Characterization of the degradation modes of the HARDWARE of a GNSS receiver and their impacts on navigation performance

End-of-studies internship in the Engineering cycle

Syntony GNSS is a human-sized company with an international dimension, based in Toulouse and with the **FrenchTech label,** specializing in **Global** Navigation Satellite Systems (GNSS).

Our ambition: To provide our customers with relevant, innovative, reliable and robust solutions.

World leaders in radio navigation and embedded systems, we are present in fast-growing markets, such as aeronautics, space, road and rail transport, mining and IoT (Internet of Things). We have developed a range of products (simulators, receivers, indoor/outdoor location systems) that meet the growing needs of these industries.

Keysight, Airbus, Airbus Constellation, Hitachi Rail, Thales Alenia Space, Honeywell, Rockwell, MDA, or the Stockholm, New York and Toronto metros... So many partners who trust us and push us to always go further.

With passion, we constantly evolve our solutions to anticipate their needs and perfect our know-how.

At Syntony, we offer a pleasant and stimulating work environment, where the quality of life at work and the availability of our employees promote fulfillment and collaboration. Intellectual stimulation is omnipresent through innovative and varied projects.

We work on a variety of subjects, ranging from aeronautics to space, transport, mining and the environment.

Thus, Syntony vibrates around three fundamental values:

Benevolence:

Together, we cultivate listening, respect and empathy in our interactions, while also valuing the multiculturalism that enriches our exchanges.

We contribute to a positive environment where everyone feels valued and supported. We enrich each other by building strong relationships, both internally and externally.

Excellence:

Together, we strive for excellence in everything we do. Through our commitment, our high standards and our sense of responsibility, we guarantee quality, efficiency and performance. It is through our collective rigour that we meet challenges and provide sustainable solutions.

Adaptability:

Together, we are flexible in the face of the changes around us.

By combining creativity, collaboration and resilience, we find innovative solutions and move forward efficiently. Our agility allows us to evolve in line with our environment.

From students to qualified professionals, help develop future navigation solutions in partnership with our team of experts. Evolve in a caring environment where your ideas take flight and your contributions strengthen the synergy of the company.

Internationally, we meet the challenges of today and tomorrow, supporting our customers throughout the entire process: from the initial vision to development, to delivery and the collection of their satisfaction.

The Context

Syntony GNSS participates in innovative railway projects such as ECOTRAIN, offering its GNSS receiver as a navigation solution. The location of the train is a critical function, putting the safety of passengers at stake. The receiver must then prove its operational safety, i.e. its ability to perform its functions without the risk of dangerous failures.

Consequently, all the risks to which the positioning system is likely to be subjected must be controlled. The contribution of this course aims to study some of these risks, specifically those concerning the equipment, the hardware part of the receiver.

The GNSS receiver estimates its position by receiving and processing satellite signals. These signals are amplified, filtered and digitized in an RF chain, and then processed in a position estimation algorithm. Each of these steps is carried out by components with specific functions, and subject to its own degradation modes.

What you'll accomplish with Syntony GNSS

The objective of the internship is to characterize the consequences that could be caused by the degradation of certain critical components of the receiver: the LNA (Low Noise Amplifier), the local oscillator, or the filters. Given the value of the material, it is not possible to carry out any real degradation. We then propose to model these potential degradation modes and then to study the impact at the receiver output: the PVT (Position, Speed, Time).

Some modes of degradation have been identified, but their real impact has yet to be specified, and the studies limit themselves to considering for the moment only the complete failure of the receiver. However, in reality, we can expect a deterioration in the quality of positioning.

Proposed activities

The work will theoretically consist of 3 stages:

1. Identification of degradation modes of receiver components
2. The implementation of means and methods for modelling degradation
3. Evaluation of the impact of these degradations on the quality of the receiver positioning

Then, depending on the progress of the work, we will be able to imagine ways of protecting certain modes of degradation.

The technical skills we are looking for:

- Data analysis
- Signal processing
- Knowledge of Navigation, GNSS System (GNSS receiver, positioning, orbitography, ...) is a plus
- Knowledge of electronics, Radio Frequencies and test and measurement instrumentation (Oscilloscope, Spectrum Analyzer) desired
- Mastery of Matlab / Octave / Python / C appreciated
- Fluency in technical English and good writing skills English / French
- A taste for experimentation and analysis of real data is a plus (critical thinking, autonomy, writing)

About you

Currently in engineering school or Master's degree, with a good foundation in mathematics and/or a specialization in space systems, GNSS, satellites, signal processing or RF..., you are looking for a 6-month internship at the end of your studies. An appetite for scientific programming and theoretical studies with experimental application is also sought.

Your technical curiosity, your desire to learn and your team spirit will be the assets necessary for the success of your mission.

Ready to get on board with us? 🚀 ✨

Send us your CV under the reference ENG-651-EN: jobs@syntony.fr.