Research Networking Programmes

Science Meeting – Scientific Report

Scientific report (one single document in WORD or PDF file) should be submitted online within two months of the event. It should not exceed seven A4 pages.

***Proposal Title**: Frequency Domain Techniques for Antenna Analysis*

Application Reference N°: 5013

1) Summary (up to one page)

Involved institutions: EPFL, UNIZAG, EMSS, UNIFI

Teachers: Prof. Juan R. Mosig (EPFL), Prof. A. K. Skrivervik (EPFL), Prof. Z. Sipus (UNIZAG), Dr. E. Lezar (EMSS), Dr. D. Ludick (EMSS), Prof. A. Freni, (Univ. Florence)

Students: 19 students from 12 different institutions: Oluwafunmilayo Agunlejika , Loughborough University, Pevand Bahramzy, Mikkel Dahl Hougs, Francesco Scattone, Marco Faenzi, Pietro Bia, Simon Hubert, Ozan Yurduseven, Mario Echeverri, Giorgio Giordanengo, Doruk Tayli, Santi Concetto Pavone, Valentina Sozio, Esthelladi Ramanandraibe, Eden Sorolla, Hamed Hasani, Baptiste Hornecker, Alexandru Tatomirescu, Zhidong Zhao.

Location: Osservatorio Ximeniano, Borgo San Lorenzo 26, Florence.

Date: 16/09/2013 - 20/09/2013

Contents: The "Frequency Domain Techniques for Antenna Analysis" course gave 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 has been 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 have been considered to give an understanding of how the choices made in designing the algorithms translate into the real strengths and limitations of the software. EMSS provided a free version of the FEKO software package, valid for one year with some minor restrictions. EMSS staff guided the practical sessions in the afternoon. In these sessions, the morning's theoretical
concepts have been put to work through the analysis and design of real life antenna examples.

2) Description of the scientific content of and discussions at the event (up to four pages)

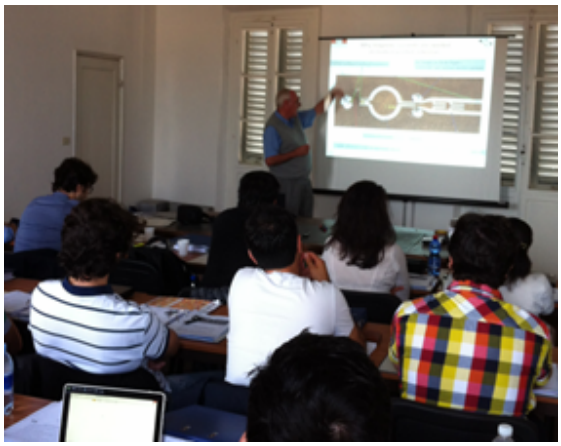
Scope of the Course
The course aimed to give the student an appreciation of the uses and limitations of frequency domain computational techniques applied to scattering and antenna problems. The module gave the student a thorough background in the methodology of these techniques from a fundamental standpoint, while giving a grasp of the practical applications. Emphasis has 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). This also gave to the participants the sensibility in using application software with insight into fundamental properties, allowing them to better understanding the constrains of the various formulations and the real significance of the various parameters involved.
During the course simple problems were considered to give an understanding of how the choices made in designing the algorithms translate into the real strengths and limitations of the software. Furthermore, EMSS provided a free version of the FEKO software package (www.feko.info), valid for one year with some minor restrictions. EMSS staff guided the practical sessions in the afternoon. In these sessions, the morning theoretical concepts have been put to work through the analysis and design of real life antenna examples.

Schedule:
Day 1: Mathematical aspects common to any frequency domain method.
Day 2: An introduction to Method of Moments for the analysis simple antennas, lenses, and focalizing structures
Day 3: Mixed Potential formulations of some integral equations in Electromagnetic: free space problems
Laboratory: analysis of a free space patch antenna
Day 4: Mixed Potential formulations of some integral equations in Electromagnetic: planar stratified media problems, 3D problems, lenses, MRI and health applications.
Laboratory: analysis of a multilayered microstrip antenna
Day 5: Periodic structures
Laboratory: analysis of periodic structures
For the detailed program see the Appendix

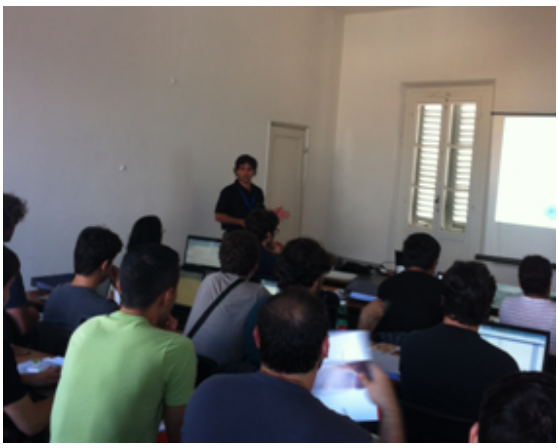
Prerequisites: Knowledge of vector analysis, partial differential equations, Fourier analysis, basic antennas, and a scientific computer language.

