Long Term Monitoring of Millau Viaduct

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Abstract

Millau Viaduct is a multi-span bridge located in the south of France which holds several world records : including longest cable stayed-bridge (2460 m) and tallest pier (245m). For megastructure like Millau Viaduct, performance monitoring is mandatory to guarantee the safety of users and optimize maintenance costs. Practically speaking, this is achieved through the continuous monitoring and the estimation of damage sensitive features extracted from static and dynamic measurements. This paper focuses on data analysis strategies carried out to extract these damage sensitive features. Regarding static measurements, operational and environmental effects are removed using iterative multilinear-regressions to reveal long term variations. The proposed approach is able to detect very light changes in piers tilt or in expansion joint movement. When dealing with dynamic measurements, natural frequencies are automatically identified through the method of frequency domain decomposition. The goal is to quantify their sensitivity to structural changes over a monitoring period of ten years. The study shows that once temperature effect is removed using regression methods, decrease of transversal frequencies is revealed which might be compatible with piers creeping.

Keywords: SHM, bridge, dynamic, modal analysis, damage detection, regression

1 Introduction

The aim of monitoring system installed on Millau viaduct is to ensure that the bridge maintain its high level of performances for at least 120 years [1]. Indeed, structure behavior can be altered due to material ageing, accidental events or equipment alterations. To achieve this goal, it is necessary to produce performance indicators able to detect early damage. In most of the cases, damage indicators are the result of data fusion between various sources of information, such as static measurements (strain, tilt, and displacement), dynamic recording (accelerations) and less frequently visual inspections. They all have to represent the structure current state.

Unlike mechanical systems, major civil structures are unique and are subject to severe environmental and operational conditions. In the case of the Millau viaduct, temperature variations

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