

Job Description for Position: CNIT1

The *Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT)*, *Laboratory of the University of Cassino and Southern Lazio, Italy*, is seeking to appoint a high-calibre doctoral candidate to join the Marie Skłodowska-Curie Doctoral Network ‘joInt wireless commuNicaTion and sEnsInG by hologRaphic surfAce TranscEivers’ (INTEGRATE).

About the INTEGRATE project

As the standardization of 5G wireless networks progresses, the research community has started focusing on what 6G will be. Motivated by the need of ensuring high data-rates while at the same time saving spectrum a major technology that has been proposed for 6G is the integration of communication and sensing services in the same infrastructure. This enables wireless networks to perceive the surrounding environments triggering new services and leading to a more efficient use of resources. The INTEGRATE project focuses on the theoretical, algorithmic, and architectural foundations of integrated communication and sensing networks, developing the first open access network-level simulator for joint communication and sensing. To this end, a new implementation of wireless transceiver is proposed, which leverages the use of reconfigurable holographic surfaces and allows the integration of communication and sensing with remarkable performance while at the same time reducing the energy consumption. Specifically, INTEGRATE will: 1) develop reconfigurable holographic surfaces (RHSs) capable of supporting joint communication and sensing tasks and that can be integrated in wireless transceivers with minimal cost and energy requirements; 2) Characterize the fundamental performance limits of integrated communication and sensing networks, developing an algorithmic framework and protocol suite to approach these limits; 3) Build the first open access software simulation platform for joint communication and sensing networks.

Position title: CNIT1 - Fundamental performance limits of RHS-based integrated communication and sensing networks.

Research project: Integrating communication and sensing tasks implies that multiple, possibly contrasting, performance metrics must be optimized, e.g. the communication rate, latency, detection rate, estimation accuracy, energy efficiency, etc. The frameworks of multi-objective optimization and monotonic optimization will be merged. The former enables the simultaneous optimization of different performance metrics, while the latter enables to compute the optimal operating points of the network with a complexity that is amenable for off-line numerical simulation. These frameworks have never been investigated in joint communication and sensing networks. A complete and novel multi-objective monotonic optimization framework will be developed for the optimization of the electromagnetic response of the RHSs and other radio resources (e.g. transmit powers, beamforming/receive filters, bandwidth allocation, etc.) for joint communication and sensing. The fundamental performance limits of the system will be characterized also by theoretical bounds on estimation accuracy, e.g. the Fisher information and the Cramer-Rao bounds, or information-theoretic bounds, e.g. the data processing inequality for the mutual information.

Objectives: Determine the ultimate fundamental performance limits of RHS-based integrated communication and sensing networks, by means of mathematical optimization, information theory, detection and estimation theory, Cramer-Rao bounds, information-theoretic bounds.

Location: CNIT Laboratory based at the University of Cassino and Southern Lazio, Cassino (FR), Italy and Politecnico di Torino, Turin, Italy.

PhD enrolment: The selected applicant will be enrolled into a Ph.D. at Politecnico di Torino, Turin program to conduct the planned research activities.

Working Time: Full-time.

Duration: Fixed-term (3 years).

Salary: in agreement with European salaries for doctoral positions, plus additional benefits.

Secondment: CNIT1 will spend a research stay of 8 months at another partner of the INTEGRATE project. The planned secondment for CNIT1 is at Ranplan Group AB, Sweden.

Eligibility requirements

- The applicant must be a doctoral candidate (i.e. not already in possession of a doctoral degree at the date of the recruitment).
- At the time of recruitment, the researcher must not have resided or carried out their main activity (work, studies, etc.) in the country of their recruiting organization for more than 12 months in the three years immediately prior to the recruitment date. Compulsory national service and/or short stays such as holidays are not taken into account.

In order to apply, use the application form at <https://integrate.cnit.it/index.php/jobs>

For further information, send an email to Prof. Alessio Zappone (alessio.zappone@unicas.it).