 - 18.00	J. LoVetri	Measurement set-ups: difficulties, antennas, numerical modeling
Tuesday	**BASIC TOOLS FOR ILL POSED PROBLEMS, AND APPLICATION TO INVERSE SOURCE METHODS**			
		08.30 - 10.30	A. Massa	Basic tools: classical and novel regularization techniques (TSVD, Tichonov regularization, compressive sensing)
		10.30 - 10.45		*Coffee break*
		10.45 - 12.45	T. Isernia	Inverse source problems: applications to antenna characterization, diagnostics and synthesis
		12.45 - 13.45		*Lunch*
		13.45 - 16.15	F. Las Heras	A first case study: the source reconstruction method for antenna diagnostics
		16.15 - 16.30		*Coffee break*
		16.30 - 18.00	A. Morabito	Exercises : solving inverse source problems via tsvd or compressive sensing
Wednesday	**QUALITATIVE AND APPROXIMATE IMAGING METHODS**			
		08.30 - 10.30	P. Kosmas	Approximated imaging methods (Born, distorted Born, Rytov, Kirchhoff, others)
		10.30 - 10.45		*Coffee break*
		10.45 - 12.45	L. Crocco	Qualitative imaging methods: introduction
		12.45 - 13.45		*Lunch*
		14.30 - 16.30	L. Crocco	Linear sampling methods: basic theory, recent developments, examples
		16.30 - 16.45		*Coffee break*
		16.45 - 18.30	L. Di Donato, G. Oliveri	Exercises: solving inverse scattering problems by means of approximate and/or qualitative methods
THURSDAY	**QUANTITATIVE IMAGING METHODS**			
		08.30 - 10.30	T. Isernia	Full-wave imaging: difficulties arising from non linearity and possible strategies for dealing with non-linearity
		10.30 -10.45		*Coffee break*
		10.45 - 12.45	P. Rocca	Stochastic strategies: theory
		12.45 -13.45		*Lunch*
		13.45 - 16.15	J. LoVetri	Deterministic strategies: theory and examples
		16.15 -16.30		*Coffee break*
		16.30 -18.15	P. Rocca/G. Oliveri	Exercises: solving microwave imaging problems by means of global optimization
FRIDAY	**APPLICATIONS**			
		08.45 -10.45	P. Kosmas	Microwave biomedical Imaging: applications, devices, inversion procedures, trends from COST MiMed
		10.45 -11.00		*Coffee break*
		11.00 -13.00	L. Crocco	GPR applications to environment, cultural heritage and civil engineering – COST TU1208
		13.00 -14.30		*Lunch*
		14.30 -16.30		Final Examinations

Microwave Imaging and Diagnostics – Venue & Grants

Taormina is a very pleasant seaside town in East Sicily, with many natural and historical attractions. In October, weather is usually fine for swimming.
The School will take place in the 'Sala dell'Archivio Storico' @ Corso Umberto (in front of 'Vicolo Stretto'), in the very center of Taormina.
A list of suggested accommodations will be circulated with the 2nd announcement



12 grants are available for participants to the co-organizing COST Action TD1301 MiMed

2 grants are available for participants to COST Action TU1208 on Civil Applications of GPR

2 grants are supported by the European Microwave Association (EuMA-EuCoM)

For info on grant applications refer to :

tommaso.isernia@unirc.it **andrea.morabito@unirc.it**