

# FABRIZIO SANTI

## CURRICULUM VITAE

### EMPLOYMENT

Feb. 2021 – May 2021

Aster s.p.a. – contratto di collaborazione per l'attività: Studi sulla localizzazione e la stima di parametri cinematici di bersagli marittimi mediante radar passivi basati su GNSS.

Feb. 2014 – Jan. 2021

Postdoctoral Researcher with the Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome.

Research contracts:

Dec. 2020 – Jan. 2021

Passive radar imaging techniques exploiting satellite transmitters of opportunity (*Incarico di lavoro autonomo*)

Dec. 2019 – Nov. 2020

Passive radar techniques for moving target detection and imaging using satellite illuminators of opportunity (*Assegno di ricerca*)

Aug. 2019 – Nov. 2019

Passive radar techniques for surveillance applications based on satellite illuminators of opportunity (*Incarico di lavoro autonomo*)

Aug. 2018 – July 2019

Parasitic concepts definition and analysis based on a Geo illuminator (*Assegno di ricerca*)

Feb. 2018 – July 2018

Bistatic radar detection and imaging exploiting satellite illuminators (*Borsa di studio*)

Dec. 2015 – Jan. 2016

Study and development of signal processing techniques for space-based passive radar systems (*Incarico di prestazione occasionale*)

Feb. 2014 – Jan. 2018

Study and development of focusing and processing techniques for active and passive multi-dimensional radar images (*Assegno di ricerca*)

### EDUCATION

November 2010 – June 2014

PhD in Radar and Remote Sensing

Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome, Italy

Dissertation: Active and passive multi-sensor radar imaging techniques exploiting spatial diversity

Advisor: Dr. Debora Pastina

April 2013 – September 2013

Visiting Research Student at the Microwave and Integrated Systems Laboratory, University of Birmingham (UK), headed by Prof. Mike Cherniakov.

8 – 15 July 2011

Attendance at the 3rd International Summer School on Radar/SAR, Wachtberg, Germany, organized by the Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR.

2008 – 2010

Master's degree in Communication Engineering

Sapienza University of Rome, Italy

Final mark: 110 cum laude / 110

Dissertation: Oil spill detection using a X-band VTS radar

Advisor: Prof. Pierfrancesco Lombardo

2004 – 2007

Bachelor's degree in Communication Engineering

Sapienza University of Rome, Italy

Final mark: 108 / 110

Dissertation: Sensors based on relaxation oscillators  
Advisor: Prof. Sergio Barbarossa

## RESEARCH ACTIVITY

Fabrizio Santi carries on his research activity with the Radar, Remote Sensing and Navigation (RRSN) group – Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome. The RRSN group employs include a Full Professor, two Associate Professors, three Postdoctoral researchers and some PhD students in Information and Communications Technologies. The RRSN group has a consolidated experience in the field of radar system design and radar signal processing and it is involved in scientific national and international collaborations in the framework of projects funded by the European Commission, by the Italian Space Agency and by the Italian radar industry.

### RESEARCH TOPICS

The main research interests of Fabrizio Santi are in the field of radar systems. Current research topics include:

- Monostatic and multistatic synthetic aperture radar (SAR)/ISAR systems and techniques
- Passive radar imagery using satellite illuminators
- GNSS-based passive radar for maritime surveillance
- Parasitic systems exploiting radar illuminators

### SCIENTIFIC COLLABORATIONS

2019 – present days

Scientific collaboration with the Passive Covert Radar Team (Department for Passive Radar and Anti-jamming Techniques - Fraunhofer Institute, Wachtberg, Germany) headed by Dr. Diego Cristallini, on the research topic 'Passive ISAR imaging exploiting DVB-S illumination.

2013 – present days

Scientific collaboration with the Microwave and Integrated Systems Laboratory (University of Birmingham, UK), headed by Prof. M. Cherniakov, on research topics concerning passive radar systems exploiting navigation satellites as opportunistic sources.

