



Experimental Verification of a Novel Accelerometer Intended for Structural Health Monitoring of Bridges

Syedmilad Komarizadehasl¹, Ahmad Alahmad¹, Jose A. Lozano-Galant², Victor Torralba³, Gonzalo Ramos¹ and Jose Turmo¹

¹Department of Civil and Environment Engineering, Universitat Politècnica de Catalunya, BarcelonaTech. C/ Jordi Girona 1-3, 08034, Barcelona, Spain

Contact: milad.komary@upc.edu, ahmad.alahmad@estudiantat.upc.edu, gonzalo.ramos@upc.edu, jose.turmo@upc.edu

²Department of Civil Engineering, Universidad de Castilla-La Mancha. Av. Camilo Jose Cela s/n, Ciudad Real, 13071, Spain

Contact: Joseantonio.lozano@uclm.es

³Tunnel and Bridge Technologies, S.L., Calle Marqués de Mulhacén 11, 08034-Barcelona, Spain

Contact: victor.torralba@tbtechno.com

Abstract

Bridges can be considered one of the most critical infrastructures of any country. Subsequently, their health state assessment is of great importance. However, durable monitoring of bridges can be highly costly and time-consuming. In addition, the current Structural Health Monitoring applications are only applicable to individual structures with a high budget for their health assessment. For a long-term economic evaluation of bridges, low-cost sensors are currently being developed for SHM applications. However, their resolution and accuracy are not yet suitable for structural system identifications. For that, a novel accelerometer based on Arduino technology is introduced in this work. Experiments show that this accelerometer has a better resolution. Illustrated test results of this paper on a frequency range of 0.5 to 8 Hz validate the performance of the proposed accelerometer.

Keywords: low-cost sensors; arduino due; accuracy and sensibility; structural health monitoring; mpu9250.

1 Introduction

Civil structures and infrastructures could be considered as the main foundation of present modern society and, hence, their soundness is of utmost importance. However, the reports of ASCE infrastructure grades shows that in the United States: (1) 9.1% of all the bridges are not structurally efficient, (2) 188 million trips are taken every day over these deficient bridges, (3) The

average age of bridges is 43 years old [1]. Monitoring and evaluating the health state of these structures are required for the maintenance applications, for minimizing the reparation costs and, eventually, for guaranteeing infrastructure safety [2][3]. Structural Health Monitoring (SHM) applications provide information on the state of structures, their functioning and their structural response. As pointed out by many scholars (see, e.g. [4]), SHM can be used to calibrate structural models of real structures (digital twins) that mimic