

COHERENT RADAR FOR MEASURING DYNAMIC AND STATIC DEFORMATIONS OF ARCHITECTURAL STRUCTURES

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Abstract: Measurements of static and dynamic deformations of civil engineering constructions such as buildings, bridges and towers is of paramount importance for structural testing before service, or for early identification of structural problems and to enable remedial actions to be taken.

Static and dynamic testing is currently implemented by contact sensors, such as networks of piezoelectric accelerometers or optical targets installed over the structure. Such sensors are accurate and reliable but need to be positioned in contact with the surveyed structure. They also provide information which is limited to the specific point of the sensor position, thus inhibiting the possibility of obtaining a continuous global map of the structure vibration. Monitoring of large structures can give rise to accessibility problems, as it requires expensive scaffolding and a network for transmission of data to a remote collection station. Moreover, in a number of situations, 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, a blast, or intentional damage. In such cases, remote sensing techniques able to scan the structure from a safe distance are required.

An interferometric radar has been recently proposed by the authors to image deformation maps of static displacements of a variety of structures, such as bridges and buildings.

In this paper, the authors present the technique and the instrument with particular emphasis to the applications. In particular, a number of cases study will be presented: a steel bridge forced by vehicular traffic, the static test of a railway bridge, the monitoring of two historic bell-towers belonging to the architectural Heritage of Florence town.