### PARTICIPATION IN RESEARCH PROJECTS

June 2018 – November 2020

*GEO-SAR – Feasibility study for the development of a geosynchronous satellite for Earth Observation.* Project funded by Italian Space Agency

January 2018 – September 2019

*Apollo – Passive radar based on GNSS illuminators for maritime surveillance.* POR FESR Lazio 2014-2020

July 2017 – June 2018

*Study and development of ship target detection techniques with a passive multistatic radar based on navigation satellites.* Sapienza Research Calls 2017 - Initial research project. (Principal Investigator)

January 2015 – December 2017

*SpyGLASS – Galileo-based passive radar system for maritime surveillance.* Horizon 2020 research programme.

November 2010 – December 2011

*Study on Distributed ISAR techniques.* Project funded by Leonardo S.p.a. (formerly Galileo Avionica)

## PROFESSIONAL ACTIVITIES

### EDITORIAL ACTIVITY

January 2021 – present days

Review Editor on the Editorial Board of Radar Signal Processing (*Frontiers*)

May 2020 – present days

Topic Editor of the journal Remote Sensing (*MDPI*)

February 2020 – present days

Guest Editor for the Special Issue 'Recent Advances on Radar and Remote Sensing using Satellite Signals of Opportunity' – Remote Sensing (*MDPI*)

October 2019 – present days

Member of the Editorial Board of the International Journal of Electronics and Communications (*AEÜ, Elsevier*)

December 2012 – present days

Routinely reviewer for a number of international technical journals in the area of radar remote sensing and signal processing.

## CONFERENCES AND WORKSHOPS

Member of the Organizing Committee of the 3rd Italian Workshop on Radar and Remote Sensing, Rome, 30-31 May 2019.

Member of the Technical Programme Committee:

- European Microwave Week (2021)
- IEEE Radar Conference (2020)
- IEEE International Radar Conference (2019, 2020, 2021)
- European Signal Processing Conference (2018)

Session Chair:

- 10-14 May 2021 – IEEE Radar Conference 2021, Atlanta, USA – Oral session 'Waveform & Waveform Diversity'
- 29 Mar.-1 Apr. 2021 – European Conference on Synthetic Aperture Radar – Oral session 'Bi-, Multistatic, and Passive SAR'
- 28-30 April 2020 – IEEE Radar Conference 2020, Washington, USA – Poster session 'Multistatic, Imaging & ATR'
- 7-8 May 2019 - International Workshop 7<sup>th</sup> PCL Focus Days, Watchberg, Germany – oral session 'Passive SAR/ISAR'

Presenting author:

- 10-14 May 2021 – IEEE Radar Conference 2021, Atlanta, USA (*virtual conference*)
- 29 Mar.-1 Apr. 2021 – European Conference on Synthetic Aperture Radar (*virtual conference*)
- 28-30 April 2020 – IEEE Radar Conference, Washington, USA (*virtual conference*)
- 26-28 June 2019 – International Radar Symposium, Ulm, Germany
- 30-31 May 2019 – 3rd Italian Workshop on Radar and Remote Sensing, Rome, Italy
- 20-22 May 2019 – IEEE GNSS+R Workshop, Benevento, Italy
- 7-8 May 2019 – 7<sup>th</sup> PCL Focus Days 2019, Wachtberg, Germany
- 22-26 April 2019 – IEEE Radar Conference, Boston, MA (USA)
- 28-29 May 2018 – 2<sup>nd</sup> Italian Workshop on Radar and Remote Sensing, Pavia, Italy
- 23-27 April 2018 – IEEE Radar Conference, Oklahoma City, OK (USA)
- 28-30 June 2017 – International Radar Symposium, Prague, CZ
- 6-9 June 2016 – European Synthetic Aperture Radar Conference, Hamburg, Germany
- 2-6 May 2016 – IEEE Radar Conference 2016, Philadelphia, Pennsylvania (USA)
- 10-15 May 2015 – IEEE Radar Conference 2015, Arlington, Virginia (USA)
- 28-29 April 2015 – 5<sup>th</sup> PCL Focus Days 2015, Wachtberg, Germany
- 13-17 Oct. 2014 – IEEE International Radar Conference 2014, Lille, France
- 8-10 Oct. 2014 – European Radar Conference, Rome, Italy
- 2-5 June 2014 – European Synthetic Aperture Radar Conference, Berlin, Germany
- 4-5 June 2012 – IEEE GOLD Remote Sensing Conference 2012, Rome, Italy
- 7-11 May 2012 – IEEE Radar Conference 2012, Atlanta, Georgia (USA)
- 24-27 Oct. 2011 – CIE International Conference on Radar 2011, Chengdu, China
- 23-27 May 2011 – IEEE Radar Conference 2011, Kansas City, Missouri (USA)

