

## Masterarbeit zu vergeben

### Reconstruction of Track Irregularities from Inertial Measurements considering the Vehicle Dynamics

*Rekonstruktion von Gleislagefehlern aus Beschleunigungsmessungen unter Berücksichtigung der Fahrzeugdynamik*

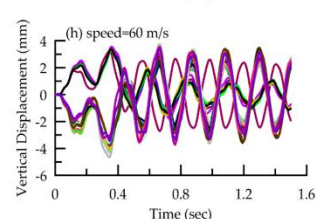
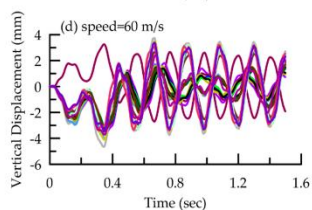
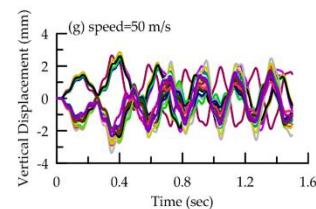
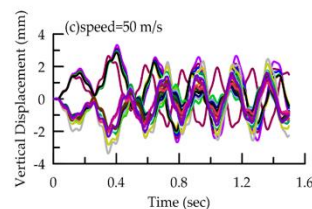
Track irregularities are considered to be the major excitation of railway vehicles, playing a primary role in the dynamic response of the vehicle-track interaction system. The determination of track irregularities is necessary for classifying tracks into quality classes and for addressing supervision and maintenance. Also, regarding the design of railway vehicles, track irregularities must be considered in the issues of running safety, ride comfort, dynamic loading and fatigue of components.

It is theoretically possible to reconstruct the vertical profile of the track via double integration of the acceleration signals measured at the axle-box of the railway vehicle. However, this direct method does not always yield good results due to the limited dynamic range of the instruments, the very wide frequency span of the signals and some issues related to the numerical integration process. In the case of lateral irregularities, the wheelset does not exactly follow the rail profile, but moves inside the wheel-rail gauge clearance. Therefore, lateral irregularities can not be determined via direct integration of the lateral acceleration signal.

*Von Vorteil sind Vorkenntnisse:  
Signalverarbeitung  
Programmierkenntnisse in Matlab*

*Earliest possible starting date for this topic is January 2021*

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A different approach to determine the track irregularities uses inertial measurements on the bogie and/or on the car body. Nevertheless, in this case appears the problem of the presence of the vehicle suspension dynamics and its influence on the measured signals. This effect necessarily needs to be considered in the analysis of the track irregularities. To deal with this issue, several system identification techniques have been applied to obtain a transfer function or parametric model to relate the track irregularities with the inertial measurements on the vehicle.

The proposal of this master thesis is to derive an inverse model, which allows the reconstruction of track irregularities and other features of the track geometry based on a transfer function or other model representation of the vehicle suspension dynamics