Angela Marino

3D Target Localization via Multiple Deployable Nodes

Tutor: Prof. Augusto Aubry

co-Tutor: Dr. Paolo Braca

Cycle: XXXV

Year: 2020-2021

My background

- **Master Science degree:** Telecommunication Engineering at the University of Naples, “Federico II”
- **Research group/laboratory:** Radar Signal Processing and Electronic Defense Research Group (RSPRG)
- **PhD start date:** 01/11/2019
- **Scholarship type:** funded by NATO Science and Technology Organization - Centre for Maritime Research and Experimentation

Research field of interest

Optimization Theory Applied to Radar Signal Processing

- Passive Bistatic Radar
  - Target localization via passive and active radars
- Frequency Diverse Array-MIMO Radar
  - Adaptive target detection
- Multiplatform Radar Systems
  - 3D Target localization via Deployable Radar Nodes

Summary of study activities

Study activities

- Statistical filtering techniques

Ad hoc PhD courses / schools

- Cooperative and Non Cooperative Localization Systems
- Matrix Analysis for Signal Processing with MATLAB

Courses attended borrowed from MSc curricula:

- Radiolocalizzazione Terrestre e Satellitare
- Teoria dell'Informazione

Conferences / events attended

- Student Contest of the 1st International Virtual School on Radar Signal Processing University of Electronic Science and Technology of China (UESTC), 22-23 December 2020. 1 paper presented. Ranked Third to the Student Contest.
- Signal Processing Symposium (SPSympo) 2021, 21-23 September 2020, Lodz, Poland. 1 paper presented. Received the Young Scientist Contest Award (First Prize).

Summary of study activities

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	0	2.7	6	0	8.7
Bimonth 2	9	0.2	7	0	16.2
Bimonth 3	3	2.5	9	0	14.5
Bimonth 4	2	1.6	7	0	10.6
Bimonth 5	0	0	6	0	6
Bimonth 6	6	0	7	0	13
Total	**20**	**7**	**42**	**0**	**69**
Expected	10 - 20	5 - 10	30 - 45	0 - 1.6	

Research activity: Overview

- Problem

  Multiplatform radar networks are of great interest in order to:
  - enlarge the surveillance area
  - improve data reliability and accuracy
  - enhance the fault tolerance
  - improve the data utilization of the system
  - endow resistance to electronic countermeasures
  - reduce the effects of shadowing.

- Objective

  – Development of an advanced 3D target position estimate algorithm for multiplatform radar systems, accounting restrictions embedded into the characteristics of the active radiation pattern.

Research activity: Overview

- Methodology

  – Formalization of ad-hoc constraints for the localization process accounting for characteristics of the acctive radiation pattern. Definition of the position estimation problem resorting to the constrained Least Squares estimation paradigm.

  – Design of an efficient optimization algorithm exploiting KKT conditions for solving the formulated non-convex optimization problem and determine the location estimate in quasi-closed-form among at most twenty-six candidates.

    - Development of a smart rooting method to solve the sixth- and fourth-order equations involved in the evaluation of the candidate optimal solutions.

  – Improvements in the position estimate accuracy in comparison with some counterparts, especially for weak target returns.

Products

[J1]	A. Aubry, P. Braca, A. De Maio, and A. Marino, "2D PBR Complying with Constraints Forced by Active Radar Measurements", IEEE Transactions on Aerospace & Electronic Systems, in Press, 2021.
[J2]	A. Aubry, P. Braca, A. De Maio, A. Marino, "Enhanced Target Localization with Deployable Multiplatform Radar Nodes Based on Non-Convex Constrained Least Squares Optimization", IEEE Transactions on Signal Processing, Under revision (RQ), 2021.
[C1]	A. Marino, A. Aubry, A. De Maio, and P. Braca, "2D PBR Localization Complying with Constraints Forced by Active Radar Measurements", IVSRSP: The 1 st International Virtual School on Radar Signal Processing University of Electronic Science and Technology of China (UESTC) , China, 22-23 Dec. 2020.
[C2]	A. Marino, A. Aubry, A. De Maio, and P. Braca, "3D Localization for Multiplatform Radar Networks with Deployable Nodes", Signal Processing Symposium, Lodz, Poland, 21-23 Sept. 2021.
[C3]	A. Marino, A. Aubry, A. De Maio, P. Braca, and D. Gaglione, "Constrained Target Localization for Multiplatform Radar Systems", Military Communications Conference MILCOM 2021, 29 Nov.–2 Dec. 2021.