Survey and testing through interferometric radar: applications to Cultural Heritage and public utilities

Massimiliano Pieraccini
Department of Electronics and Telecommunications
University of Florence, Via Santa Marta, 3 50139 Firenze, Italy
massimiliano.pieraccini@unifi.it

The static and dynamic characterization of architectonic structures is of paramount importance, in particular when they are part of the Cultural Heritage, in order to survey their conservation status, and possibly to plan maintenance or remedial works.
The conventional monitoring tools of structural displacements of buildings are represented by a variety of techniques, such as those based on networks of optical targets installed over the structure, strain gauges to detect deformations, collimation nets to detect displacements, inclinometers to measure rotations. Such sensors are accurate and reliable, but require to be in contact with the structure to be surveyed, and information is localized to the specific point where the sensor is positioned. Settling the optimal sensor placement is a common problem encountered in many engineering applications and is a critical issue in the implementation of effective structural health monitoring. Furthermore, the monitoring of large structures can give rise to accessibility problems, often requiring the use of costly and cumbersome scaffolding. In a number of situations, the placing of contact sensors may be not possible; this is the case, for example, in buildings with symptoms of impending collapse after a seismic shock or a blast. The capability of performing in-service monitoring is a key requirement for planning survey campaign aimed at the early identification of structural problems in order to enable low-cost maintenance remedial actions to be taken.
In the last years the research group of the author has developed portable high speed radar systems able to perform both static and dynamic testing of large structures, as bridges, bell-towers, buildings, dams, wind towers..
These systems operate at distance, without installation of sensors on the structure, that can be kept in-service during the measurements. Because its high rate acquisition (up to 100HZ) and its long term stability it is able to perform both dynamic testing and static, by providing information about natural frequencies, modal shapes, elasticity, long term deformation, ..
In this presentation the author will review the working principle, it will report several examples of applications, and finally it will discuss potential and limits of this novel technique.

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