Job Description
MetaWireless Early Stage Researchers
Consorzio Interuniversitario per le Telecomunicazioni (CNIT)

The Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), Laboratory of the University of Cassino and Southern Lazio, Italy, is seeking to appoint two high-calibre Early Stage Researchers (ESRs) to join the Marie Skłodowska-Curie Innovative Training Network on **'Future Wireless Communications Empowered by Reconfigurable Intelligent Meta-Surfaces'** (MetaWireless).

Position	Early Stage Researcher - CNIT-1: Radio resource allocation in RIS-based wireless networks (RIS = reconfigurable intelligent surfaces) - CNIT-2: Localization and sensing through meta-surface structures (RIS = reconfigurable intelligent surfaces)
Location:	CNIT Laboratory based at the University of Cassino and Southern Lazio, Via G. Di Biasio 43, 03043, Cassino (FR), Italy.
Working time:	Full Time
Duration:	Fixed-Term (3 years)
Living, mobility, family, and research allowances:	In agreement with the MSCA-ITN financial regulations (http://ec.europa.eu/research/participants/data/ref/h2020/other/guides_for_applicants/h2020-guide-appl-msca-itn_en.pdf - Section 5, page 27)

About MetaWireless

Wireless connectivity has become a pillar of our society. The growth of wireless traffic is relentless, forecast to reach a staggering worldwide aggregate of 5,016 exabytes by 2030, along with bit rates of 1 Tb/s and new services related to sensing, localization, low-latency, and ultra-reliability. While the performance of wireless networks has improved phenomenally over the last decades, progress is by now pushing against fundamental limits and the mechanisms that have sustained these huge improvements are starting to falter. New evolutionary leaps are called for in order to ensure that the aforementioned forecasts can become a reality. To date, every wireless system has abided by the premise that the propagation radio channel is fixed by nature and cannot be tampered with, but only compensated through ever more sophisticated transmission/reception schemes. A potential evolutionary leap for 6G-and-beyond networks is to break free from the postulate that channels are uncontrollable factors. Serving such a vision, MetaWireless pursues the disruptive idea of designing wireless networks by treating the environment itself as a quantity to be controlled and optimized. Precisely, the manipulation of the wireless environment can be made possible by incorporating reconfigurable intelligent surfaces. These are planar structures, made of meta-materials and electromagnetically discontinuous, which do not adhere to conventional reflection and diffraction laws; rather, they can modify in a controllable fashion the phase and wavefront of impinging radio waves. If deployed to coat objects, walls, or building facades, they could allow customizing in real time the electromagnetic response of environments. Making this vision a reality requires the training of a new generation of researchers and a multidisciplinary effort involving wireless communications, physics, electromagnetic theory, and computational learning, which are the ingredients that define the MetaWireless project.

The Role

CNIT-1 and CNIT-2 will be hosted by CNIT, in its research laboratory based at the university of Cassino and Southern Lazio, which is located in the city of Cassino, Italy. Both ESRs will be enrolled into a PhD programme and will write their thesis on a topic related to *"Radio resource allocation in RIS-based wireless networks"* (CNIT-1) and *"Localization and sensing through meta-surface structures"* (CNIT-2), under the supervision of Prof. Stefano Buzzi and Prof. Alessio Zappone for the entire duration of their Ph.D. programme. CNIT-1 and CNIT-2 will benefit, in addition, of a secondment period at other partners of the MetaWireless project.

Further information about the Ph.D. projects can be found in the following tables.