Course schedule: 30 hours (23h lectures, 7h laboratory and assignments)
The course gives 2 ECTS credits, plus 1 additional ECTS credit upon successful submission of required material, within 15 day starting from the course end.

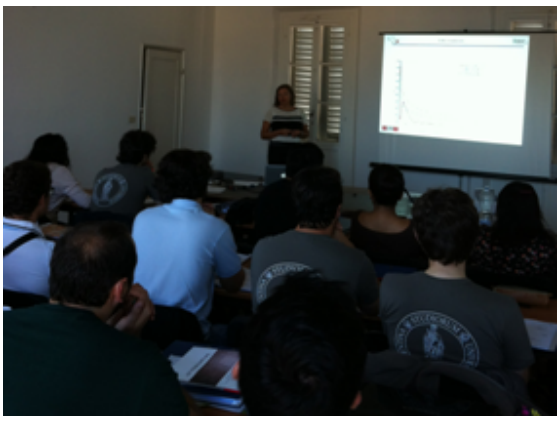
Material given to the students: All the students have been supplied with the copies of the slides presented by the speaker.

Professors Z. Sipus (left) and J. Mosig (right)

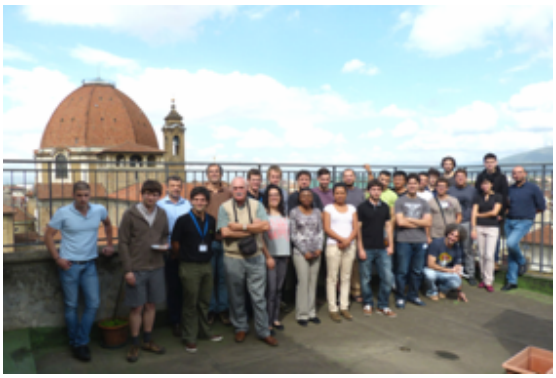



Dr. E. Lezar (left), Dr. D. Ludick (right)




Prof. A. Skrivervik (left), Students during the final test (right)

Location: The course will be held at the Osservatorio Ximeniano, Borgo San Lorenzo 26, Florence, founded by the Jesuit Leonardo Ximenes in 1756. The Osservatorio Ximeniano is in downtown Florence, very close to the Duomo Cathedral.
The property of the observatory is of the City of Florence that has provided the use of the lecture hall and all the structure facilities for free.



Teachers and students on the terrace of the Osservatorio Ximeniano facing the course hall.

3) Assessment of the results and impact of the event on the future directions of the field (up to two pages)

Evaluation of the course from the students

The standard ESOA evaluation form was distributed to the students; all students completed the evaluation form. The outcome is reported in Table I. After the outcome of the evaluation form (an average grade of 8.94 over 10) and after discussion and interaction with the students, we have noticed a very high level of global satisfaction. The pertinence of the practical work was especially appreciated by the students.

The targets of the course under both the scientific and collaborative point of view have been achieved. The success push the teachers to propose again to the ESoA board to put on the course on 2015.

	Teachers
9.28	Prof. Juan Mosig
9.22	Prof. Zvonimir Sipus
9.20	Prof. Anja Skrivervik
8.88	Prof. Angelo Freni
8.71	Prof. Danie Ludick
8.59	Prof. Evan Lezar
8.98	*Average grade*
	Logistic/Laboratory
8.83	Logistical support
8.38	Laboratory Evaluation
8.61	*Average grade*
	Average grade of teachers
9.40	Instructor is knowledgeable about the subject
9.22	Instructor is prepared
8.47	Instructor encourages participation
9.14	Instructor answers students' question
8.96	Instructor is enthusiastic about teaching
9.22	Instructor's fluency in English
8.98	Interest material
9.02	Relevance material
8.84	Instructor uses teaching aids
8.91	How pertinent were the course objectives to the targer audience
8.85	How well do you feel the course objective were met?
8.76	How well do you feel about the level of detail of the course documents?
8.98	*Average grade*
8.94	Overall average grade

