Satellite Interferometric Data and Perturbation Characteristics for Civil Structures at Nanohertz

Gaetano Miraglia[1][0000-0002-3611-0215], Erica Lenticchia[1][0000-0002-3746-2933], Mohamad Dabdoub[2][0000-0003-3303-9115] and Rosario Ceravolo[1][0000-0001-5880-8457]

[1] Polytechnic of Turin, Turin 10129, Italy
[2] Northeastern University, Boston (MA) 02115, USA
gaetano.miraglia@polito.it, erica.lenticchia@polito.it, dabdoub.m@northeastern.edu, rosario.ceravolo@polito.it

Abstract. Following the concept that *structures move because something causes their movement*, in the paper, the authors analyze interferometric satellite Line-of-Sight displacement acquired over the territory of Rome (Italy) during the period 2011-2019 from a spectral point of view. To obtain a comprehensive understanding of the behavior of civil structures in this unusual frequency bandwidth (~3-300 nHz), an in-depth analysis of the possible sources of perturbation is called into question.

To reach this goal, the difference in the vibration characteristics of measured Line-of-Sight displacements and spectral entropy is studied. The main environmental effects that could affect the built environment (e.g., temperature, rain, relative humidity, etc.) are also analyzed in terms of the power spectrum and spectral entropy. The main frequencies associated with both environmental data and remote displacements are highlighted, while for vibration frequencies in remote displacements that do not correlate with environmental actions, a preliminary analysis is performed. Finally, signal noise models are compared to understand their feasibility for input-output structural simulations at nanohertz frequency scales.

A more in-depth knowledge of the inputs of a system would allow to perform more significant virtual experiments or numerical predictions, also contemplating new sources of excitation for civil structures.

Keywords: Structural Health Monitoring, Interferometric Data, Perturbations, Nanohertz, Spectral Entropy.