Position: CNIT-1
Title: Radio resource allocation in RIS-based wireless networks.
Scientific context: The large number of degrees of freedom provided by the RISs makes conventional resource optimization methods too complex and necessitates dedicated radio resource allocation strategies. This project is focused on developing radio resource allocation algorithms that strike the best trade-off between performance and complexity. The algorithms will be designed to jointly optimize communication performance (i.e. spectral/energy efficiency, latency, reliability) and the overhead needed for channel estimation and feedback. This will be achieved by employing multi-objective and sequential optimization, which are optimization frameworks that achieve near-optimal performance with a lower complexity than state-of-the-art methods. Also, deep learning and deep unfolding methods based on artificial neural networks will be explored, to improve the complexity-performance trade-off of the developed resource allocation methods.
Objectives: Developing new optimization frameworks for the design of RIS-based wireless networks
Expected results: Improve the performance of traditional optimization approaches and identify the ultimate performance limits of RIS-based wireless networks.
Acquired knowledge: Optimization theory and design tools for large optimization problems. Knowledge of RIS-based wireless networks.
Planned secondment(s): NEC (Germany) for 6 months.
Ph.D. enrolment: University of Cassino and Southern Lazio (Italy).

Position: CNIT-2
Title: Localization and sensing through meta-surface structures.

Scientific context: The use of meta-surfaces with a large number of units promises unprecedented localization accuracies, but at the same time leads to new detection and estimation problems. This project is focused on developing novel localization and tracking algorithms based on the track-before-detect concept. The objective is to deploy RIS-based networks that perform communications, localization, and tracking on the same software and hardware platform for sub-6 GHz and (sub-) millimeter-wave frequencies. Optimal and sub-optimal algorithms will be devised, and the optimality of the latter ones will be assessed by the tools of Fisher information and the Cramér-Rao lower-bound. A major difference between RIS-based and conventional wireless networks is the large size of the meta-surfaces, which breaks the conventional assumption of far-field propagation. In indoors/outdoors, thus, near-field propagation is expected to occur often, which leads to the need of modeling and taking into account the curvature of the radio wavefront, which impacts the accuracy of localization and tracking. Specific algorithms that account for near-field propagation will be devised, and their performance analyzed.

Objectives: Develop novel methodologies for tracking, and estimation in RIS-based wireless networks.

Expected results: A novel framework that improves the localization accuracy with respect to available approaches for wireless networks.

Acquired knowledge: Knowledge detection and estimation theory and in RIS-based wireless networks.

Planned secondment(s): NOKIA (Finland) for 6 months.

Ph.D. enrolment: University of Cassino and Southern Lazio

Duties and Responsibilities

1. Undertake postgraduate research in support of the agreed doctoral research project.
2. Work closely with the academic supervisors to ensure the compatibility of the individual project with the overall goals of MetaWireless.
3. Present and publish research in both academic and non-academic audiences.
4. Attend and participate to academic and non-academic conferences, events and seminars.
5. Attend and participate to all training events and supervisory meetings.
6. Be seconded to other network partners as necessary to fulfil the grant obligations.
7. Prepare progress reports and similar documents on research for funding bodies, as required.
8. Contribute to the delivery and management of the wider programme, including attending and participating in programme committee meetings.
9. Actively contribute to the public engagement and outreach activities as described in the grant agreement.

As job descriptions cannot be exhaustive, the ESR may be required to undertake other duties, which are broadly in line with the above duties and responsibilities.

Person Specification

1. An undergraduate degree and a postgraduate Master's degree (or equivalent) in electronic or electrical engineering, mathematics, electromagnetics, or a physical sciences subject.
2. Excellent mathematical skills and background (optimization theory is a plus).
3. High proficiency in Matlab, Mathematica, Maple, R, or similar programming software.
4. Solid background on wireless communications (antennas, propagation, resource allocation is a plus).
5. Excellent written and verbal communication, including presentation skills.
6. Highly proficient English language skills.
7. Excellent organisational skills, attention to details and the ability to meet deadlines.
8. Ability to think logically, create solutions and make informed decisions.

9. Willingness to work collaboratively in a research environment.
10. A strong commitment to his/her own continuous professional development.
11. Willingness to travel and work across Europe.

