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Coordinating the Antenna Research in Europe

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Secondments start-up and results in AEGs

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Abstract

The CARE activities about secondments in WP1 are detailed at Initial, Intermediate and Final stages. In detail, 3 releases of this document will be provided according to the abovementioned deadlines.

Keyword List

Secondments, researchers mobility, antenna

Document Evolution

Revision	Date	Reason of change
Rev. 1.0	30 June 2010	First Edition
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1. Initial status of the Secondment activities in AEGs

1.1. *Secondments topics proposed by the Partners*

The secondment topics proposed by the Partners are in line with the structure of the Antenna Expert Groups (AEGs).

In detail:

- AEG1 – Millimetre and Submillimetre Wave (coordinator UR1)
- AEG2 – Small Antennas and Sensors (coordinator IMST)
- AEG3 - Wideband Antennas (coordinator KIT)
- AEG4 – Array Antenna (coordinator UPM)
- AEG5 – Smart antenna (coordinator UPM)

The benefits are expected from their coordination efforts as reported in the following paragraphs.

1.1.1. *IDS Ingegneria dei Sistemi Spa*

Proposal for a secondment from IDS to TNO

TOPIC – Array antennas optimisation

Work description

IDS and TNO collaborate on antenna research since long time.

Recently, TNO is studying a complex array antenna able to exhibit a very low cross-polarization signal. The IDS/ESA software named ADF is expected to provide a design environment able to cope with this type of problem and identify a proper solution for the array configuration.

In this frame, IDS is planning to send a researcher from IDS staff in order to provide the ADF software tool and, together with the TNO colleagues, use it according to the TNO requirements of the array under study.

Duration

4 months, financed by the CARE budget for secondments

The collaboration will start very soon.

1.1.2. *Katholieke Universiteit Leuven*

Proposal for a secondment from KUL to Aalto University

TOPIC – Submillimeter -wave antennas and systems

Aalto University (AU), School of Science and Technology (previously: Helsinki Institute of Technology), working under supervision of Prof. Antti Raisanen, is one of the leaders within Europe in the field of submillimeterwave antennas and systems. The department carries out research and provides undergraduate and postgraduate education in microwave and millimetre wave measurement, antennas, radio wave propagation, advanced artificial materials, electromagnetics, circuit theory and space technology. Moreover, The Department of Radio Science and Engineering is also involved in the [MilliLab](#) (Millimetre Wave Laboratory of Finland), which has the status of External Laboratory of the European Space Agency ([ESA](#)). The main research activities in the hosting group are currently related to passive and active MMwave/THz imaging.

On the other hand, in cooperation with IMEC, on of the strategic research lines at KUL are the analysis, design, fabrication, and measurements of millimetre wave antennas.

Work description

The purpose of this secondment is to combine the expertise of KUL-IMEC with the expertise of Aalto University to facilitate the scientific progress in several areas.

1. The characterization of microbolometers: This will be done with responsivity measurements. AU has already used backward-wave oscillators (BWO) for antenna pattern measurements. However, the main challenges with the BWOs are related to the strongly varying output power as well as the ill-behaving output beam due to the over-moded waveguides used. The output waveform of the BWO needs to be understood and controlled better in order to conduct power-calibrated measurements.
2. Holographic imaging technique: AU has proven the feasibility of the indirect holographic method with a dedicated MMwave network analyzer (ABmm MVNA). The next step towards the actual realization of the idea is to use a more realistic detector than the state-of-the-art MVNA. For that, a simple array of antenna-coupled square-law detectors has to be designed, such as zero-bias diodes, and the system behaviour of the manufactured imager has to be studied.

The objective of the work is taking part in the development of the Characteristic Mode analyzer, mainly coding a MATLAB function for Z-matrix calculation for infinite dielectric layers.

