Master Project

Real-Time Fault Detection and Isolation for Lateral Control of an Autonomous Vehicle

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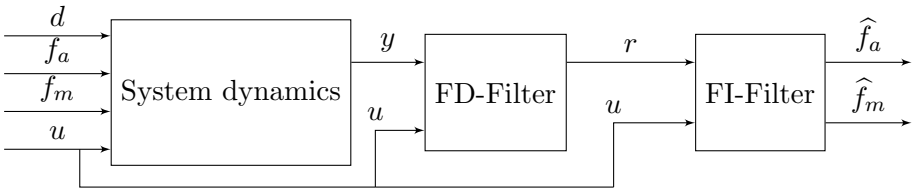
Context

Autonomous vehicles are rapidly becoming the center of attention in the future of the automotive industry. Novel control and observer techniques are continuously being developed to ensure a safe and efficient implementation of autonomous driving in the human society. One of the greater goals for autonomous vehicles is defined as being able to autonomously drive the vehicle without human intervention. A lack of human intervention requires the vehicle to be aware of fault scenarios for which it should undertake appropriate action.



The focus of this project is to detect and isolate faults occuring in the steering system in a lane-keeping scenario. Two types of faults are of particular interest in this project (f_a, f_m in the figure above) and the main challenge is posed by these two faults being unobservable from one another. A lateral vehicle model can be derived that can describe the lateral dynamics of a vehicle on a constant longitundinal velocity, this model can be used for filter synthesis. A variation in this velocity will cause deterioration of the result of the filter based on the linearized model, thus an extention of the main method is developed that can decouple the linear parameter-varying nature of the system.

Project tasks

This master thesis project is aimed at developing a fault detection and isolation method applicable to a wide range of models with a particular occurence of faults. Requirements set on the method are:

1. Detect and isolate dynamically undetectable faults in real-time
2. Provide an analytical performance bound on the estimation error of these faults
3. Decouple the effect of the linear parameter-varying nature of the plant

This master thesis project is done in coorporation with TNO, department of Integrated Vehicle Safety. The algorithm will be designed and validated experimentally.