

Jean-Philippe OVARLEZ – CV

Ph.D. student from 1988 to 1991 in the Radar System Division at ONERA (the French Aerospace Lab), I joined ONERA as a scientific researcher in January 1992 and defended my Ph.D. Thesis in April 1992. During the reorganization of ONERA in September 1997, I joined the Advanced Methods for Signal Processing unit of the Radar and Electromagnetism Department in the Physics Domain. In September 2002, I became the ALBATROS Project leader, which led to the development, control, and emphasis of new techniques and research made for the ONERA DEMR RAMSES airborne system (SAR image algorithms, interferometry, polarimetry, thesis supervisions, software development, etc.). In August 2003, I became a member of the Scientific Committee of the ONERA Physics Branch. I was elected President of the DEMR Scientific Advisory Board in January 2006 and again in January 2007. In January 2008, I joined the French-Singaporean SONDRALab on a part-time basis (two days per week) to supervise Signal Processing activities. I was an attached scientist in January 2010 for one year at DSO National Laboratories in Singapore. In 2011, I obtained a Research Directorship Habilitation (HDR) thesis in Signal Processing from the University of Paris-Sud and my qualification to the University Professor position. In 2015, I became a member of the Special Area Team (SAT) in Theoretical and Methodological Trends in Signal Processing (TMTSP), EURASIP. My research interests are centered on the topic of Statistical Signal Processing for radar and SAR applications such as Time-Frequency, imaging, robust detection, and parameters estimation.

SKILLS: STATISTICAL SIGNAL PROCESSING

- Spectral Analysis, Source Localization
- Time-Frequency Analysis, Time-Scale Analysis, Wavelet
- Radar, Sonar
- Detection, Parameters Estimation
- Array Signal Processing
- Radar Imaging (ISAR, SAR), Radar Imaging in Laboratory
- Statistics (PDF estimation, Bayesian Methods, Higher Order Statistics, Statistical Tests)
- Recognition Methods
- Algorithms and scientific software development (C, Fortran, Matlab, Maple, LaTeX, etc)
- Supervision of Transversal Projects, contacts with industries and universities
- Languages: Russian, English (spoken, written)

EDUCATION

- 2012 and 2018: Qualification to University Professor Position (CNRS Section 61) in 2012, reconducted in 2018, n° 18161225385.
- Feb. 14, 2011: Research Directorship thesis (Habilitation) from University of Paris Saclay: Some Contributions to Methods of Analysis, Detection, and Estimation for Radar and SAR Imaging.
- 1988-1992: PhD in Physic from Paris 6 University (Signal Processing specialty) defended on April 13, 1992 with Merit (Très Honorable): The Mellin Transform: A Tool for Broadband Signal Analysis.
- 1986-1987: DEA (Master 2) in Automatic and Signal Processing in LSS Orsay with Merit (Bien). LSS and CSEE Internship: Speech Recognition in Highly Noisy Background.

- 1984-1987: Engineering Degree from ESIEA (École Supérieure d'Informatique Électronique Automatique - 9 Rue Vésale, Paris 5, France) with Merit (Très Bien).
- 1981-1984: School of preparing to Institute of high education (Mathématiques Supérieures et Spéciales, Option Maths), Lycée Henri Wallon - 59300 Valenciennes, France.
- June 1981: Bacalaureate C serie, Lycée Henri Wallon - 59300 Valenciennes, France.