Duration

6 months, mainly financed by a Ph.D. scholarship

Place

TNO, The Hague, The Netherlands

1.1.3. Czech Technical University in Prague

The CTU prepared two hosting positions for AEG 2 and AEG 3. Another topic (AEG2) is under the preparation

TOPIC - Modal decomposition of fields by the Characteristic Modes (AEG 2)

Modal decomposition of electromagnetic fields is a general way to get insight into behavior of radiating structures. The Theory of Characteristic Modes presents a very good background for analysis of resonant/radiating properties of microstrip patch antennas. Our team here at CTU is coding quite sophisticated MATLAB-based TCM analyzer which can work either on multicore computers (parallel computing) as well as it can distribute the tasks along an arbitrary-sized computer network.

The theory is based on weighted eigenvalue equation for impedance operator described by the EFIE (Electric Field Integral Equation) solution. Simply, the Moment impedance matrix $Z=R+jX$ is obtained and decomposed into set of orthogonal Characteristic currents and corresponding eigenvalues. So far, Z-matrix calculation is done by using the Makarov's MoM codes (Sergei Makarov – Antenna and EM modeling with Matlab). However, these codes utilize only the free-space Green's function, thus only structures with air dielectric are allowed to be analyzed.

Work description

The objective of the work is taking part in the development of the Characteristic Mode analyzer, mainly coding a MATLAB function for Z-matrix calculation for infinite dielectric layers.

The work of the trainee can involve the following aspects:

- Introduction of our work and status of the Modal analyzer's code
- Literature research
- Implementation of Z matrix calculation (Matlab function) for RWG elements with infinite dielectrics layers Green's functions
- Comparison with other software (CST MWS)

Work is not limited to only the Z-matrix implementation, but could include other tasks of interest (Q calculation, near/far electric field calculation from currents etc..)

Duration

The time frame is flexible, but will be at least 1 month

Place

CTU-FEE, Prague, Czech Republic

Profile of the candidates

The candidate should have must be well motivated, communicative, and able to work independently as well as in team, and have an open mind for ideas and comments. A strong background in antennas (planar microstrip), electromagnetics and CEM is recommended. Good MATLAB knowledge and programming skills required. He/she should be fluent in English.

Contact

To apply for the position, or for more detailed information, please contact:

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TOPIC - Investigation and design of high precision filters and wideband antennas (AEG 3)

The theory of electrical filters has been very well established in recent decades. The same is valid for the antennas of various kinds for various applications. The basic filter design is known – transforming the tolerance pattern to the normalized low pass filter, its design and backward transformation. The most important task is then to design a real filter using a real technology - waveguides, planar circuits, etc. The main goal is the get a direct way of the filter and antenna design reducing tedious and time consuming optimizations and a so called “cut and try” way of the work. The systematical investigation based on the solution of field equations is necessary, e.g., coupling matrix synthesis. The final objective of the work is to find the ways of the design of the high quality and high performance filters and wideband antennas aimed for microwave and millimetre wave bands.

Work description

The objective of the work is to verify the behaviour of particular filter elements by numerical simulation in the CST Microwave Studio, and participation in experiments. Programming the code that performs the calculation of coupling matrices and following filter design. Studying ways how to change antenna radiation pattern by a specific required manner.

The work of the trainee can involve the following aspects:

- Introduction of our work and the theory of microwave filters and their design
- Literature search
- Help with programming
- Comparison with other software (CST MWS)

Duration

The time frame is flexible, but will be at least 2 month

Place

CTU-FEE, Prague, Czech Republic

Profile of the candidates

The candidate should be communicative and able to work independently. Sufficient knowledge of electromagnetic field theory is highly recommended. Good MATLAB/FORTRAN knowledge and programming skills is required together with fluent English.

Contact

To apply for the position, or for more detailed information, please contact:

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TOPIC – Wearable antennas for satellite communication

This topic is under the preparation

Contact

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The CTU will send the student (probably to UNISI) for the collaboration in the field of Antenna electromagnetic structures for wireless powering based on Electromagnetic Field theory

1.1.4. Université de Rennes 1

The secondment will consist in hosting young researchers at IETR for a duration up to 6 months. Two positions are offered in the period 2010-2011.

