8th National Congress on Civil Engineering, 7-8 May 2014
Babol Noshirvani University of Technology, Babol, Iran

A Review of State of the Art on Automated Railway Condition Inspection

Fereidoon Moghadas Nejad [1], Nasser Taheri [2], Hamzeh Zakeri [3]
1-Associate Professor,
2-M. Sc. Student,
3-Ph.D Candidate,
Department of civil and environmental engineering, Amirkabir University of Technology
Nasser_taheri@aut.ac.ir

Abstract

This paper deals with some related methods in the realm of soft and hard developments which currently employed inspection and health monitoring condition in railway domains. A brief review of Non-Destructive Testing (NDT) is presented in this paper. NDT based inspections are categorized into three groups: 1) Visual, 2) Semi-Automated and 3) Full-Automated. NDT technologies are useful for real-time management and will improve the ability of long-term predictive models. At the end of each part, positive and negative points of each method have been discussed and finally ongoing advancements have been addressed.

Keywords: Non-Destructive Testing, Rail Defects, Automated inspection.

1. Introduction

Railroads conduct regular inspections of their track in order to maintain safe and efficient operation. In this way periodical surface inspection of rolling plane including detection of defects relating to the ties, fasteners, rail, special track work and ballast section is required [1].

As part of the Rail Defect Management (RDM) scheme, the rail industry has employed rail-failure reporting and archiving to monitor the occurrence of rail failures in the network over time. Rail-failure reports contain some useful data and provides information with regards to the location where the rail failure took place, the type of damage, route, date of discovery, track, and type of rail [2]. Hence these reports can be used to build a general statistical picture of the occurrence of rail failures, their causative factors and their frequency within the rail network. Established upon network usage, defect occurrence and rail failure statistics it is possible to adjust the inspection and maintenance schedules, prioritizing certain parts of the rail network over others, in order to achieve increased efficiency in the allocation of effort and available resources [2].

Currently, most of these inspections are manual and are managed visually by railroad track inspectors. Usually, the maintenance of the railway plane is done by trained personnel who periodically monitors the images recorded by a TV camera installed on a moving train. In fact, this manual inspection is lengthy, laborious and potentially hazardous and the results strictly depend on the capability of the observer to capture possible anomalies and identify critical situations [3].

In addition to aforementioned fact, the importance of high quality data for track condition monitoring has led to development of new technologies for data collection and defect analysis. In-service rails are systematically inspected for internal and surface defects, using various NDT techniques, including ultrasonic, magnetic induction (or magnetic flux leakage, MFL), eddy current sensing and visual inspection [2]. Interim approaches to automated track inspection are also possible, which have the potential to improve inspection effectiveness and efficiency.

This paper demonstrates an overview of innovative systems for condition monitoring applications currently in use or under development for the inspection of railway track components. Automatization of the inspection tasks has been developed connected to different technologies (cameras, sensors, computer processers, etc.) to best match the needs of the railway industry and improve safety, planning, and maintenance strategies. These technologies, in conjunction with defect analysis and comparison with historical data, will enhance longer-term predictive health assessment of the track system and its components, more informed and proactive maintenance strategies, and improved understanding of track