

## ESR7

**Project title:** Radar perception

**Place of employment and planned mobility:** Örebro University, Sweden: 6 months – seconded to Bosch Rexroth, Germany: 9 months, Örebro University, Sweden or TU Munich, Germany: 9 months

**Supervisory team:** Achim J. Lilienthal, Henrik Andreasson, Christine Brach, Ralf Becker

**Project tasks and objectives:** To use radar as a sensing modality on mobile robots has attracted increasing interest over the last years and its widespread introduction is expected to have a substantial impact for mobile service robots in industrial applications. Especially its resilience to smoke or dust and challenging weather conditions (such as heavy rain, fog or snow) presents a substantial advantage compared to lidar or visual perception, for example. Recent developments in hardware and novel perception algorithms have paved the way towards robust radar approaches to odometry, localization and mapping that can deal with the complex characteristics of radar signals (which can be difficult to interpret due to multipath reflection, speckle noise, and receiver saturation).

With a view on autonomous applications and long-term deployments, this project will set out investigating and quantifying the accuracy that can be achieved for odometry, localization and mapping with different state-of-the-shelf radar systems, particularly in comparison to respective lidar solutions. Based on these initial comparisons, using available and newly collected data, and building on expertise at Örebro University, Bosch Rexroth and TU Munich, the development of novel 2D and particularly 3D radar approaches (possibly combining classic and AI components) is a central goal in this project. Another aim is to evaluate the suitability of radar solutions (alone or in addition to lidar) for Simultaneous Localization and Mapping (SLAM) in changing environments. It is also planned to further develop approaches that evaluate partial results (e.g., after registration or map updates) with the goal to identify possible issues so as to be able to detect and remedy them online (radar introspection).

In this project, the ESR will acquire deep knowledge of state-of-the-art radar hardware and radar perception algorithms leveraging classic and AI approaches. The ESR will have the chance to shape the future in mobile robotics and further gain experience working in an international environment in academia and industry. The ESR will also be involved in dissemination through social media promotion of the network, such as Webropol surveys, and LinkedIn groups, YouTube video channels, Twitter and blogging.

**Starting date:** April 1<sup>st</sup>, 2023. Negotiable.

**Duration of the work contract:** 24 months/full-time contract with the intention to extend to a full PhD thesis (48 months).

**Trial period:** 6 months.

**Target degree:** Licentiate degree<sup>1</sup> from Örebro University, Sweden. Possibility for a PhD degree from TU Munich, Germany.

**Approximate gross salary:** about 3600 EUR/month plus family allowance if applicable

**Eligibility:** ESR shall at the date of recruitment, be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree. The researcher must

---

<sup>1</sup> In Sweden (and Finland) the Licentiate degree is formally equivalent to half of a doctoral dissertation [https://en.wikipedia.org/wiki/Licentiate\\_\(degree\)](https://en.wikipedia.org/wiki/Licentiate_(degree)). The Licentiate constitutes a milestone on the way to a PhD, which is the aim of this position.



not have resided or carried out his/her main activity (work, studies, etc) in the country of his/her first employer (Örebro University, Sweden) for more than 12 months in the 3 years immediately prior to his/her recruitment.

The applicant must be in possession of a Master of Science (MSc) diploma at the beginning of the employment in engineering, computer engineering, mathematics, automation, or similar.

**English language requirements:** Proficiency in written/spoken English is mandatory.

## Application

**Closing date:** The call is open until March 9, 2023 (and will remain open until the position is filled)

Applicants should submit the following documents, ideally in one PDF to [achim.lilienthal@oru.se](mailto:achim.lilienthal@oru.se) and [henrik.andreasson@oru.se](mailto:henrik.andreasson@oru.se):

- **Certified copies of the bachelor's and master's degree certificates with the Diploma Supplement (DS)** as approved by the EU Commission for degrees completed in European universities (when applicable) Official translations into English (if the original documents are in a language other than English)
- **Curriculum Vitae/CV**
- **List of publications (if any)** and a description of your contributions in the publication
- **References:** Contact details of 2 or more referees included in the CV
- **Motivation letter:** maximum 1 page where you introduce yourself and present your qualifications; you may include also your previous research fields and main research results. Please emphasize your future goals career-wise
- **Copy of the passport**
- **Proof of residence:** Statement and certificates/documents demonstrating your residence(s) in the last 4 years

**We look forward to receiving your application!**

## Additional information

**Working and living conditions in Sweden at Örebro University** - Ph.D. students in Sweden are University employees and they have all the social and financial rights of other employees. Among these: a fixed monthly salary adequate to the cost of living in Sweden, inclusion in the Swedish social security system, and at least 28 days of paid vacation each year. These conditions are guaranteed for three years as long as the requirements for the Ph.D. studies are fulfilled. Ph.D. students in Sweden have to take advanced courses during their study program. These are typically technical courses relevant to their research project, but may also be courses about other related disciplines, including scientific methodology and project management. Courses at the Centre for Applied Autonomous Sensor Systems (AASS) are meant to provide students with a unique educational background in autonomous sensor systems. Ph.D. candidates in Sweden may devote up to 20% of their time to institutional work. This work typically consists in helping with the undergraduate education. The percentage of time spent with institutional work is added to the total duration of the Ph.D. studies. In summary, the Ph.D. students at AASS will be doing four sorts of things during their Ph.D.: work on their research project; take graduate courses; contribute to undergraduate education; and participate in the scientific life of AASS and of the international community. More information about the Ph.D. studies at AASS can be found [here](#).



The University of Örebro is a young university currently enrolling more than 14000 students. It is located in Örebro, a city with 130000 inhabitants, which is situated in central Sweden. For more information about the University of Örebro click [here](#) and about the city, [here](#).

**Working and living conditions in Germany at Bosch Rexroth.** Germany is the heart of European industry and offers a high standard of living. Beyond that a sumptuous and varied scenery and stunning medieval towns and cities are offered. Germany lives up to its reputation of being clean, efficient and very welcoming. Aside from modern advances in technology and science, Germany is also rich in culture.

The **Bosch Rexroth sites** where the secondment of the ESR will take place are located in Ludwigsburg (Grönerstraße 5/1) and Ulm (Lise-Meitner-Straße 4), which is well known for the world's highest church tower "Ulmer Münster". Ulm is a lovely small city with about 125.000 residents located between Munich and Stuttgart. Not least thanks to the university of Ulm and the nice historic downtown it offers attractive living conditions.

Bosch Rexroth is an innovative company specialized in machines and systems of any size and has global application experience in market segments such as Mobile Applications, Machinery Applications and Engineering, Factory Automation and Renewable Energies. Bosch Rexroth is in the cutting edge of forming the next generation of mobile machines using electrified, electronic and digitally networked solution in order to increased power, safety, efficiency and intelligence of future Mobile Machines.

