PhD Proposal: Robust GNSS phase tracking for a precise positioning

- PhD advisor: Stéphanie Bidon (ISAE/DEOS/SCAN)

- Application deadline: ~~March~~ April 15 2018

- Field of study: Navigation signal processing

- Keywords: recursive estimation, Bayesian filtering, phase tracking, GNSS

- Partnership: Airbus Defence and Space

Main objective

The goal of the research project is to develop new estimation algorithms to track the carrier phase of a multifrequency GNSS (Global Navigation Satellite System) signal in harsh environments. For that purpose Bayesian filtering techniques will be favored. The carrier phase is actually used for precise positioning in GNSS receivers. Precise positioning is of great interest in many domains of application.

Job description

To determine its position, a conventional GNSS receiver uses code delay measurements of the satellites in view. In that case, the precision of localization can be of a few meters. To obtain centimeter accuracy, it is necessary to additionally use carrier phase measurements that give, in number of carrier cycles, a precise measure of the distance with the satellites. In practice, phase measurements are provided by Phase Lock Loop (PLL). Unfortunately, PLLs are very sensitive to perturbations and can be subject to cycle slips (i.e., an estimation error of the phase ambiguity range).

To enhance phase tracking performance, two mains strategies can be thought of:

1. A first approach consists in improving the tracking technique without augmenting the measurements. This can be achieved with a better description of the signal model (measurements and dynamics) and/or by implementing more efficient estimators. Particularly, PLLs ignores the nonlinearity between the measurements and the carrier phase.

2. A second approach consists in augmenting the information brought to the estimation problem via some prior information (e.g., about the receiver dynamics or the conditions of propagation) or by augmenting the number of measurements (e.g., use of a multifrequency waveform).

In this research project, both strategies will be investigated. Specifically, nonlinear phase estimation techniques will be developed in conjunction with the use of a multifrequency GNSS signal. Previous work conducted in the lab has pointed out several research directions [4].

Qualifications

We are looking for a PhD candidate with an MSc in signal processing (or equivalent) and with a good academic record. Applicants should be highly motivated and rigorous. Background in GNSS is a plus but not compulsory.

Due to the targeted funding, European citizenship is required. This thesis is in collaboration with Airbus Defence and Space, Toulouse.

The lab

The PhD candidate will conduct his research within the SCAN (Signal Communications Antenna and Navigation) group of the Department of Electronics Optronics and Signal, ISAE-Supaéro, Toulouse.

Application

For more information about this position and/or to apply please contact professor Stéphanie Bidon with your resume, a letter of motivation and your current academic records.

A few lab references

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