PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Salvatore Savarese

XXX Cycle

Training and Research Activities Report – First Year

Tutor: Amedeo Capozzoli

1. Information

Salvatore Savarese, MS Degree in Electronic Engineering – Università di Napoli Federico II

XXX Cycle- ITEE – Università di Napoli Federico II

Fellowship type: POR FSE Campania 2007-2014/2014-2020

Tutor: Amedeo Capozzoli

2. Study and Training activities

a. Courses
- Ad hoc Course, "Aspetti elettromagnetici nella progettazione di reti wireless", from 20/01/2015 to 03/02/2015
- Ad hoc Course, "Project Management per la Ricerca", from 30/01/2015 to 27/02/2015
- Ad hoc Course, "Elettromagnetismo e relatività", from 06/02/2015 to 27/02/2015
- Ad hoc Course, "Fondamenti di Analisi Funzionale", from 07/04/2015 to 30/04/2015
- Ad hoc Course, "Designing and writing scientific manuscripts for publication in English language scholarly journals, and related topics", from 15/06/2015 to 17/06/2015

b. Seminars
- "Smoothed Particle Machine Perception: a proposed method for sensor fusion and physical-spacial perception", Nick Hockings, 14/01/2015
- "Mechanics of Solids: From beam theory to rapid prototyping for surgery planning", Prof. Ferdinando Auricchio, 15/01/2015
- "Affidabilità di dispositivi e moduli elettronici di potenza", Dr. Alberto Castellazzi, 24/03/2015, 24/03/2015 and 24/03/2015
- "Partial Possibilistic Regression Path Modeling", Prof. Rosaria Romano, 20/04/2015
- "Mathematical Modeling of Atomic Force Microscopes", Dr. Martin Homer, 22/04/2015
- "Lecture on Current and Future Trends in Advanced Antenna Applications", Prof. Constantine Balanis, 03/05/2015
- "Evoluzioni a lungo termine delle reti mobili", Ing. Silvio De Nicola, 08/06/2015
- "Regularization of two-fold bifurcations in planar piecewise smooth systems", Prof. John Hogan, 23/06/2015

c. External courses
- "24th Summer School on Parallel Computing" at CINECA – Rome, from 13/07/2015 to 24/07/2015 (website: http://www.hpc.cineca.it/content/24th-summer-school-parallel-computing)

	Credits year 1								Credits year 2		Credits year 3			
	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated		Estimated		Total	Check
Modules	20	0	10	0	3	6	6	25	10		0		25	30-70
Seminars	5	0	0,8	2	1,6	0	0	4,4	5		5		4	10-30
Research	35	7	4	6	5	3	6	31	45		55		31	80-140
	60	7	15	8	4,6	6	6	60	60		60		60	180

3. Research activity

The research activity is focused on advanced diagnosis techniques for radio and optical telescopes in astronomical applications.

To guarantee the high performance required to these systems, a continuous monitoring and reassessment is necessary to suppress deviations from their nominal behavior. During the first year, the attention has been focused on the diagnosis of large reflector antennas employed in radio telescopes.

The aim of the activity has been twofold.

First, a theoretical study has been carried out to develop an optimized approach to the diagnosis problem minimizing the measurement time, thus simplifying the tracking of the source and reducing the effects of the variations of the environmental conditions as well as the idle time forced by the maintenance activity.

Secondly, the problem of the numerical and experimental validation of the algorithm has been faced, leading to the definition and realization of an outdoor far field test range.

Concerning the first point, at the beginning the methods available in literature have been taken into account and implemented. In particular, microwave holography has been considered, which is based on the acquisition of a complete set of Far Field Pattern (FFP) data, wherein the acquisition of both amplitude and phase is made possible thanks the use of a second antenna employed as reference. Then an alternative approach has been considered, requiring the measurement of the amplitude only of the FFP, simplifying the measurement set up.

Unfortunately, both cases require the acquisition of the FFP on a very large number of points, resulting in lengthy measurement process.

Accordingly, an optimized diagnosis procedure has been devised, based on the optimization of the singular values behaviour of the relevant operator. The proposed diagnosis is aimed at reducing the number of required FFP sampling points, in order to reduce the time length of the measurement.

The second aspect of the activity has involved the problem of validating the diagnosis algorithms. Obviously, a numerical analysis can been carried out to test the model exploited to describe the system and to evaluate the performance of the algorithm. To this end, a reliable commercial software exploited to simulate reflector antennas has been exploited. However, to complete the analysis the experimental validation becomes mandatory, and an experimental outdoor far field test range is required.

Accordingly, a test range has been set up thanks to the collaboration with Istituto Nazionale di Astrofisica (INAF) of Naples. Its realization has involved the full development of the software to drive an Alt-Azimuth positioner and to remotely control the instrumentation. In addition, an upgrade of the internal connections of a Vector Network Analyser has been performed in order to allow the interferometric acquisition.

Collaborations

Osservatorio Astronomico di Capodimonte - Istituto Nazionale di Astrofisica(INAF-OAC) - Ing. Pietro Schipani

4. Products

Conference Papers

Capozzoli A., Curcio C., D'Elia G., Liseno A., Savarese S., and Schipani P. ,
"Optimized Diagnosis of Reflectors Misalignements in Radioastronomical Applications"
9th European Conference on Antennas and Propagation (EuCAP 2015), 12-17 April 2015

Capozzoli A., Curcio C, Liseno A., and Savarese S.,
"GO Solutions with Fast Marching"
10th European Conference on Antennas and Propagation (EuCAP 2016) - submitted