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Ballast quality assessment using Ground Penetrating Radar data processed in frequency domain

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In the transport infrastructures context, the support layers have a fundamental role in the degradation of the track condition, both in structural aspects and in terms of fouling of the materials that comprise them. Particularly in the field of railway research, ballast is the key element, and its fouling leads to track deterioration. Thus, the main focus of this work is based on the evaluation of the ballast fouling using Ground Penetrating Radar (GPR). In order to determine the applicability of the method on the evaluation of railway characteristics, laboratory samples and measurements carried out in situ, on sections of two railways in operation were analysed. In both cases the different ballast fouling levels were evaluated, using specialized software for this approach (temporal analysis); and then comparing these results with results of a frequency analysis in an automatic calculation program. This paper presents the possibilities of testing with GPR equipment by analysing an electromagnetic wave, in the temporal and frequency domain for the purpose of investigate the level of degradation of a railway track. Some recommendations are also made regarding the use of this method, adding the need for future developments in an attempt to reduce the number of destructive tests still practiced nowadays.
Railway research efforts are carried out not only to solve the problems of degradation, but also to determine the contribution of each parameter in the whole process. This paper aims to contribute to the improvement of the use of non-destructive techniques in the characterization of support layers, specifically in the detection of the level of contamination of the rail ballast in the presence of fine particles.
The approach presented herein represent an important tool in the sense of selecting efficiently, well-defined, zones that need intervention or rehabilitation. The aim is to contribute to the identification of critical areas and, if possible, to predict future defects, in a non-destructive, continuous way.
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