

Job Description

MetaWireless Early Stage Researcher

Bell Labs, Access and Devices Laboratory, Transceiver Research

Nokia Solutions and Networks Oy, Oulu, Finland

Bell Labs, Access and Devices Laboratory, Transceiver Research, Nokia Solutions and Networks Oy, Oulu, Finland is seeking to appoint a high-calibre Early Stage Researcher (ESR) to join the Marie Skłodowska-Curie Innovative Training Network on ‘**Future Wireless Communications Empowered by Reconfigurable Intelligent Meta-Surfaces**’ (MetaWireless).

Position Early Stage Researcher

- NOK-1: Ray-tracing module for RIS-based wireless

Bell Labs, Transceiver Research, Kaapelitie 4, 90620 Oulu

Location:

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

NOK-1 will be hosted by Bell Labs, Transceiver Research, which is located in Kaapelitie 4, 90620 Oulu. The ESR will be enrolled on the PhD programme of Aalto University, Espoo, Finland, and will write his/her thesis on a topic related to “*Ray-tracing module for RIS-based wireless networks*”, under the supervision of Mr. Olli Piirainen for the entire duration of his/her Ph.D. programme. NOK-1 will benefit, in addition, of secondment periods at other partners of the MetaWireless project.

Further information about the Ph.D. project can be found in the following table.

Position: NOK-1
Title: Ray-tracing module for RIS-based wireless networks.
Scientific context: Existing system-level simulators are based on the fundamental assumptions that the objects reflect and refract the radio waves based on Snell’s laws. To overcome Gap 4.1, this ESR project is focused on redesigning the Nokia Bell Labs ray tracing simulator “WiSE”, to account for beyond Snell interactions of the radio waves. A first proposed approach will consist of introducing a new software module capable of equivalently rotating the objects to mimic the modelling of different angles of reflection/diffraction for given angles of incidence. A subsequent approach will consist of generalizing “WiSE” with appropriate mathematical-based macros to model functions different from reflection/refraction (e.g. change of polarization) by using the zero-sheet representation of RISs, and for application to general conformal RISs. An important issue to deal with will be the assessment of the computational complexity of the resulting approach, and the number of wave interactions (e.g. reflections) that can be modelled as a function of computation time and complexity. The new module will be employed to create an innovative environment to develop and test computational learning methods (e.g. reinforcement learning, distributed learning, federated learning).
Objectives: To introduce a new ray tracing module that accounts for the generalized Snell’s laws of reflection and refraction.
Expected results: To re-engineer the ray tracing module of Nokia Bell Labs to obtain an environment to test reinforcement learning methods.
Acquire knowledge: Principles of ray-tracing simulation and of reinforcement learning approaches for RIS-based networks.
Planned secondment(s): TUW-3 months (M18-M20) / AAL-3 months (M24-M26): To integrate the ray tracing module in TUW’s Vienna system simulator and acquire new theoretical knowledge on ray tracing. To study meta-surfaces properties at AAL and integrate them in ray tracing.
Ph.D. enrolment: Aalto University, Espoo, Finland (professor Tretyakov)

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.
3. High proficiency in Matlab and C language or similar programming software.
4. Solid background on wireless communications (antennas, propagation, stochastic geometry is a plus).
5. Excellent written and verbal communication, including presentation skills.
6. Highly proficient English language skills.
7. Excellent organisational skills, attention to detail 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 this post:

- 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 Mr. Jorma Pallonen, 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) Registration and submission of the application material to the Nokia, Finland recruitment website (<https://careers.nokia.com/jobs/metawireless-early-stage-researcher-57622>)

Applications must be sent to both the mentioned addresses to ensure the proper handling of each application.

Informal enquires for further information about the position can be send to Mr. Jorma Pallonen (jorma.pallonen@nokia-bell-labs.com).

Note 1: Registrations and submissions need to be done to both websites.

Note 2: By registering on either of the two websites 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 Nokia level, the recruitment will be coordinated by the host organization (Bell Labs, Transceiver Research, Finland). More precisely, the recruitment and selection of the ESRs will executed by the Scientist-in-Charge of the MetaWireless project for Nokia Bell Labs (Mr. Olli Piirainen) and by at least another research scientist of Bell Labs Transceiver Research, Finland. The entire process will be overseen and approved by the Human Resources department of Nokia Solutions and Networks Oy, Finland.

The application deadline for the post is on **13 July 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 **14 July 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.

Further Information

For more information about the post NOK-1, please contact Mr. Jorma Pallonen (jorma.pallonen@nokia-bell-labs.com).

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.