



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 – Second Year

Tutor: Amedeo Capozzoli

co-Tutor: Angelo Liseno, Claudio Curcio



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

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

co-Tutor: Angelo Liseno, Claudio Curcio

2. Study and Training activities

a. Courses

- External Course "12TH Advanced School on Parallel Computing" at CINECA - Casalecchio di Reno (BO), from 15/02/2016 to 19/02/2016 (website: <https://events.prace-ri.eu/event/470/>)
- Ad hoc course "Designing and writing scientific manuscripts for publication in English language scholarly journal and related topics", by prof. Chie Shin Fraser, from 27/05/2016 to 02/06/2016
- Ad hoc course "Complementi di Analisi funzionale", by prof. Renato Fiorenza, from 03/05/2016 to 21/06/2016

b. Seminars

- "Armi Autonome: Problemi Etici e Decisioni Politiche", prof. Guglielmo Tamburrini, 01/12/2015
- "Security Operations in una Telco, esperienze e riflessioni dal campo", ing. Fabio Zamparelli, 04/12/2015
- "Gallium Nitride for power applications: benefits challenges, and state of the art", Dr. Giorgia Longobardi, 16/12/15
- "Verifying ConGolog Programs on Bounded Situation Calculus Theories", Prof. Yves Lesperance, 17/12/2015
- "Radar Adaptivity: Antenna Based Signal Processing Technique", ing. Alfonso Farina, 12/02/16
- "Perception-based surround sound recording and reproduction", Dr. Enzo de Sena, 22/02/16
- "Programmable network conjugations", Dr. Roberto Bifulco, 26/02/16
- "Workshop on Nano-Electromagnetics Applications", Prof. Amir Boag and Dr. Stefano Bellucci, 17/05/16
- "An overview on image forensics with emphasis on physics-based scene verification", Dr. Christian Riess, 18/05/16

	Credits year 1							Credits year 2							Credits year 3		Total	Check	
	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary			Estimated
Modules	20	0	10	0	3	6	6	25	10	0	3	0	3	0	0	6	0	31	30-70
Seminars	5	0	0,8	2	1,6	0	0	4,4	5	1,4	1	0	1	0	0	3,4	5	7,8	10-30
Research	35	7	4	6	5	3	6	31	45	8	8	9	8	9	9	51	55	82	80-140
	60	7	15	8	9,6	9	12	60	60	9,4	12	9	12	9	9	60	60	121	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.

Concerning the diagnosis of large reflector antennas employed in radio telescopes, the attention was focused on electromagnetic methods.

Among different methods available, 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. An alternative approach has been considered as well, which requires 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, during the first year 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 activity of the second year has been focused on the further development of the diagnosis method.

First, a Principal Component Analysis (PCA) has been employed to restore the linear relationship between the unknowns and the data, necessary to resort to an optimized sampling. The PCA allows to manage more general feed misalignments, whereas previously only lateral displacement could be considered.

Secondly, an experimental analysis has been carried out employing an outdoor far field test range, set up thanks to the collaboration with Istituto Nazionale di Astrofisica (INAF) of Naples during the first year. The control driver of the Alt-Azimuth positioner used in the test range has been upgraded to allow a simple stepped non-uniform scan, necessary to the proper field sampling over the optimized grid.

A stepped movement of the positioner impairs the performance because it extends the measurement time. Therefore, a continuous scan would be appealing but would require a complex control system of the antenna positioner. In this regard, a collaboration was started with the Automatic Control Group led by prof. Celentano in order to develop such a control system using the linear scanner available in the anechoic chamber of the Microwave Laboratory of DIETI.

Collaborations

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

Dipartimento di Ingegneria Elettrica e Tecnologie dell'Informazione – Prof. Giovanni Celentano

4. Products

Capozzoli, A., Curcio, C., Liseno, A. and Savarese, S., "GO solutions with Fast Marching."
In 10th European Conference on Antennas and Propagation (EuCAP), pp. 1-5. IEEE, 2016.

Capozzoli, A., Curcio, C., Liseno, A., Savarese, S. and Schipani, P., "Singular values behaviour optimization in the diagnosis of feed misalignments in radioastronomical reflectors."
In SPIE Astronomical Telescopes+ Instrumentation, pp. 99124P-99124P. International Society for Optics and Photonics, 2016.

Capozzoli, A., Curcio, C., Liseno, A., Savarese, S. and Schipani, P., "Efficient Diagnosis of Radiotelescopes Misalignments"
In 38th Annual Symp. of AMTA. Antenna Measurement Techniques Association, 2016.