

Internships (2) positions: Smart microwave and millimeter-wave radar detection

The present internships will unfold within the framework of a collaboration between RF-Microtech France SAS, and the Micro and Nonosystems for wireless communication (MINC) group of LAAS-CNRS. The aim is to develop an innovative wireless cognitive (i.e. endowed of localization, identification, sensing, communications capabilities) platform based on the most advanced millimeter wave radar systems available on the market. The solution targeted by this development would be capable to enhance the detection capability (resolution and accuracy) beyond the present state of the art, and to extend the classical functionalities associated to a radar, such as range and speed detection, with other critical detection features such object unique identification and sensing of environmental parameters (pressure, temperature, humidity, ...).

Millimeterwave radars are nowadays extremely popular especially in automotive industry which is driving the deployment of 77 GHz technology in a number of critical applications (e.g. autonomous cruise control, autonomous parking, ...). Cost reduction and progresses in miniaturization and consumption are paving the way toward an unprecedented penetration of these systems in all aspects of modern life (Factory 4.0, Precision farming, silver economy, healthcare, smart-home, ...).

The activity planned for this internship are organized as follows:

- Get hands-on the hardware and software control/analysis tools available. This will unfold by aiming the system at conventional targets (arbitrary shape/material, distance, speed and number).
- Perform result analysis in order to select the most suitable solution. This study will be carry out by evaluating the main key performance indicators (such as accuracy, resolution, range, ...) with respect to system specification (e.g. hardware configuration, frequency, bandwidth, radiated power (EIRP),...) and typical application constrains (e.g. LOS or not, cluttering, ...).

From this common preliminary part two different but complementary tasks will be assigned to two different candidates:

- i. Design, manufacturing and test a customize intelligent tag which embeds a retrodirective (depolarizing) antennas solution and a coding circuitry (to imprint identification and possibly sensing capabilities)¹.

¹ L. Marcaccioli, et al., "An accurate indoor ranging system based on FMCW radar," 2011 IEEE Intelligent Vehicles Symposium (IV) Baden-Baden, Germany, June 5-9, 2011 (From RF Microtech - Italy)

- ii. Design, coding and test of software interface capable to pilot the radar and analyze the data through dedicate signal processing tools (high resolution algorithms and customized estimator)².

Both tasks will start be considering an indoor location and sensing demonstrator already available in-house and which is based on the ISM 5.8GHz frequency band (VISPO)¹.

The position gives access to an outstanding scientific background and technical infrastructure which has been gathered by the hosting organizations (LAAS-CNRS has been one of the first pioneers in radar for passive sensing applications³). Noteworthy is that the candidates will benefit from the availability of a unique range of commercial millimeter-wave radars which includes: 24GHz 2x4 MIMO radar from IMST; 60GHz 2x4 MIMO radar from Infineon; 77 GHz 4x8 MIMO radar from INRAS and the 122 GHz SISO radar from Silicon Radar.

Keen on preserving the fundamental human values and respecting basic human rights, the team made of RF Microtech engineers and the LAAS-CNRS researchers will be able to offer a very stimulating, competent and international working environment, by means of which to fulfill personal ambitions and professional potentialities.

The candidates sought for these positions need to have a sound background in high frequency engineering (RF circuits, antennas and wave propagation) and signal processing (coding and complex signal data analysis) respectively. A background in radar theory is welcome.

The internship has a duration of 6 months and it is accompanied by a financial remuneration. Please note that these internships are likely to be followed by a (3 years) PhD industrial scholarship (type CIFRE⁴).

About the hosting organizations:

LAAS (Laboratoire d'Analyse et d'Architecture de Systèmes) is a CNRS (Centre National de la Recherche Scientifique) research unit working at the crossroad between engineering, science and information communication technology.

RF-Microtech France (SAS) is a spin-off company from RF Microtech (srl)⁵ based in Italy (Perugia) and LAAS-CNRS⁶ in Toulouse. RFM proposes a service going from design to

² D. Henry, H. Aubert, T. Véronèse and É. Serrano, "Remote Estimation of Intra-Parcel Grapes Quantity From Three-Dimensional Imagery Technique Using Ground-based Microwave FMCW Radar," "IEEE Measurement and Instrumentation Magazine 2017

³ M. M. Jatlaoui, P. Pons, and H. Aubert, "Pressure micro-sensor based on Radio-Frequency transducer," in IEEE MTT-S Int. Microwave Symp. Dig., 2008, pp. 1203–1206

⁴ Visit the ANRT website: http://www.anrt.asso.fr/fr/espace_cifre/accueil.jsp#.WJxZMhIrKL4

⁵ RF Microtech website: www.rfmicrotech.com

⁶ LAAS-CNRS website: www.laas.fr

prototyping of innovative solutions for advanced wireless communication and sensing applications.

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