## TEACHING EXPERIENCE

A.A. 2020-21

Lecturer for the Course 'Remote Sensing for Earth Observation' - Space and Astronautic Engineering - Master's Degree Program – University of Pisa (Italy).

A.A. 2020-21

Tutor for the Course 'Communication Systems' – Computer Engineering, Bachelor's Degree Program - UniNettuno University (Italy).

A.A. 2018-19, 2019-20, 2020-21

Lecturer for the courses 'Communication Engineering' and 'Radar and Earth Observation' - Master in Satellite Systems and Services – Sapienza University of Rome (Italy).

2020 – present days

Supervisor for bachelor's thesis in Computer Engineering – UniNettuno University.

2014 – present days

Co-supervisor of PhD students in Information and Communication Technologies and Visiting PhD students.

2013 – present days

Co-supervisor for master's thesis in Communication Engineering and Space and Astronautic Engineering – Sapienza University of Rome

2011 – present days

Seminars and lessons in the courses: 'Radar imaging' (Communication Engineering, Electronic Engineering, Space and Astronautic Engineering - Master Degree Program), 'Radar and Remote Sensing Laboratory' (Communication Engineering – Master Degree Program) and 'Radar Systems' (Communication Engineering – Master Degree Program).

## **AWARDS**

- Co-author of the Second Best Student Paper awarded at the 2018 European Synthetic Aperture Radar Conference (Aachen, Germany, June 2018): "Ship targets feature extraction with GNSS-based passive radar via ISAR approaches: preliminary experimental study", by F. Pieralice, F. Santi, D. Pastina, M. Antoniou, M. Cherniakov.
- Best Italian Thesis on Remote Sensing Award from the IEEE Geoscience and Remote Sensing South Italy Chapter, 2010.