Host institution

IETR (Institut d'Electronique et de Télécommunications de Rennes, Rennes, France) is a public research institute with around 300 researchers including PhD students and post-doctoral fellows. The Institute is organized in 5 research departments: Antennas & Microwave Department, Communication / Propagation / Radar Department, Automation Department, Microelectronics Department, Image Processing Department.

These two positions are offered by the Antennas & Microwave Department. This Department gathers 22 researchers, 45 PhD students and more than 15 post-doctoral fellows. It is strongly involved in national and international research projects.

Work description

The two research topics covered by these two positions are the following:

- Design of wide band, UWB and/or electrically-small antennas,
- Design of millimeter-wave antennas with emphasis on transmit-arrays and reconfigurable antennas.

In both cases, the work of the trainee involves the following aspects:

- Literature study,
- Antenna design,
- Antenna prototyping,
- Experimental characterization.

Duration

The time frame is flexible, and will be up to 6 months (3 months per position). Extension is possible under conditions to be defined.

Background of the applicants

The candidate should have must be well motivated, communicative, and able to work independently as well as in team, and have an open mind for ideas and comments. A strong background in antennas and electromagnetics is recommended. He/she should be fluent in English. Knowledge of French is not a requirement.

Contact

To apply for the position, or for more detailed information, please contact:

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1.1.5. *IMST GmbH*

Proposal for a secondment on Antenna Design

Host Institution

IMST, located in Kamp-Lintfort, Germany, was founded in 1992 with the support of the government of North Rhine-Westfalia. It focuses on R&D projects for mobile communications systems, integrated and high frequency circuits, and antenna technology. The company has a staff of 150 employees, mostly scientists and engineers, and about 4,500 m² of laboratories and offices.

IMST covers the whole design process, from the creation of ideas for new products to actual implementation, product qualification, and manufacturing support. R&D projects are usually carried out in collaboration with partners in industry, other research institutions, and universities.

Work description

The objective of the work is taking part in the design of antennas for different applications, like mobile communications, radar, satellite communications and UWB. These types of antennas are application driven solutions where not only the antenna itself but also its environment has to be considered in the design. This results often in highly complex buildups that require a large deal of expertise.

Most of the work involves complex 3D-field simulations using an FDTD-based field solver (Empire), and extensive literature research, as well as contact with PCB-manufacturers and measurements. The work of the trainee can involve the following aspects:

- Literature research
- Design of antenna elements and structures
- Extensive EM-field modelling & simulations
- Realisation of antenna structures on different types of materials (soft/hard substrates)
- Measurement & test of the realised antennas

Duration

The time frame is flexible, but will be at least 6 months.

Place

IMST, Kamp-Lintfort, Germany

Profile of the candidates

The candidate should have must be well motivated, communicative, and able to work independently as well as in team, and have an open mind for ideas and comments. A strong background in antennas and electromagnetics is recommended. He/she should be fluent in English. Knowledge of German is not a requirement.

Contact

To apply for the position, or for more detailed information, please contact:

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Proposal of secondment from IMST to University of Nice Sophia-Antipolis (related to AEG1 & ABPG2)

TOPIC – Design and measurement of integrated mm-wave antennas on LTCC

A very promising but also challenging technology for the integration and/or miniaturisation of mm-wave antennas is found in the use of LTCC (Low Temperature Co-fired Ceramic) as a substrate. Using LTCC allows complex antenna structures or electrical circuits to be placed in the most area-effective way, yielding in very small modules. However, characterising the behaviour of antennas integrated in monolithic LTCC modules is a complex issue. Test structures can be defined, but the results may differ from those of the actual system, due to the interfaces required.

