Optical Structural Health Monitoring of the Frescoes in the Conegliano Cathedral, Italy

Filippo CASARIN
DICEA, Padova University, via Marzolo 9, Padova, Italy, filippo.casarin@dicea.unipd.it

Abstract

The Sala dei Battuti (Battuti Hall) in the Scuola dei Battuti, is located in the front part of the Conegliano cathedral, in north-eastern Italy, right above the arches facing the street. The Battuti were a self-flagellating, charitable lay brotherhood which took up residence in Conegliano. The present cathedral (duomo) started off as their church, only becoming the town's cathedral in the seventeenth century. The 'Sala dei Battuti' is a long space covered in colourful, and rather charming, Biblical frescoes, mostly by the painter Francesco da Milano (1511).

The frescoes of the Battuti Hall are subject to serious cracking likely due to differential settlements of the facade of the cathedral and of the adjoining structures, namely the massive bell-tower. In fact, as often happens, the structural connection between buildings and structures with different static and dynamic behaviour may lead to cracking due to interface shear forces. Furthermore, the dynamic effect could have been emphasized by the action of the bells, generating remarkable vibrations during their swinging movement.

Prior to the execution of repair works in the wooden roof of the hall, due by summer-autumn 2012, the Head Office for the Cultural and Landscape Heritage of the Veneto Region decided to monitor the already visible cracks in the frescoes – before and during the structural intervention - in order to avoid any possible disturbance caused by the works to the frescoes, by stopping or calibrating the activities if any sign of cracks widening was noticed during the works execution.

Besides monitoring the main cracks by means of “traditional” electronic linear potentiometric displacement transducers – in areas where the connection between these and the walls was possible by the absence of frescoed surfaces - it was adopted an innovative optical monitoring device, composed by a 2 MPixel camera installed facing the main reported crack, right in the Battuti Hall, where the use of traditional methodologies was forbidden due to the presence of frescoes. The challenge was the evaluation of the effectiveness of such SHM methodology in appraising very reduced displacements, in the range of the 1/100th of mm, as traditional sensors do.

The paper describes the SHM system with a specific focus on the optical acquisition system, comparing the results of this last with the outcomes of the more traditional linear potentiometric displacement transducers.