Master Thesis

Detection of local instabilities on a scale vehicle-track model through measured accelerations of the vehicle

Abstract

As part of the new methods to evaluate the track quality and schedule the maintenance of railways, it has been proposed to use electronic devices on trains that are capable of measuring the vertical acceleration of train journeys to detect failures in the alignment.

This document analyzes the vertical acceleration of the vehicle-track model of the Institute for Railway and Transportation Engineering of the University of Stutt-gart

Methodology

- The first step was the recognition, the analysis and the classification of the failures patterns of the scale vehicle-track model.
- The second step iwas the development of trained model in Matlab by using the statistical characteristics of six tests with around 760000 sample numbers, those characteristics include: Mean, Root-mean-square, Standard deviation, Principal component analysis, twelve Spectral peaks, five Spectral power fea-



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• The final step iwasthe validation of the trained model by executing a tested model with 14 tests, which have different configurations, changing the speed, direction, orientation, continuity and starting position.

Conclusions

- The detection of the local instabilities achieves in general, a positive answer of 84%.
- The different configurations of the test don't have problems with the change of orientation, direction and initial position, however,
 - it is clear to see that the positive response decreases when the speed is lower and also when the test is continuous and increases the speed of the vehicle.
- For future works, it is recommended to feed the model not only with more classified data ,but with tests with different configurations, to adjust the model to random conditions.
- It is also recommended adjusting the model by changing the number of batches and the number of spectral peaks and spectral power features.
- Likewise, it is expected that the model can improve its positive answer when the sensor measures vertical, horizontal and lateral accelerations simultaneously and when a gyroscope, that can measure the spins in the three axes, is added to the test.





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