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Estimation of static load due to weight in motion system

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Abstract

The present paper is about the numerical modelling of a weight-in-motion system developed with the aim of assessing the static loads imposed by the train to the track infrastructure. The presented WIM system constitutes a part of a larger project PEDDIR dedicated to the Portuguese acronym for "weighing in motion and wheel defect detection" system. In order to overcome disadvantages due to of costs and traffic management typical of conventional static weighing, such system could be convenient. This study focuses on numerical parametric studies as about the prone influence of speed, rail pad properties, foundation properties, and track unevenness profile on train dynamic load by one hand and on the accuracy of the access mean of the static load from the dynamic measurements.

Key words: Weigh-in-motion systems (WIM), track overweight, train speed, rail pad stiffness & damping, foundation stiffness & damping, rail unevenness

1. Introduction

The assessment of loads imposed by railway traffic on the infrastructure is a major concern for railway administrations in order to avoid overloaded conditions that can induce damage in the railway tracks. Measured weight in motion in track and compared with the permitted weight is important in order to show the warning in control system when the train is overloaded [1]. The presented WIM system constitutes a part of a larger project PEDDIR dedicated to the Portuguese acronym for "Systems for weighing in motion and wheel defect detection". [2, 3]. The importance of the issue become clear when wheel load can be performed without stoping train in order to eschew consequences on the railway traffic.

The development of efficient WIM method with high accuracy estimation procedures from track measurements is one of the important subject which draw the attention of both the railway industry and the scientific research [9-11]. Different monitoring schemes and experimental setups have been proposed for that effect, but usually the systems are based on the measurement of the dynamic response of the rail, i.e., installing strain gauges or accelerometers.

The present system is based on 12 strain gauges installed in the each rail web, positioned in the neutral axis to infer the shear stress as will be illustrated in further section, allowing the measurement of the load imposed by the axle to the track along 6 sections (pair of 2 consecutive strain gauges). It should be highlighted that the load imposed by track