## **ANNEXES**

Scientific publications

Roma, 15.05.2021

Fabrizio Santi

## Scientific publications

### Publications in international journals

- [J13] I. Pisciotano, F. Santi, D. Pastina, D. Cristallini, "DVB-S based passive polarimetric ISAR – methods and experimental validation", *IEEE Sensors Journal*, vol. 21, no. 5, pp. 6056 – 6070, Mar. 2021.
- [J12] D. Pastina, F. Santi, F. Pieralice, M. Antoniou, M. Cherniakov, "Passive radar imaging of ship targets with GNSS signals of opportunity", *IEEE Transactions on Geoscience and Remote Sensing*, vol. 59, no. 3, pp. 2627 – 2624, Mar. 2021.
- [J11] F. Santi, D. Pastina, M. Bucciarelli, "Experimental Demonstration of Ship Target Detection in GNSS-Based Passive Radar Combining Target Motion Compensation and Track-before-Detect Strategies", *Sensors* 2020, 20(3), 599.
- [J10] F. Santi, F. Pieralice, D. Pastina, "Joint Detection and Localization of Vessels at Sea With a GNSS-Based Multistatic Radar," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 57, no. 8, pp. 5894-5913, Aug. 2019.
- [J9] D. Pastina, F. Santi, F. Pieralice, M. Bucciarelli, H. Ma, D. Tzagkas, M. Antoniou, M. Cherniakov, "Maritime Moving Target Long Time Integration for GNSS-Based Passive Bistatic Radar", *IEEE Transactions on Aerospace and Electronic Systems*, vol. 54, no. 6, pp. 3060-3083, Dec. 2018.
- [J8] H. Ma, M. Antoniou, D. Pastina, F. Santi, F. Pieralice, M. Bucciarelli, M. Cherniakov, "Maritime Moving Target Indication Using Passive GNSS-Based Bistatic Radar", *IEEE Transactions on Aerospace and Electronic Systems*, vol. 54, no. 1, pp. 115-130, Feb. 2018.
- [J7] Z. Li, F. Santi, D. Pastina, P. Lombardo, "Passive Radar Array with Low-Power Satellite Illuminators Based on Fractional Fourier Transform", *IEEE Sensors Journal*, vol. 17, no. 24, pp. 8378-8394, Dec. 2017
- [J6] F. Santi, D. Pastina, M. Bucciarelli, "Estimation of ship dynamics with a multiplatform radar imaging system," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 53, no. 6, pp. 2769-2788, Dec. 2017.
- [J5] Z. Li, F. Santi, D. Pastina, P. Lombardo, "Multi-frame fractional Fourier transform technique for moving target detection with space-based passive radar", *IET, Radar, Sonar & Navigation*, vol. 11, no. 5, pp. 822-828, May 2017.
- [J4] F. Santi, M. Bucciarelli, D. Pastina, M. Antoniou, M. Cherniakov, "Spatial resolution improvement in GNSS-based SAR using multistatic acquisitions and feature extraction", *IEEE Transactions on Geoscience and Remote Sensing*, vol. 54, no. 10, pp. 6217-6231, Oct. 2016.
- [J3] F. Santi, D. Pastina, "A parasitic array receiver for ISAR imaging of ship targets using a coastal radar", *Hindawi International Journal of Antennas and Propagation*, Volume 2016 (2016), Article ID 8485305.
- [J2] F. Santi, M. Antoniou, D. Pastina, "Point Spread Function Analysis for GNSS-Based Multistatic SAR", *IEEE Geoscience and Remote Sensing Letters*, vol. 12, no. 2, pp. 304-308, Feb. 2015.
- [J1] D. Pastina, F. Santi, M. Bucciarelli, "MIMO Distributed Imaging of Rotating Targets for Improved 2-D Resolution", *IEEE Geoscience and Remote Sensing Letters*, vol. 12, no. 1, pp. 190-194, Jan. 2015.

Under review

- [Js1] F. Santi, G. P. Blasone, D. Pastina, F. Colone, P. Lombardo, "Parasitic surveillance potentialities based on a GEO-SAR illuminator", submitted to *MDPI Remote Sensing journal*.

### Publications in international conference proceedings

- [C25] F. Santi, I. Pisciotano, D. Pastina, D. Cristallini, "First experimental results on multi-angle DVB-S based passive ISAR exploiting multipolar data", 2021 *IEEE Radar Conference*, Atlanta, USA, 10-14 May 2021.
- [C24] F. Santi, I. Pisciotano, D. Cristallini, D. Pastina, "Preliminary investigations toward multi-frame DVB-S based passive ISAR", 2021 *European Synthetic Aperture Radar Conference*, 29 Mar.-1 Apr. 2021.
- [C23] F. Santi, D. Pastina, M. Antoniou, M. Cherniakov, "GNSS-based multistatic passive radar imaging of ship targets," *IEEE RadarConf 2020*.
- [C22] I. Pisciotano, D. Cristallini, D. Pastina, F. Santi, "Experimental Results of Polarimetric Passive ISAR Exploiting DVB-S2 Illumination", *IEEE RadarConf 2020*.
- [C21] F. Santi, F. Pieralice, D. Pastina, M. Antoniou, M. Cherniakov, "Passive radar imagery of ship targets by using navigation satellites transmitters of opportunity," *International Radar Symposium IRS 2019*, Ulm, Germany, 26-28 June 2019.
- [C20] F. Santi, D. Pastina, "Application of track-before-detect techniques in GNSS-based passive radar for maritime surveillance," *IEEE Radar Conference 2019*, Boston, Massachusetts (USA), 22-26 April 2019.
- [C19] F. Pieralice, F. Santi, D. Pastina, M. Antoniou, M. Cherniakov, "Ship targets feature extraction with GNSS-based passive radar via ISAR approaches: preliminary experimental study", *EUSAR 2018*, Aachen, Germany, 4-7 June 2018.
- [C18] F. Santi, F. Pieralice, D. Pastina, "Multistatic GNSS-based passive radar for maritime surveillance with long integration times: experimental results", 2018 *IEEE Radar Conference*, Oklahoma City, OK, USA, 23-27 Apr. 2018.
- [C17] F. Pieralice, D. Pastina, F. Santi, M. Bucciarelli, "Multi-transmitters ship target detection with GNSS-based passive radar", *Radar 2017*, *International Conference on Radar Systems*, Belfast (UK), 23-26 Oct. 2017.

