UNIVERSITÀ DI PISA

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

"Electromagnetic numerical methods and CAD software for RF, Microwaves, Biomedical and EMC applications"

Prof. Ing. Agostino Monorchio[1] – Dott. Ing. Nunzia Fontana[2]

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Short Abstract:

Modern CAD programs for the design of microwave and radiofrequency systems are nowadays an important and necessary competence of ICT engineers; in order to exploit the huge potentialities provided by computing tools, users should be technically aware of the limits and possibilities offered by modern CAD software. The course aims to providing the ability of using the modern CAD programs for the design of microwave and radiofrequency systems, with applications in circuit and antenna design, biomedical applications, EMC evaluation for pre-compliance. At first, the theory of numerical methods for applied electromagnetics, widely employed in commercial CAD tools, will be presented such as Method of Moments (MoM), Finite Elements Method (FEM) and Finite Difference Time Domain (FDTD). Each method will be critically presented according to advantages and disadvantages. The second part of the course will be devoted to hands-on laboratory design by using popular CAD such as ANSYS HFSS, ALTAIR FEKO, SIMULIA CST, for the 'design-by-yourself' exercises. Exercises will be aimed at identifying the main differences among the software tools.

Course Contents in brief:

- Numerical methods: Method of Moments - MoM, Finite Elements Method - FEM, Finite Difference Time Domain - FDTD
- ANSYS HFSS
- SIMULIA CST
- ALTAIR FEKO

Total # of hours of lecture: 20

References:

[1] https://www.ansys.com/products/electronics/ansys-hfss

[2] https://www.3ds.com/products-services/simulia/products/cst-studio-suite/

[3] https://altairhyperworks.com/product/FEKO

CV of the Teachers

Agostino Monorchio is Full Professor at the University of Pisa. He spent several research periods at the Electromagnetic Communication Laboratory at Pennsylvania State University (USA), both as a recipient of a scholarship (Fellowship Award) of the Summa Foundation, New Mexico (USA), and in the framework of CNR-NATO Senior Fellowship programme. He has carried out a considerable research activity and technical consultancy to national, EU and U.S. industries, coordinating, as principal scientific investigator, a large number of national and European research projects. Prof. Monorchio is active in a number of areas including computational electromagnetics, microwave metamaterials, radio propagation for wireless systems, the design and miniaturization of antennas and electromagnetic compatibility, biomedical microwaves applications.

The activity is mainly carried out at the Microwave and Radiation Laboratory (www.mrlab.it) of the Department of Information Engineering, University of Pisa. His research results have been published in more than 130 journal papers and book chapters, and more than 200 communications at international and national conferences, he is co-author of 4 patents. In 2012 he has been elevated to Fellow grade by the IEEE for his contributions to computational electromagnetics and for application of frequency selective surfaces in metamaterials.

Nunzia Fontana is Assistant Professor at the University of Pisa. She received the M. Sc. degree (summa cum laude) in telecommunications engineering and the Ph.D. degree in remote sensing from the University of Pisa, Italy, in 2008 and in 2012, respectively.

From 2012 to 2016, she was a Post-Doctoral Researcher with University of Pisa with the Department of Information Engineering. From 2016 to 2019, she was a Researcher with the National Inter-University Consortium for Telecommunications. She is currently an Assistant Professor with the Department of Energy, Systems, Territory and Construction Engineering, University of Pisa, lecturing electrical circuits.

Her research interests include: wireless power transfer; antennas, impedance matching networks design, prototyping and RF testing; radio frequency coils design for magnetic resonance and RF testing and bio-electromagnetics. Her research activities have been published in several international scientific journals and in a number of international conference proceedings. She is IEEE Member and ACES Member. Dr. Fontana serves as an Associate Editor for ACES Journal.

Room and Schedule

Room: Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor for theoretical lessons; ex-B26 for hands-on design

Schedule (2nd semester of Academic Year 2020-2021):

Day1 (5 hours) – Numerical methods

Day2 (5 hours) – MoM example: ALTAIR FEKO

Day3 (5 hours) – FEM example: ANSYS HFSS

Day4 (5 hours) – FDTD/FIT example: SIMULIA CST