

Performance Assessment of a Stabilization Platform for Novel Inertial Sensors

Inertial measurement units are a valuable part of today's navigation systems due to their autonomous measurement principle and, as an inertial navigation system, yield the ability to estimate the full kinematic state of a moving platform. The problem is the large drift of the position, velocity and attitude estimates due to integration of random and systematic errors in the measured accelerations and angular rates.

Atom interferometry is a novel concept that enables superior accuracy measurement of inertial quantities, while the signal is essentially drift-free for long periods of time. The drawback of this new sensor is the very low dynamic range, which needs special consideration. The dynamic range can be extended via sensor fusion with complementary inertial measurement units, or the sensor can be stabilized in order to reduce the impact of vibrations and to compensate for a rotation of the frame.

In the QGyro project such a sensor is currently developed. In order to evaluate the capabilities of the prototype, a stabilization platform with three degrees of freedom (2x inclination angles, 1x linear drive) is provided which allows for a compensation of rotations and a control of the acceleration of the end-effector.

The goal of this thesis is to assess the capabilities of the stabilization platform. This includes the maximum achievable speed and acceleration, as well as the accuracy of the positioning of the end-effector by defining different trajectories. In the progress, the transfer behaviour of the control input to the platform needs to be assessed. The control is done via python interface, which eventually needs to be extended. Another topic that can be discussed is the transfer behaviour of the platform control to the actual output of the atom interferometer.

You will be able to work together with the QGyro project team, but have a very clear niche job. This high-end technology is work in progress on the way to a fully-capable quantum inertial navigation system.

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