Table I

4) Annexes 4a) and 4b): Programme of the meeting and full list of speakers and participants

Annex 4a: Programme of the meeting

Monday 16 October 2013

9:00 – 10:30	A. Freni	*90'*	An overview on frequency domain methods Mathematical aspects common to any frequency domain method Part I
10:45 – 12:45	A. Freni	*120'*	Mathematical aspects common to any frequency domain method Part II
14:45 – 16:15	A. Freni	*90'*	Mathematical aspects common to any frequency domain method Part III Quizzes and guided discussion
16:30 – 17:30	A. Freni	*60'*	Review of basics of linear system solvers

Tuesday 17 October 2013

09:00 – 10:30	Z. Sipus	*90'*	An introduction to Method of Moments
10:45 – 12:45	Z. Sipus	*120'*	Construction of Moment Method programs
14:45 – 16:15	Z. Sipus	*90'*	Examples of development of Moment Method codes (thin wire antennas, slot antennas). Quizzes and guided discussion
16:30 – 17:30	Z. Sipus	*60'*	Green's functions for specific structures Analysis of lenses and focalizing structures

Wednesday 18 October 2013

09:00 – 10:30	J. R. Mosig	*90'*	Mixed Potential formulations of some integral equations in Electromagnetics: free space problems. I) Basics
10:45 – 11:45	J. R. Mosig	*60'*	Mixed Potential formulations of some integral equations in Electromagnetics: free space problems. II) Advanced topics
11:45 – 12:45	J. R. Mosig	*60'*	Free space patch example: an introduction
14:45 – 16:15	EMSS	*90'*	Free space patch example: implementation with FEKO
16:30 – 17:30	EMSS	*60'*	Free space patch example: implementation with FEKO

Thursday 19 October 2013

09:00 – 10:30	J. R. Mosig	*90'*	Mixed Potential formulations of some integral equations in Electromagnetics: planar stratified media problems. I) Basics
10:45 – 11:45	J. R. Mosig	*60'*	Mixed Potential formulations of some integral equations in Electromagnetics: 3D problems, lenses, MRI and health applications
11:45 – 12:45	J. R. Mosig	*60'*	Multilayered microstrip antenna example: an introduction
14:45 – 16:15	EMSS	*90'*	Multilayered microstrip antenna example: implementation with FEKO
16:30 – 17:30	EMSS	*60'*	Multilayered microstrip antenna example: implementation with FEKO

Friday 20 October 2013

09:00 – 10:30	A. Skrivervik	*90'*	Periodic structures
10:45 – 12:45	A. Skrivervik	*120'*	Periodic structures
14:45 – 16:15	EMSS	*90'*	Periodic problems: practical implementation with FEKO
16:30 – 17:30	All	*60'*	Quizzes, guided discussion and wrap-up

Annex 4b: Full list of speakers and participants

Teachers:

1 Prof. Juan R. Mosig (EPFL)
2 Prof. A. K. Skrivervik (EPFL)
3 Prof. Z. Sipus (UNIZAG)
4 Dr. E. Lezar (EMSS)
5 Dr. D. Ludick (EMSS)
6 Prof. A. Freni, (Univ. Florence)

Students: 19 students from 12 different institutions:

1 Oluwafunmilayo Agunlejika , Loughborough University, UK
2 Pevand Bahramzy, Aalborg University, DK
3 Mikkel Dahl Hougs, Technical University of Denmark, DK
4 Francesco Scattone, IETR ESEO ANGERS, F
5 Marco Faenzi, University of Sienna, I
6 Pietro Bia, Politecnico di Bari, I
7 Simon Hubert, Ecole Polytechnique de Louvain, B
8 Ozan Yurduseven, Delft University of Technology, NL
10 Mario Echeverri, Istituto Superiore Mario Boella, I
9 Giorgio Giordanengo, Istituto Superiore Mario Boella, I
11 Doruk Tayli, Lund Tekniska Hogskola, S
12 Santi Concetto Pavone, University of Sienna, I
13 Valentina Sozio, University of Sienna I
14 Esthelladi Ramanandraibe, IETR ESEO ANGERS, F
15 Eden Sorolla, École Polytechnique Fédérale de Lausanne, CH
16 Hamed Hasani, École Polytechnique Fédérale de Lausanne, CH
17 Baptiste Hornecker, École Polytechnique Fédérale de Lausanne, CH
18 Alexandru Tatomirescu, Aalborg University, DK
19 Zhidong Zhao, Nice University, F