IABSE Symposium 2019 Guimarães
Towards a Resilient Built Environment - Risk and Asset Management
March 27-29, 2019, Guimarães, Portugal

Finite Element Model Updating of a Grandstand as Basis to Assess its Vibration Serviceability Limit State

Javier Naranjo-Pérez, Andrés Sáez

Department of Continuum Mechanics and Structural Analysis, Universidad de Sevilla, Seville, Spain

Javier F Jiménez-Alonso

Department of Building Structures and Geotechnical Engineering, Universidad de Sevilla, Seville, Spain

Nicolás González-Gómez, Felipe García-Sánchez

Department of Civil Engineering, Materials and Manufacturing, Universidad de Málaga, Malaga, Spain

Contacting author: jnaranjo3@us.es

Abstract

The performance of the finite element (FE) model updating technique is validated in this work via the evaluation of the vibration serviceability limit state of a real stadium grandstand. This type of structures can suffer from vibration phenomena due to the dynamic action of spectators. As benchmark structure, grandstand of the University of Malaga stadium is considered. To simulate the action of the spectators, body units were numerically implemented. A preliminary FE model of the grandstand was built and then the updating process was conducted based on the modal parameters experimentally identified. The maximum deck acceleration given for the two different FE models, preliminary and updated, is compared. As result, a relative difference around 19% is obtained. It can be concluded that the updated FE model represents more accurately the structural response of the grandstand.

Keywords: model updating; stadium grandstand; vibration; spectator-structure interaction.

1. Introduction

Minimizing the differences between the numerical response and the actual response of the structure has been an objective for researchers in recent years. The model updating technique [1] arises as the main tool to overcome this issue. The updating process is based on iteratively modifying some uncertain physical parameters of the model until it finds those associated with the minimum difference between the numerical and experimental results. The use of this technique is validated in this study through the assessment of vibration serviceability limit state for two different models: the preliminary and the updated model of a real stadium grandstand. These structures are susceptible to high vibrations induced by the crowd action of the spectators [2]. In addition, the

https://doi.org/10.2749/guimaraes.2019.0745
Distributed by structurae