- [C16] F. Santi, D. Pastina, M. Bucciarelli, "Maritime moving target detection technique for passive bistatic radar with GNSS transmitters", IRS 2017, 18th International Radar Symposium, Prague (CZ), 28-30 June 2017.
- [C15] F. Pieralice, F. Santi, D. Pastina, M. Bucciarelli, H. Ma, M. Antoniou, M. Cherniakov, "GNSS-based passive radar for maritime surveillance: Long integration time MTI technique", 2017 IEEE Radar Conference, Seattle, WA, USA, 8-12 May 2017.
- [C14] H. Ma, M. Antoniou, M. Cherniakov, D. Pastina, F. Santi, F. Pieralice, M. Bucciarelli, "Maritime target detection using GNSS-based radar: Experimental proof of concept", 2017 IEEE Radar Conference, Seattle, WA, USA, 8-12 May 2017.
- [C13] Z. Li, F. Santi, D. Pastina, P. Lombardo, "Satellite-based PCL for moving target detection using Keystone transform and FrFT", RADAR 2016 - CIE International Conference on Radar, Guangzhou, China, 10-13 October 2016.
- [C12] F. Santi, M. Bucciarelli, D. Pastina, M. Antoniou, M. Cherniakov, "Passive multi-perspective GNSS-based SAR using CLEAN technique: an experimental study", EUSAR 2016, Hamburg, Germany, 6-9 June 2016.
- [C11] F. Santi, M. Bucciarelli, D. Pastina, M. Antoniou, M. Cherniakov, "Passive multistatic SAR with GNSS transmitters and using joint bi/multi-static CLEAN technique", 2016 IEEE Radar Conference, Philadelphia, PA, USA, 2-6 May 2016.
- [C10] F. Santi, M. Bucciarelli, D. Pastina, M. Antoniou, "CLEAN technique for passive bistatic and multistatic SAR with GNSS transmitters", RADAR 2015 - IEEE Radar Conference, Arlington, Virginia (USA), 10-15 May 2015.
- [C9] F. Santi, M. Bucciarelli, D. Pastina, "Multi-sensor ISAR technique for feature-based motion estimation of ship targets", RADAR'14, International Radar Conference 2014, Lille, France, 13-17 Oct. 2014.
- [C8] F. Santi, M. Antoniou, D. Pastina, D. Tzagkas, M. Bucciarelli, M. Cherniakov, "Passive multi-static SAR with GNSS transmitters: preliminary experimental study", EuRAD 2014, Rome, Italy, 8-10 Oct. 2014.
- [C7] F. Santi, M. Antoniou, D. Pastina, D. Tzagkas, M. Bucciarelli, M. Cherniakov, "Passive multi-static SAR with GNSS transmitters: first theoretical and experimental results with point targets", EUSAR 2014, Berlin, Germany, 2-5 June 2014.
- [C6] F. Santi, D. Pastina, P. Lombardo, "ISAR while-scan mode for coastal surveillance", RADAR 2014 - IEEE Radar Conference, Cincinnati, Ohio (USA), 19-23 May 2014.
- [C5] F. Santi, D. Pastina, M. Bucciarelli, "Multi-sensor ISAR techniques for motion estimation of pitching, rolling and yawing targets", RADAR 2013 - IEEE Radar Conference, Ottawa, Ontario, Canada, 29 April - 3 May 2013.
- [C4] F. Santi, M. Bucciarelli, D. Pastina, "Target rotation motion estimation from distributed ISAR data", RADAR 2012 - IEEE Radar Conference, Atlanta, Georgia (USA), 7-11 May 2012.
- [C3] D. Pastina, F. Santi, M. Bucciarelli, P. Lombardo, "2D-MIMO SAR/ISAR imaging of moving targets with reconfigurable formation of platforms", EUSAR 2012, Nuremberg, Germany, 23-26 April 2012.
- [C2] D. Pastina, F. Santi, M. Bucciarelli, "Multi-angle distributed ISAR with stepped-frequency waveforms for surveillance and recognition", RADAR 2011 - CIE International Conference on Radar, Chengdu, China, 24-27 October 2011.
- [C1] F. Santi, P. Lombardo, D. Pastina, "Oil spill detection using a coastal high-resolution radar", RADAR 2011 - IEEE Radar Conference, Kansas City, Missouri (USA), 23-27 May 2011.

