



NORTH ATLANTIC TREATY ORGANIZATION

**SCIENCE AND
TECHNOLOGY
ORGANIZATION**



**LECTURE SERIES
SET-257**

**on “Compressive Sensing Techniques for Radar and
ESM Applications”**

**sur “Techniques d’acquisition par la compression
d’impulsion pour les applications radar et MSE”**

organized by the

Systems and Electronics Technology Panel

to be held in

Birmingham, United Kingdom - 11-12 March 2019

Athens, Greece – 14-15 March 2019

Dayton, OH, United States – 11-12 September 2019

**This Lecture Series is open to citizens from NATO,
Partnership-for-Peace (PfP) Nations and Australia.**

Latest Enrolment Dates:

NATO Nations **2 weeks prior LS date**

Non NATO Nations **3 weeks prior LS date**

Enrol on-line at <https://events.sto.nato.int>

**All presentations and discussions will be held in
English.**

Background

The mission of STO is to conduct and promote co-operative research and information exchange. STO consists of a three level organization: the Science and Technology Board (STB), the Panels/Group and the Technical Teams. The Sensors and Electronics Technology (SET) Panel is one of the seven Panels/Group under the STB.

The SET Panel mission is to advance technology in electronics and passive/active sensors as they pertain to reconnaissance, surveillance and target acquisition, electronic warfare, communications and navigation; and to enhance sensor capabilities through multi-sensor integration/fusion. This concern the phenomenology related to target signature, propagation and battle space environment, EO, RF, acoustic and magnetic sensors, antenna, signal and image processing, components, sensor hardening and electromagnetic compatibility.

Theme

Compressive sensing (CS) is a novel acquisition and processing technique that enables reconstruction of sparse signals from a set of non-adaptive measurements sampled at a much lower rate than required by the Nyquist-Shannon sampling theorem as pertaining to the full signal bandwidth. In particular, compressive sensing exploits the fact that the information bandwidth of the signal is much smaller than the full signal bandwidth.

For radar and ESM sensors, the use of CS may lead to several benefits, such as significant hardware reductions in ESM receivers, unambiguous signal recovery from incomplete measurements (filling in missing data) in interleaved radar modes (SAR/GMTI, multi-function radars) and sparse arrays, high resolution imaging with significantly less data and/or hardware.

The main objective of this Research Lecture Series is to present the fundamentals and the cutting edge of CS techniques for a number of radar and ESM applications, with an outlook to expected future developments and hardware implications of CS based architectures.

Topics to be covered:

- Introduction and overview of CS applied to radar.
- Introduction and application of CS for Electronic Support Measures (ESM).
- Introduction and application of CS to Inverse SAR.
- Application of CS to 2D/3D SAR.
- Hardware architectures for compressive sensing.
- Applications of convex optimization to GMTI.

Thème:

L’acquisition par la compression d’impulsion est une nouvelle technique d’acquisition et de traitement du signal qui permet de reconstruire des signaux éparés à partir d’un ensemble de mesures non adaptatives échantillonnées à une fréquence bien plus basse que celle requise par le théorème d’échantillonnage de Nyquist-Shannon relatif à l’intégralité de la largeur de bande du signal. L’acquisition par la compression d’impulsion exploite en particulier le fait que la largeur de bande d’information du signal est beaucoup plus étroite que la largeur de bande complète du signal.

Pour les radars et les capteurs MSE, l’utilisation de l’acquisition par la compression d’impulsion peut avoir plusieurs avantages, tels que la réduction significative du nombre de récepteurs MSE, la récupération non ambiguë du signal à partir de mesures incomplètes (remplissage des données manquantes) en modes radar imbriqués (SAR/GMTI, radars multifonctions) et matrices creuses, ainsi que l’imagerie à haute résolution avec sensiblement moins de données et/ou de matériel.

L’objectif principal de cette série de conférences de recherche est de présenter les fondamentaux et les techniques de pointe en matière d’acquisition par la compression d’impulsion pour un certain nombre d’applications radar et MSE et de donner un aperçu des évolutions attendues et de leurs implications pour le matériel des architectures basées sur l’acquisition par la compression d’impulsion.

Sujets traités :

- Introduction et vue d’ensemble de l’acquisition par la compression d’impulsion appliquée au radar
- Introduction et application de l’acquisition par la compression d’impulsion aux mesures de soutien électronique (MSE)
- Introduction et application de l’acquisition par la compression d’impulsion aux SAR inverses
- Application de l’acquisition par la compression d’impulsion aux SAR 2D/3D
- Architectures matérielles d’acquisition par la compression d’impulsion
- Applications de l’optimisation convexe au GMTI

Lecture Series Director

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LECTURE SERIES PROGRAMME

DAY ONE

- 8:30 Registration
- 9:00 Opening Ceremony & STO Overview
Dr. Laura ANITORI
- 9:15 Introduction and Overview
Dr. Laura ANITORI
- 9:30 Introduction to CS applied to radar
Dr. Laura ANITORI
- 10:45 Break
- 11:15 Introduction to CS for ESM
Prof. Andy STOVE
- 12:30 Lunch Break
- 14:00 Introduction to radar imaging
Prof. Marco MARTORELLA
- 15:15 Break
- 15:45 Introduction to CS for GMTI
Dr. Muralidhar RANGASWAMY
- 17:00 End of day 1

DAY TWO

- 9:00 Application of CS to 2D/3D SAR
Prof. Emre ERTIN
- 10:00 Morning Break
- 10:30 Application of CS to Inverse SAR
Prof. Marco MARTORELLA
- 11:30 Applications of CS for ESM
Prof. Andy STOVE
- 12:30 Lunch Break
- 14:00 Hardware architecture for CS
Prof. Emre ERTIN
- 15:00 Afternoon Break
- 15:30 Applications of CS for GMTI
Dr. Muralidhar RANGASWAMY
- 16:30 Concluding Remarks and Evaluation
Dr. Laura ANITORI
- 17:00 End

APPLICATION TO ENROLL LECTURE SERIES SET-257

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A General Information Package with information on travel, accommodation and local arrangements will be placed on the enrollment website. Participants are responsible for their own travel arrangements.

If you are unable to enrol via the internet, please contact the CSO enrolment coordinator:
lectureseries@cs0.nato.int

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