The goal of this secondment is to combine the expertise of IMST in the design of integrated mm-wave antennas on LTCC with the know-how of the University of Nice Sophia-Antipolis regarding measurement of mm-wave antennas. For that an IMST researcher (Christos Oikonomopoulos-Zachos) will visit the University of Nice Sophia-Antipolis for a week, to perform the measurements on the existing prototypes.

Work description

- Fabrication of antennas at 60GHz on LTCC
- Characterisation of the antennas (matching, radiation)
- Optimisation of the designs
- Optimisation of the manufacturing procedure
- Benchmarking of the measurement facilities

Duration

1 week, in December 2010

Further secondments concerning measurement & test of the realised antennas within the framework of the activities are listed in D 1.1.

Secondment from IMST to ICECOM (related to AEG1)

TOPIC – Array antennas

An IMST Early Stage Researcher attended ICECOM 2010 in Dubrovnik, to get acquainted with the latest developments in the field of planar array antennas.

Duration

1 week, in September 2010

These are the expected secondments from IMST:

- Markus Krengel. Early Stage Researcher. He attended ICECOM 2010 in Dubrovnik, Croatia, from 20/9/2010 to 22/09/2010.

- Christos Oikonomopoulos-Zachos. Early Stage Researcher. He is planning a short mission to the University of Nice Sophia-Antipolis to exchange know-how regarding the design of millimetre-wave antennas on LTCC (on IMST side) and their characterisation (on U. Nice side). The stay should take place in December 2010.
- Further secondments will consist in hosting young researchers for a duration of 6 months or more. IMST has prepared an offer and a requirement profile that will be published shortly.

1.1.6.***Universita degli Studi di Siena***

The hosting position at the UNISI for student fro CTU is under the preparation (collaboration in the field of Antenna electromagnetic structures for wireless powering based on Electromagnetic Field theory)

1.1.7. *Universidad Politécnica de Madrid*

Proposal of secondments from Radiation group

- **Secondment at DTU from 6/9/2010 to 17/12/2010.**

Supervisor: Prof. Sergey Pivnenko from the Department of Electrical Engineering at DTU.

The secondment goal is the collaboration in an antenna measurement field project and specifically in the antenna measurement post-processing. Particularly the work is planned on the error compensation in microwave and millimeter wave antenna measurement processes due to noise, reflections and antenna misalignment.

The profile of the candidate was a Phd student in the general area of antenna design and measurement.

The secondment has been published in the internal web page of the UPM and the selection has been already done to Mr Francisco Cano Facila.

- **Secondment at ESA - ESTEC from 10/1/2011 to 30/6/2011.**

Supervisor: Cyril Mangenot.

UPM has published the grant in the UPM web page and the PhD student Mr. Alfonso Muñoz has been selected and his stay has to be approved by ESTEC-ESA.

He will work in the characterization of compact range for millimeter and sub-millimeter antenna measurement.

- **Secondment at UNIZAG from 1/2/2011 to 30/4/2011**

Supervisor: Prof. Zvonimir Sipus.

The secondment has the objective to learn about electromagnetic numerical methods and to work in specific techniques for antenna modeling and numerical methods applied to printed antenna design.

After its publication in the UPM web page, the selected student has been Mr Andres García-Aguilar, PhD student in the Department of Signal, Systems and Radiocommunication of UPM.

- **Secondment at Toronto University from 1/4/2011 to 30/6/2011.**

Supervisor Prof. Sean Victor Hum.

This secondment has been selected to work in the field of active antenna design and reconfigurable antenna design, either on frequency band modification or in pattern configuration through active circuit control.

A first selection has been done between several PhD students at UPM and Mr Javier Garcia Gasco has passed the first selection and presented to the UPM final approval.

1.1.8. *Netherlands organisation for applied scientific research*

Host Institution

As prominent player in the Dutch knowledge infrastructure, TNO has the role to be the crucial link from Research & Development to commercial exploitation of knowledge in terms of new products and services. This mission locates TNO naturally between the academic and the industrial world, offering to the young researchers the possibility to work in a challenging and multidisciplinary environment with an ideal balance of scientific research and industrial application oriented development.

