Line of sight stabilization using direct drive actuators in a gyro stabilized sensor system

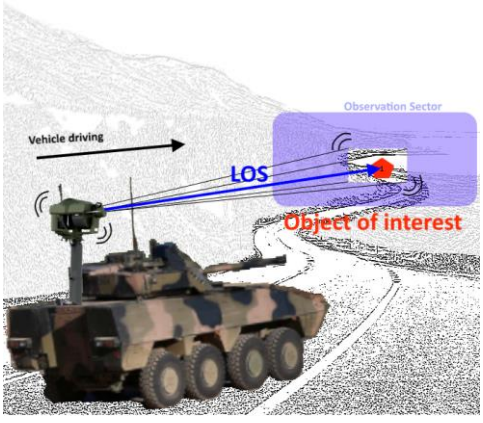
Master's thesis number:MT-28-22

Introduction and background:

Line of sight stabilization is about keeping the line of sight in a sensor (camera, laser) towards an object of interest while being exposed to external disturbances. A military vehicle may in some cases be equipped with a long-range observation sensor platform. The sensor platform must be capable of observing with a steady and accurate line of sight during its mission, which can be achieved by mounting the sensors on a stabilized pan tilt platform. This thesis documents a concept study where a direct drive concept has been evaluated against a gear box drive for a stabilized elevation axis on a long-range observation platform. A prototype was developed and used as reference, where an optimal linear quadratic controller, LQR, together with a linear quadratic optimal state estimator, a Kalman filter, was used as an LQG stabilization controller.

Problem description and objective:

1. Develop mathematical models for direct drive system and Harmonic Drive system by using a theoretical approach with physical laws and/or by using black box model system identification on measurement data.
2. Develop a direct drive prototype control system.
3. Develop controllers for the system. An LQ optimal controller shall be designed for the stabilization control loop with an additional LQ optimal state estimator, a Kalman filter.
4. Simulate the frequency response and step response of the system using Matlab and Simulink.
5. Conduct and analyse applicable time series and frequency response tests on physical conceptual model with direct drive and Harmonic Drive gear actuators.



Candidate:

Eirik Engen

Telephone:

975 79 811

Email:

eirik.engen@rheinmetall.com