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Subject Area	Sensor, Actuator and Communication Systems

Dynamic-Related GNSS Attenuation in Avalanches

Project Thesis

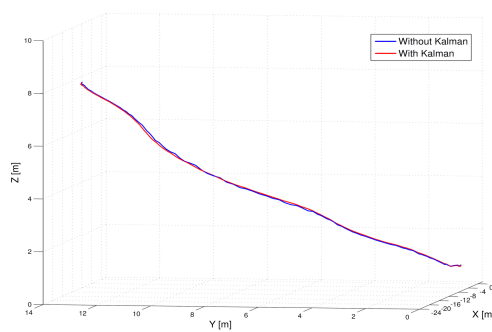


Powder Avalanche, Source: www.slf.ch

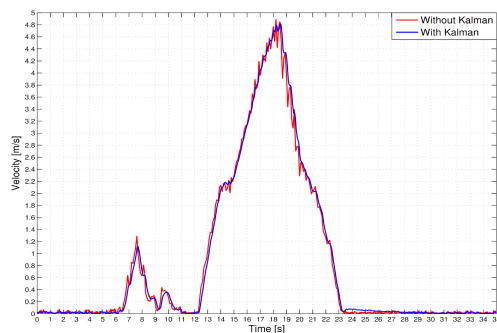
If a person gets caught by an avalanche the time of rescue is crucial in order to save the victim from a painful death. Even though rescue technology progressed in the last couple of years and provides several solutions in order to fasten the location and rescuing process, there are still too many fatal accidents happening until this day. The main objective of this project is to determine whether it is possible to track an avalanche victim during the avalanche outflow by using a GPS receiver hardware combined with an inertial measurement unit. Moreover, to determine the possibility to extrapolate the victim's position based on the given inertial navigation data even if the GPS reception is lost during the avalanche incident. In a first step the basics of snow, avalanche dynamics, rescuing and avalanche victim's statistics have been examined in order to provide an established knowledge base for the upcoming workflow in which the evaluation and design of a suitable logging hardware was pursued.

This avalanche logger has been successfully composed involving the evaluation of suitable sensors, the proper design of the PCB and the implementation of an appropriate software. The device is able to log incoming GPS, acceleration, gyro and compass data, which are subsequently relayed to a loosely coupled Kalman filter, which processes the data offline in order to determine the position, velocity and acceleration of the measured data. Unfortunately it was not possible to test the hardware in a real avalanche during the project period, however, the hardware had been tested letting it slide down a hill while attached to a sled. Even though this measurement does not actually reflect the dynamics of a real avalanche, it made it possible to implement a suitable offline processing algorithm including a dedicated Kalman filter.

In a next work step the Kalman filter will be examined under the condition of missing GPS data and the planning and execution of a measurement in a real avalanche will be executed, whose results shall help improving the state of the art avalanche transceiver technology and leading to an increased number of rescued avalanche victims.



Sled Position with and without Kalman Filtering



Sled Velocity with and without Kalman Filtering