Eligibility Requirements

All candidates must meet the following requirements to be considered for these posts:

a) Early-Stage Researchers (ESRs) shall at the time of recruitment by the host organisation be in the first four years (full-time equivalent research experience) of their research careers and not yet have been awarded a doctoral degree. Full-time equivalent research experience is measured from the date when a researcher obtained the degree which would formally entitle him or her to embark on a doctorate, either in the country in which the degree was obtained or in the country in which the researcher is recruited.

b) At the time of recruitment by the host organisation, ESRs must not have resided or carried out their main activity (work, studies, etc.) in the country of their host organisation 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.

How to Apply

Applications must be submitted, to the attention of Prof. Stefano Buzzi and Prof. Alessio Zappone, according to the following procedure:

1) Registration and submission of the application material to the MetaWireless recruitment website (https://h2020-msca-itn-metawireless.cnit.it/jobs/).

2) Parallel application and submission of the application material to direzione@cnit.it, as reported on CNIT website (https://www.cnit.it/en/2021/02/18/metawireless-early-stage-researchers/).

Informal enquires for further information about the positions can be send to Prof. Stefano Buzzi and Prof. Alessio Zappone (s.buzzi@unicas.it, alessio.zappone@unicas.it).

Note 1: Registrations and submissions need to be done both to the MetaWireless website and through CNIT application email.

Note 2: By registering with both methods mentioned above, the applicants agree that all members of the MetaWireless project can access their personal data and application material.

Each application must include the following material:
a) A cover letter explaining the motivation for applying for the post.
b) A curriculum vitae setting out the educational qualifications as well as any additional scientific achievements and publications.
c) Evidence of English proficiency.
d) Copy of Bachelor's and Master's certificates.
e) Copy of Bachelor's and Master's transcripts.
f)   Any additional material useful for the assessment of the candidate (e.g., recommendation letters, research project/statement in agreement with the requirements specified in previous text).

Selection Process

The selection and recruitment processes of the ESRs will be in accordance with the European Charter and Code of Conduct for the Recruitment of Researchers. The recruitment process will be open, transparent, impartial, equitable, and merit-based. There will be no overt/covert discrimination based on race, gender, sexual orientation, religion or belief, disability or age. To this end, the following selection criteria for the recruitment of the ESRs will be considered:

1) Curriculum vitae
2) Academic performance (diplomas, university transcripts, etc.)
3) Research and industrial experience
4) Awards and fellowships
5) Publications and patents
6) Research, leadership, and creativity potential
7) English knowledge
8) Other relevant items based on the specific candidate

The recruitment process will adhere to the guidelines described in the Grant Agreement of the MetaWireless project. At the network's level, the recruitment will be coordinated by the Recruitment Committee of the project in order to guarantee gender- and sector-balance. At the CNIT's level, the recruitment will be coordinated by the host laboratory (CNIT Laboratory based at the University of Cassino and Southern Lazio). More precisely, at the CNIT's level, the recruitment and selection of the ESRs will be executed by Prof. Stefano Buzzi and Prof. Alessio Zappone. The entire process will be overseen and approved by the Administrator of CNIT and by the Responsible of the Human Resources of CNIT.

The application deadline for both posts is **30 April 2021**. Each application will be acknowledged electronically (e.g., by return email) and a unique ID number will be assigned to it. The applications will be analysed after the application deadline, and the shortlisted candidates will be invited to a teleconference interview. The selected candidates are expected to be recruited during the period **1 May 2021 - 30 November 2021**. At the end of the selection process, all the applicants will be informed of the outcome of their application by return email. Applicants interested in joining CNIT are invited to apply for both posts CNIT-1 and CNIT-2, and to express their preference for the most suitable post (if any).

Further Information

For more information about the posts CNIT-1 and CNIT-2, please contact Prof. Stefano Buzzi (s.buzzi@unicas.it) and Prof. Alessio Zappone (alessio.zappone@unicas.it).

Disclaimer

By applying for this position, the applicants give their consent to circulate their application and personal data within the members of the consortium.

By applying for this position, the applicants declare to fulfil the eligibility requirements defined by the MSCA.

By applying for this position, the applicants agree that they will comply with the secondment plan.

By applying for this position, the applicants agree that they will comply with the planned Ph.D. enrolment.