

# Monitoring of Induced Groundborne Vibrations in Cultural Heritage Buildings: Miscellaneous Errors and Aliasing through Integration and Filtering

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## Abstract

Cultural Heritage Buildings are considered highly complex, having evolved over time, and contain various heritage components. These assets are becoming increasingly at risk due to unprecedented transformation processes in cities, from underground railways. Experimental and monitoring strategies can serve as diagnostic tools on the effects of long-term exposure to induced vibrations, from this new source. The current work presents the Structural Health Monitoring (SHM) outcomes in the Church of the Angels (Igreja dos Anjos), a monument of the early 20th century, in Lisbon, Portugal, directly over a subway station, in a shallow railway line, subjected to groundborne vibration.

Criteria from international standards provide threshold values, mostly in terms of velocity, which are linearly related to stress and strain fields. Specific criteria for non-structural components are usually set, accounting among others, frequency bandwidths and levels of intermittency. Even if recommendations specify the velocity as a primary measurement, it is often needed to obtain velocity-time histories from acceleration data, as accelerometers are widely used in practice. Weak signal processing, low sampling frequencies, the type of integration in time or frequency domain and digital filtering, with incorrect cut-off frequency bandwidths, may lead to processed signals, distorted in terms of shape, phase and amplitude.

## Palabras clave

**Palabras clave de autor:** [Groundborne vibrations](#); [historical construction](#); [integration of kinetic quantities](#); [masonry structures](#); [signal processing](#); [structural health monitoring](#)

**KeyWords Plus:** [MASONRY](#); [MODEL](#); [IDENTIFICATION](#); [PALACE](#); [TOWER](#)

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