

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

CNR/IEIT - Antenna and Processing Technologies in Complex Environments

Funded By	C.N.R. - CONSIGLIO NAZIONALE DELLE RICERCHE [Piva/CF:02118311006]
Supervisor	MAGGIORA RICCARDO - riccardo.maggiora@polito.it
Contact	Peverini Oscar Antonio Virone Giuseppe
Context of the research activity	The research activity is focused on the design of antenna systems for sensing in complex environments. This involves electromagnetic analysis of large structures, definition of manufacturing-oriented geometries, compact interfaces with electronics and signal processing. The main application scenario will be sensing for Moon exploitation. Impact of developed technologies on secure communication will be also investigated.
Objectives	<p>The research activity will be carried out in the framework of the PROgramma di Ricerca Spaziale di base (PRORIS), which is a joint project between Consiglio Nazionale delle Ricerche and Istituto Nazionale di AstroFisica.</p> <p>Since the earliest lunar explorations, it has been clear that chemical and thermal information on the lunar surface and subsurface is crucial to understanding the composition, origin, and evolution of the Moon.</p> <p>The limited penetration depth of the state-of-the-art systems prevents information on the global structure of the deepest lunar subsurface temperature, mineralogy, and heat flow.</p> <p>To overcome these limitations, it was considered possible to use microwave radiometers, which, with a much longer wavelength, could observe at depth. In addition to the temperature of the regolith, microwave measurements can potentially also provide information on other properties such as the dielectric constant and density. The PRORIS project plans to develop a broad-spectrum, low-frequency microwave radiometer compatible with installation on a lunar rover.</p> <p>The candidate will perform numerical simulations, manufacturing-oriented design, measurements and signal processing for sensing antennas. Possible additional applications of the developed antenna and signal processing</p>

technologies to space debris detection and secure communications will be also explored.

The research activity will be carried out at the Istituto di Elettronica ed Ingegneria dell'Informazione e delle Telecomunicazioni (IEIT) of Consiglio Nazionale delle Ricerche (TO).

IEIT has a long heritage in the design and characterization of microwave and millimeter-wave subsystems for both space and terrestrial application, developed and exploited in several projects with Thales Alenia Space, OHB, TIM, and many other partners. The candidate will have access to the new research infrastructure denominated TeraHertz Advanced Manufacturing (TERAM) and the new facilities that have been acquired within the projects of the National Recovery and Resilience Plan (PNRR) denominated SoBigData, RESTART and Earth-Mars-Moon (EMM).

Skills and competencies for the development of the activity

Knowledge on applied electromagnetics with reference to antenna technologies (arrays, feed systems) at microwave/millimeter-waves. Experience on simulation tools and lab equipment. Knowledge on Matlab for data and signal post-processing. General knowledge on communication and sensing. Good attitude to team work.