PROFESSIONAL POSITIONS

- Jan. 1992-2023: Senior Research Scientist: Maître de Recherche 1 in 2003, Maître de Recherche 2 (DR2) in 2013, Research Director (DR1) in 2019 in the Advanced Methods in Signal Processing (MATS) Unit of the ONERA Radar and Electromagnetism Department (DEMR)
- Jan. 2010-2011: Visitor Research Scientist (funded by French Ministry of Defense) in DSO National Laboratories, Singapore.
- Since Jan. 2008: Attached Research Scientist at a part-time to CentraleSupélec SONDRALab. In charge of Signal Processing activities.
- 1988-1991 : PhD Student in ONERA Radar Systems Unit.
- 1987-1988: Conscript: « Scientifique du Contingent », August 1987 in SAMAN, French Naval Air Forces in Toussus-Le-Noble (78), France.
- 1987: Master 2 Internship in CSEE (Compagnie des Signaux et d'Entreprises Électriques) and in LSS (Signal and Systems Laboratory from University of Paris Saclay).
- 1986: INRIA (Institut National de Recherches en Informatique et Automatique): 12 months research internship (March to December): Kalman Filtering.

Ph.D. THESIS

"The Mellin Transform: a Tool for Broadband Signals Analysis", PHD Thesis from Paris 6 University, April 1992.

Many signal analysis methods have a reasonable theoretical significance only for the class of narrow-band signals, which is connected with the group of time and frequency translations. This is the case, for example, of the Time-Frequency Distributions of the Cohen's class, but also, of the Woodward Ambiguity Functions, which thus, found a limitation in their use conditions. These two typical examples have, however, an extension in the broadband domain: the Bertrand's Affine Time-Frequency Distributions and the Wideband Ambiguity Functions. These forms are related to the affine group transformations which act on the signals by time dilations and translations. This feature complicates their implementation and suggests the use of a Mellin Transform in order to process dilations efficiently. This work is devoted to the study of this new transform, which has many similarities with the Fourier's one (physical interpretation of the Mellin variable in the time-frequency plane, properties, discrete transform, sampling theorem). All the new applications, theoretical results or the algorithms developed with the help of this transform are presented: fast computation of the Affine Time-Frequency Distributions and their smoothing versions (Wavelet Transform), fast computation of the Wideband Ambiguity Functions, the theoretical development of the Cramer-Rao

Bounds for the velocity and time-delay estimates in the broadband case and finally, the Broadband Radar Imaging using Dimensionalized Wavelet Transform.

RESEARCH DIRECTORSHIP HABILITATION

"Some Contributions to Methods of Analysis, Detection and Estimation for Radar and SAR Imaging", HDR (in french) from Paris 11 University, February 2011.

This HDR thesis presents a synthesis of works I have been conducting since more than twenty years in the Signal Processing Unit (Electromagnetism and Radar Department) of ONERA, the French Aerospace Lab. All these works have mainly been devoted to the Signal Processing techniques for radar and imaging radar.

The first part comes logically from my Ph.D. works conducted on the Mellin Transform and consists in extending Time Frequency Distributions for radar imaging. Usually used for analyzing non stationary signals, these techniques allow to study the coloration and the anisotropy of the scatterers in a SAR or ISAR image. Mainly based on sub-band and sub-look decompositions, these Time-Frequency distributions allow also to study the angular and spectral non-stationarity of the polarimetric mechanisms of scatterers in polarimetric SAR images but also to improve the quality of the interferometric coherency estimate (INSAR) and of the polarimetric coherency estimate (POLINSAR).

The second part concerns radar detection and estimation in non homogeneous and/or non-Gaussian environment. The compound Gaussian SIRV (Spherically Invariant Random Vectors) modelling, allows nicely to extend all the classical detection schemes based only on the Gaussian assumption. Jointly used to robust and powerful estimators of the unknown environment parameters (e.g. covariance matrix), these modelling techniques can be applied to multi channels radar detection (array processing for source localization, STAP (Space Time Adaptive Processing), MIMO, interferometry, polarimetry, hyperspectral imaging, etc.).

In fact, these two research axes that have been built and exploited independently can be jointly be used to solve new problems that are developed in my research perspectives. All the applications derived from these two axes are quite numerous: mono and multi channels SAR images analysis (detection, segmentation, classification), moving target detection in SAR images, hyperspectral imaging, change detection, etc.