Title: Hybridization of Galileo E1, E5 with inertial signals for a large range of dynamics

Context:

The interest in hybrid Inertial Navigation Systems (INS) and Global Navigation Satellite System (GNSS) positioning for defense issues has grown steadily over the last decades. Indeed, GNSS positioning can vastly improves INS precision and robustness in many different applications: traditional ballistic ammunitions, military vehicles or soldiers on foot. The recent commissioning of the European global navigation satellite system, Galileo, enables novel International Traffic in Arms Regulations (ITAR) free development of European defense technologies. Indeed, since 2016 Galileo has been operational and its complete efficiency will be reached in 2020. Due to the new generation of satellites clocks combined with novel bi-frequency signals, the new European positioning system is expected to improve the overall performances of GNSS positioning.

Project:

Many INS/GNSS hybridization scheme have been proposed and studied over the last decades since it takes the best of both worlds to achieve an improved navigation solution. All these methods are linked to an application context and dynamics that condition the filter design. Globally, being able to adapt the filter to diverse and changing dynamic conditions remains an open issue. The hybridization methods are applied to a wide range of dynamics related to the specificities of all applications: fast-maneuvering system, high velocities for guided ammunitions or low/free dynamics, multi-path for soldiers.

To address this open issue, in a context where novel European Galileo signals are available, a PhD work is proposed on the topic of INS/Galileo integration algorithms where novel integration schemes must be invented. The integration architectures will be discussed for finding an appropriate compromise between integration depth, performance requirements and other sensors such as magnetometers or inertial units according to different dynamics.

The proposed PhD research will be conducted in cooperation between two institutes: ISL (French-German research institute of Saint-Louis) and IFSTTAR (The French institute of science and technology for transports, development and network) who both own a recognized experience in positioning. The GNC group at ISL is specialized in projectiles navigation with inertial and magnetic sensors and the GEOLOC laboratory at IFSTTAR has been conducting research on positioning and navigation methods and systems for pedestrians and terrestrial vehicles with GNSS and inertial/magnetic signals for many years.

Under the academic supervision of IFSTTAR's GEOLOC laboratory registered at the University of Nantes, the PhD student will be employed by the French-German Research Institute of Saint-Louis (www.isl.eu) with a 3-year contract (CDD, about 2000 € / month). The PhD position will mainly take place at ISL's office (Saint-Louis, Alsace, France)

Desired competences:

Master II and/or Engineer diploma in Automatic Control and/or Signal Processing: Kalman Filter, GNSS (GPS, Galileo), Inertial Measurement Unit, MATLAB/Simulink