FINITE-ELEMENT UPDATING OF THE UNIVERSITY OF EXETER FORUM WALKWAY

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ABSTRACT

This paper presents the finite element (FE) model updating of a walkway, part of the University of Exeter's Forum building. The walkway is a relatively slender structure with natural frequencies in the range that can be excited by human induced vibrations. Whilst this particular structure is not problematic, many similar structures have exhibited problems regarding their vibration serviceability.

It is often difficult for designers to model and predict the as-built modal properties of such structures with an adequate degree of precision. Thus updating of their FE models is highly instructive for situations like this one. The aim of this paper is to assess the ability to predict accurately the modal properties of this particular structure and to correlate and update the initial FE model with experimental results. The initial model is made based on technical drawings and on the best engineering judgement. Comparing however, the natural frequencies and mode shapes of the FE model with experimental results, it can be seen that the model needs to be updated to match the real structural properties (natural frequencies and mode shapes) as accurately as possible.

Examining the experimental results, it was seen that two of the modes involved a significant amount of movement at the supports which was not properly represented by the initial FE model. The uncertain parameters that affected the response most were found by using a sensitivity analysis. The main parameter that affected the modal response of the structure was found to be the support conditions. Manual updating was then performed and the natural frequencies along with the mode shapes of the updated model were compared and correlated with their measured counterparts. After the updating, a FE model was obtained where the four first vibration modes were successfully updated. The obtained updated properties are by no means a unique solution. They lead however to a reasonable model of the walkway which more accurately represents its modal properties.

SUGGESTED THEMES

Walkway vibrations, Modal analysis, Finite element model updating