TNO has a long and consolidated expertise in the development of phased arrays and imaging systems for radars, space and security applications, in cooperation with governmental institutions, industrial and research partners. The young researchers hosted by TNO will be working in the Antenna Group of the Transceivers Department.

Work description

Two main research topics will be addressed in the framework of this project:

- Focal plane arrays of sub-millimeter lens antennas for imaging systems (WP1 - AEG1 - BPG1)
 - Contribution to the development of theoretical models and software tools for the analysis of large focal plane arrays;
 - Design of integrated antennas and detectors;
 - Short secondment to a leading research center developing technology for sub-mm wave imaging instruments.
- Reconfigurable phased arrays (WP1 - AEG4 - BPG1)
 - Literature review and classification of current State-of-the-Art reconfigurable array systems;
 - Investigation of topologies for reconfigurable arrays;
 - Design of reconfigurable/tunable antennas for phased arrays;
 - Short secondment to a leading industry developing technology for tunable systems and/or phased arrays.

Duration

TNO will host two young researchers for a total period of approximately 8 man-months. The duration of the parlance will range from a minimum of 3 months to a maximum of 5 months. Part of the budget will also be used to support the secondment of one or two researchers at industries and/or research centers leading in the technological fields related to the two research topics. Extensions of the research positions, outside the budget allocated within the CARE project, will be evaluated by TNO together with the hosted researchers.

Contact

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1.1.9. University of Zagreb

Secondments from UNIZAG are expected to:

- University of Siena in the field of new milimetre and submilimetre structures (AEG 1)
- Graz University to work in the field of antennas for RFID (AEG2)
- CTTC Barcelona to work on reconfigurable antennas and FSS (AEG5)

and to host PhD student from UPM.

1.1.10. Politechnika Wroclawska

Politechnika Wroclawska (WUT) expressed the interest in secondments in the period June 2010 – September 2011. in relevant Antenna Expert Groups:

AEG2 (*Small antennas and Sensors Expert Group*), and

AEG4 (*Array Antenna Expert Group*).

No proposals have been identified so far. However, we are interested in sending:

- M.Sc. student on “Radiation pattern measurements of iPod and small terminal antennas in a full spherical format”.
- Ph.D. student, for wearable antenna testing.

1.2. Advertisements, Identification of candidates and Appointment procedure

According to the planned secondments listed in the previous paragraph, a set of advertisements of the CARE opportunities, together with the scientific topics related, are distributed in the main international conferences in Antennas and Propagation (i.e. at the EuCAP010 conference in Barcelona or URSI/APS2010 in Toronto).

In addition, the open positions will be published in the CARE Virtual Centre, published in a dedicated section of the EurAAP portal at www.antennasVCE.org.

An initial list of candidates is planned to be extracted from the applications, received by email.

According to the procedure detailed in the CARE Description of the Work, the local teams will proceed with the selection of candidates and will inform Prof. Mazanek (the Secondments Responsible) about the names and expertise of the young researchers involved in the CARE Secondments.

1.2.1. Secondments Forms

In order to reach an uniform and controlled approach to the management of the CARE secondments, both from the applicants and hosting sides, 4 Forms have been produced:

- 1) the CARE Host Application Form; this form, available on the CARE website, must be filled by the Institutions that would like to host a CARE secondment (these are the Open Positions)
- 2) the CARE Secondment Application Form; this form, available on the CARE website, must be filled by the researchers that would like to apply for a CARE secondment
- 3) the CARE Grant Officialisation Form; this form has to be sent to the selected applicant in order to inform him/her about the successful result of his/her application
- 4) the CARE Secondment Report Form; this form must be filled by the seconded researcher at the end of the secondment period, in order to present the results of the hosted activity.

The Forms are available on the CARE Virtual Centre, in the Secondment section.