SAR remote sensing using diversity modes: principles and selected applications

Abstract:

Synthetic Aperture Radar (SAR) is a powerful tool for mapping wide and remote areas and for synthesizing high-resolution images of the microwave reflectivity of environments. This information can be used to retrieve geo- and biophysical parameters, detect and localize objects, and measure relative motion.

SAR sensors can operate in diverse modes, with a series of acquisitions performed using slightly modified configurations. Diversity can be achieved by using different polarizations (SAR polarimetry), measuring responses from different positions (SAR interferometry and tomography), at different times (SAR time series), or at different frequencies (multi-frequency SAR).

This talk introduces the basics of SAR imaging for remote sensing applications, presents the principles and main advantages of the major diversity modes, and illustrates their potential for various applications such as complex scene mapping, artificial object detection, 3D reconstruction of urban areas, and 3D imaging of snow, ice, and forests. A description of the recently launched ESA BIOMASS mission, operating a satellite P-band SAR system with polarimetric, interferometric, and tomographic capabilities, is then provided. The final application presented concerns the use of multi-sensor, multi-physics, and asynchronous time series of acquisitions provided by the Copernicus Sentinel-1 and Sentinel-2 missions to monitor deforestation and observe forest fires in tropical regions.

Speaker:

Laurent Ferro-Famil received the Laurea degree in electronic systems and computer engineering, and the M.S. and Ph.D. degrees in electronics from the University of Nantes, Nantes, France, in 1996, 1996, and 2000, respectively. In 2001, he joined the University of Rennes 1, Rennes, France, as an Associate Professor and was promoted to Full Professor in 2011. Since 2021, he has been a Professor at ISAE-SUPAERO, University of Toulouse.

He is a member of the Navigation, Radar, and Remote Sensing team within the Department of Electronics, Optronics, and Signal Processing at ISAE-SUPAERO, and is also affiliated with the Radar Group of the CESBIO Laboratory, Toulouse. His research interests include radar signal processing for remote sensing applications, radar polarimetry theory, electromagnetic imaging, and remote sensing of natural media using multi-baseline PolInSAR data and time-series of multi-source acquisitions. His work focuses on applications such as classification, electromagnetic scattering modeling, physical parameter retrieval, forest degradation monitoring, and three-dimensional reconstruction of environments using SAR tomography.

Date and Location:

27Th February 2026, 10:00 a.m., Aula TA1, edificio di Via Nuova Agnano, 11, Napoli.