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DYNAMIC STRUCTURAL HEALTH MONITORING OF A TRANSMISSION TOWER USING INTERFEROMETRIC RADAR

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ABSTRACT

This work presents an application of an interferometric radar to evaluate the dynamic characteristics of a Lattice Transmission Tower case study in Portugal. The paper describes the main techniques of the radar equipment and its technical characteristic. A comprehensive description of the experimental procedures for the investigated case study is given. The results of the radar data analysis and the identification of dynamic characteristics of the transmission tower are also addressed.

The main results of dynamic monitoring serve as an input to calibrate a numerical model (frequency manual tuning) of a lattice transmission tower and thus improve the actual structure behaviour knowledge for posterior performance assessment.

Keywords: radar, remote sensing, interferometry, structural health monitoring, lattice transmission tower

INTRODUCTION

Structural health monitoring can have a huge contribution to the mitigation/reduction of possible structural failure and consequence social-economic losses. One of the possible techniques used at the present to evaluate to dynamic behavior of structures is ambient vibration analysis.

Ambient vibration test (AVT) have significant benefits for large scale structures where it is difficult to provide the significant level of input force required to carry out a realistic forced vibration test (Ivanovic, 2000). Therefore AVT can be very useful to acquire more knowledge of the structure under study (dynamic behavior, damage detection) and can help in developing structural models for use in performance-based engineering. In this particular case the purpose is to gather more information about the dynamic behavior of the structure through the utilization of remote sensing (non-contact) technique a radar-based microwave interferometer (Pieraccini, 2007).

Lattice transmission tower are one of the most common solution to support overhead power lines. Even nowadays transmission towers are a very complex structure to accurate analyze, due to complicated loading condition (extreme winds, earthquakes) and the diverse sources of non-linearities that exist at the system behavior level (Lu, 2016).

CONCLUSIONS

This study shows some of the main difficulties encounter during the dynamic investigation of the transmission tower. The high density of members of an ordinary lattice tower is one of the

main issues in the interpretation of results of the radar data. Nevertheless the first frequencies of the system tower-conductor were identified which allow then to manual calibrate the numerical model developed for this case study.

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