

Remote Monitoring Of Bridge Displacement With Sar Data From Different Satellite Missions

Daniel TONELLI, Valeria F. CASPANI, Daniele ZONTA

Several hundred satellites are monitoring our planet every day and some carry synthetic aperture radar (SAR) sensors that provide high-resolution weather-independent imagery of the Earth. In the last two decades, SAR technology have been increasingly used to monitor remotely large-scale phenomena such as subsidence, uplifting, or landslides. The idea is to take several images of the area of interest at different times and to analyze them with advanced processing techniques such as interferometric SAR (InSAR) to measure millimeter-level motion of the ground. Recently, several studies started to investigate the use of remote sensing for civil infrastructures control. In principle, this technique allows monitoring an infrastructure network without installing any traditional sensors on site; however, its implementation for civil applications is still at its early stage and only a limited number of case studies have been reported in the literature. Our goal is to investigate the feasibility of using SAR data for structural health monitoring of bridges with reference to some case studies over the Po River in the northern Italy. Data provided by different Satellite Missions (COSMO-SkyMed, Sentinel 1A) with radar sensors characterized by different spatial and temporal resolutions and by different frequency bands are processed. The PSInSAR technique is used to extract displacement time histories of bridges components by using open-source routines from the Sentinel Application Platform (SNAP) and Stanford Method for Persistent Scatterers (StaMPS). Vertical and East-West horizontal components of the mean displacement vectors are calculated for portions of bridges decks. Results show that high-resolution SAR data detect millimetric structural displacements, which might result from environmental changes, such as the Po River water flow rates and the air temperature variation.