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Dynamic Identification for Representative Building Typologies: Three Case Studies from Bucharest Area

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Abstract

The paper presents results from an experimental program implemented for three representative buildings in Bucharest metropolitan area and aimed to explore the potential of various dynamic identification methods in providing information about building state changes. The objective is to establish reference values of potential use in rapid earthquake damage detection systems. Each of the selected buildings was designed according to a different seismic code, in force at the time of its construction. The methods employed for this study were: the analysis of Fourier spectra, the analysis of the transfer function and the random decrement technique. To validate the results, the fundamental periods of vibration determined experimentally were compared with the corresponding values predicted by the empirical formulas specified in the corresponding editions of the Romanian seismic code. The results revealed consistent values for both the fundamental period and the damping ratio of the buildings. However, small variations of the two parameters were identified, depending on the time the recordings were performed, noise sources and levels and building occupancy. The results, in terms of validated data on the dynamic characteristics of Romanian building stock and of assessment of methods performance, add up to the information pool needed for the development of countrywide pre- and post-earthquake assisted decision tools.

Keywords: Ambient Vibrations; Reinforced Concrete Buildings; Dynamic Parameters.

1. Introduction

Vibration monitoring of buildings represents an important source of information about their state, in terms of material degradation, structural changes or damage [1, 2]. With the advancement of vibration recording instruments, data transmission technologies and numerical methods for dynamic characteristics identification, more and more applications have been implemented, from structural health monitoring of critical infrastructures to decision support systems for natural hazards mitigation in urban areas. The technique is of particular interest for earthquake-prone areas, case in which monitoring is performed for low-amplitude vibrations, as ambient vibrations, as well as for seismic ground motions. The basic idea of ambient vibration monitoring is to rapidly detect changes in the building's dynamic characteristics (natural periods, damping) and to reliably relate these changes to potential damage or degradation. The advantages of the method are its simplicity and the relatively low costs of its application. From the practical point of view, the time required by the deployment of a building instrumentation system for vibration

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