

Serviceability assessment of footbridges via interval analysis

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Keywords: *Footbridges; Human-induced vibration; Interval Analysis; Serviceability.*

Abstract

This paper studies serviceability assessment of footbridges through a non-deterministic approach. The propagation of uncertainties characterizing both pedestrian-induced loading and the structural dynamic properties has been recently studied adopting the Taylor series expansion technique (Tubino et al. 2020). Furthermore, assuming probability distributions of the uncertain parameters, the probability distribution of the mean value of the maximum acceleration has been estimated numerically.

Actually, possible ranges of variation of the loading and structural parameters are available rather than their probability distributions. Thus, a suitable tool for taking into account uncertainties is interval analysis (Muscolino and Sofi 2012). In this paper, starting from the analytical expression for the spectral moments of the structural response (Piccardo and Tubino 2012), the improved interval analysis is applied together with an optimization strategy that allows to obtain the bounds of the interval cumulative distribution function (Muscolino et al 2016) of the maximum footbridge acceleration. Based on this approach, an interval of probability of reaching a suitable comfort level is defined.

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