



For our **Institute of Communications and Navigation** in **Oberpfaffenhofen**, we wish to recruit a qualified

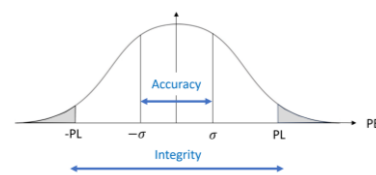
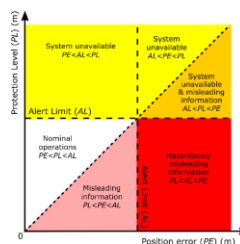
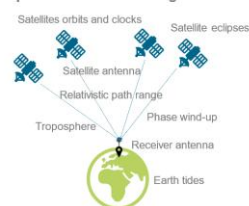
Master Student

Investigation and Development of Integrity Concepts for Precise GNSS Positioning

Background:

New navigation applications, such as autonomous urban mobility, require accurate and precise positioning and navigation while ensuring safety. The GNSS technique of Precise Point Positioning (PPP) utilizes precise satellite products and advanced error modelling to achieve a high level of accuracy worldwide. The safety of a navigation solution, i.e. the measure of trust that navigation information is correct, can be quantified by its integrity. However, the integrity of PPP remains up-to-date insufficiently investigated and developed. The main reasons are that integrity concepts, e.g., RAIM and SBAS, were developed for code-based positioning and cannot be applied directly to PPP, which is driven by carrier-phase observations. A key open question is how to ensure the integrity of PPP, given its dependence on external products, temporally correlated errors, and potential carrier-phase ambiguity resolution failures. Therefore, an integrity framework explicitly tailored to PPP is needed, including PPP-specific integrity definitions, error bounding and protection level computations suitable for PPP users.

Ionosphere-free PPP modeling and corrections



Your Mission:

This thesis will investigate integrity aspects for PPP, which may include the following steps:

- Literature review of existing integrity monitoring concepts with an assessment of their applicability to PPP, and identifying major integrity risk sources for PPP
- Study the error propagation from external products and applied models into the PPP solution
- Stochastic error modelling and error analysis
- Quality control of ambiguity resolution
- Probability of wrong carrier-phase ambiguity fixing and its impact on integrity
- Derive new concepts for PPP error bounding and protection level computation
- Experimental validation of the new concepts using data recorded with DLR vehicles and an aircraft

Theory: 30%, Development: 30%, Experimental: 40%

Your qualifications:

We offer an opportunity to a student in geodesy, electrical, communications, computer science or related engineering field. Desired skills are:

- Knowledge of satellite navigation, PPP and GNSS error sources
- Knowledge of integrity concepts is plus
- Experience in signal processing and error modelling
- Experience with MATLAB
- Fluent English

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