#### Submitted abstracts

- [Cs2] A. Testa, F. Santi, D. Pastina, "First experimental results on multi-angle DVB-S based passive ISAR exploiting multipolar data", accepted to the International Radar Symposium 2021, to be held in Berlin, Germany, June 2021.
- [Cs1] I. Nasso, F. Santi, D. Pastina, "Ship target velocity estimation with multi-transmitter GNSS-based passive radar exploiting long integration times", accepted to the International Radar Symposium 2021, to be held in Berlin, Germany, June 2021.

#### Speeches at national and international conferences and workshops

- [W7] F. Santi, F. Pieralice, D. Pastina, "Detection localization and imaging of vessels at sea with a GNSS-based passive radar," 3rd Italian Radar and Remote Sensing Workshop, Rome, Italy, 30-31 May 2019.
- [W6] F. Santi, F. Pieralice, D. Pastina, "Passive multistatic imaging exploiting GNSS transmitters", IEEE GNSS+R 2019 Specialist Meeting on Reflectometry using GNSS and other Signals of Opportunity, Benevento, Italy, 20-22 May 2019.
- [W5] F. Santi, F. Pieralice, D. Pastina, "Ship target detection and localization with a GNSS-based passive radar using long integration times and multistatic acquisitions," 7th PCL Focus Day, Wachtberg (Germany), 7-8 May 2019.
- [W4] F. Santi, F. Pieralice, D. Pastina, "Multistatic GNSS-based passive radar for maritime surveillance", 2nd Italian Radar and Remote Sensing Workshop, Pavia, Italy, 28-29 May 2018.
- [W3] F. Pieralice, F. Santi, D. Pastina, M. Bucciarelli, H. Ma, M. Antoniou, M. Cherniakov, "GNSS-Based Passive Radar Detection for Maritime Surveillance", 1st Italian Radar and Remote Sensing Workshop, Naples, Italy, 25-26 May 2017.
- [W2] F. Santi, M. Bucciarelli, D. Pastina, M. Antoniou, D. Tzagkas, M. Cherniakov, "Passive multistatic imaging exploiting GNSS transmitters", 5th PCL Focus Day, Wachtberg (Germany), 28-29 April 2015.
- [W1] F. Santi, M. Bucciarelli, D. Pastina, "2D-MIMO distributed ISAR imaging of rotating targets with improved range and cross-range resolution", IEEE GOLD Remote Sensing Conference, Rome, Italy, 4-5 June 2012.

#### Dissertations

[D1] F. Santi, “Active and passive multi-sensor radar imaging techniques exploiting spatial diversity”, PhD final dissertation, June 2014.