Detection of railway superstructure defects using vehicle inertial response based on the bogie room model.

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Abstract

Rail transport has emerged the most important transport for both freight and passengers, and its strategic importance has increased significantly in recent years [1]. As a result, railway administrations are focusing their efforts on addressing the challenges related to track quality maintenance and prompt repair of any defects. As a result, this publication focuses on the mathematical analysis of the inertial signals that occur in the track user vehicle, utilizing the bogie room model [2]. The goal is to identify any changes in the geometry of the track superstructure that may affect track quality, using data obtained from a specialized acquisition system installed on commercial trains during normal operations. Ultimately, the aim is to enhance the quality and safety of rail transport.

In this manner, firstly, suitable hardware was developed to collect the required data for implementing the proposed mathematical model. The hardware comprises triaxial accelerometers installed on the unsprung masses of the bogie, a GPS-based positioning system, a data acquisition system, a communication system, and a power supply system. Next, algorithms were developed to analyze the signals acquired in each instance, which also included the determination of the best frequency filter to use. Subsequently, the system was assembled and tested as a functional prototype, specifically on track 1 of MetroValencia, in the section between the stops Torrent and Paiporta.

From the tests carried out, the thesis is focusing on the analysis of topics that proved to be of importance, such as the development and adjustment of adaptive filters to the speed of vehicles, and the adaptation of the analysis to the direction of traffic.

References

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