The **French-German Research Institute of Saint-Louis (ISL)** situated in the border triangle of Germany, France and Switzerland is an internationally renowned research institute belonging to a global industrial and economic network.
The spectrum of our core activities comprises a variety of topics: aerodynamics, energetic and advanced materials, lasers and electromagnetic technologies, protection, security and situational awareness. Our activities are related to both basic and applied research.

ISL is offering a **PhD Position**

Research field: Flight techniques for projectiles

GNSS independent localisation using LEO satellite signals of opportunity with inertial navigation

Context

Off-grid localisation and localisation of airborne systems such as drones is increasingly based on the coupling of different sensors. The most widely used solution is a coupling of Inertial Measurement Units (IMUs) with Global Navigation Satellite Systems (GNSS) like GPS or Galileo. It is known that the loss of the GNSS signal leads to a drift of the position estimation. Indeed, GNSS is vulnerable to interference as evidenced by the resurgence of incidents reported in the vicinity of commercial ports, on highways and even by civil aviation. Hence it is necessary to find an alternative, capable of maintaining an accurate navigation solution when the GNSS service is lost.

The recent past years have seen an interest to the use of Signals of OPportunity (SOP) for navigation, and in particular signals from Low Earth Orbit satellite communication systems (known as LEO) such as Iridium Next, Orbcom, etc. First research projects and startups using these systems for navigation show promising results. The advent of "super-constellations" like OneWeb or Elon Musk's Starlink is likely to improve the quality and availability of such positioning solutions.However, several challenges are encountered by SOP users of LEO systems, in particular the knowledge of Satellites' positions, the time of the transmit and even the weak signals properties in terms of ranging measurements. All these originate from the fact that these systems have not been designed for the need of navigation and are "passively exploited". While the standalone use of these signals shows accuracy and availability limitations, their coupling with inertial sensors makes it possible to overcome certain limitations.

Project

This PhD-thesis aims to develop a navigation system by hybridisation between LEO system Signal Of Opportunity and an Inertial Measurement Unit. The candidate will study the benefits offered by this coupling for navigation. Then he/she will develop the signal processing and navigation algorithms. The developments carried out will then be validated and tested by experimentation in the lab, in field and flight tests.

Qualifications

- Master degree in Electrical Engineering, Telecommunication, or similar
- Experience in signal processing, MATLAB (and toolboxes like Simulink) and C++
- Motivation to work on mathematical modelling, simulation, coding and experimental testing of electronic circuits
- Ideally some background in radio/satellite and inertial navigation

French-German Research Institute of Saint-Louis (ISL)

Nabil JARDAK – Guidance, Navigation and Control
5 rue du Général Cassagnou – 68301 Saint-Louis – France
nabil.jardak@isl.eu – tel : +33 (0)3 89 69 51 01

www.isl.eu

© ISL 2022 – Realisation ISL/COM-ED – November 2022