

## **Dr. TAOUS MERIEM LALEG**

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### **Short biography:**

Dr. Taous Meriem Laleg is a Senior Researcher at the French National Institute for Research in Digital Science and Technology (Inria), based in Paris-Saclay, where she leads the BOOST project team. From 2011 to 2021, she was an Assistant and then Associate Professor of Electrical and Computer Engineering and Applied Mathematics at King Abdullah University of Science and Technology (KAUST). At KAUST, she founded and led the Estimation, Modeling, and Analysis (EMAN) research group, was affiliated with the Bioengineering Program and the Computational Bioscience Research Center (CBRC), and actively contributed to the KAUST Smart Health Initiative.

Her research interests lie in control theory and signal processing, with a focus on developing effective estimation methods and algorithms to understand physical systems, extract hidden information, and design advanced control and monitoring strategies. Her projects are strongly motivated by real-world applications in engineering and bioengineering.

Dr. Laleg is actively involved in the scientific community. She serves as Associate Editor for the IEEE Transactions on Network Systems, the International Journal of Robust and Nonlinear Control, and the IEEE Systems Journal. She is also a member of the Technical Area Committee on Theoretical and Methodological Trends in Signal Processing (TMTSP) of EURASIP, the IEEE Control Conference Editorial Board (CEB), the IEEE European Conference Editorial Board, and the IFAC Technical Committee on Biological and Medical Systems (TC 8.2), where she serves as Vice-Chair for Social Media.

**Keynote title:** Semi-Classical Signal Analysis: From Theory to Biomedical Signal and Image Processing

### **Keynote abstract:**

Semi-Classical Signal Analysis (SCSA) is a novel paradigm that bridges mathematical physics and signal processing by leveraging the spectral theory of Schrödinger operators for data representation and analysis. Inspired by tools from semi-classical analysis, SCSA provides an alternative to conventional signal transforms, enabling adaptive and physically interpretable decompositions.

In this keynote, I will present the foundations of SCSA and show how the Schrödinger operator framework allows signals to be reconstructed from their discrete spectra, achieving a natural balance between resolution and regularization. This approach offers distinctive advantages for denoising and feature extraction, particularly in contexts where robustness and interpretability are essential.

The presentation will emphasize applications to biomedical data, illustrating how SCSA enables effective denoising, feature extraction, and characterization of complex physiological signals. We will also demonstrate its extension to two-dimensional data, showing its potential for biomedical image analysis. I will conclude by outlining recent developments, open questions, and the potential role of SCSA in shaping next-generation signal and image processing.