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AN INTERGRATED APPROACH FOR MONITORING SOIL SETTLEMENTS AT THE VIRGO SITE

The Virgo detector, currently in its 2nd generation configuration "Advanced Virgo", is a Michelson interferometer aimed at the gravitational waves research and at opening a new window on the study of the Universe. It is made of two orthogonal arms being each 3 kilometers long and is located at the site of the European Gravitational Observatory (EGO), in the countryside near Pisa, Italy.
Over the years a steady subsidence process has been observed as a consequence of the building and embankment overloads. In consideration of the subsoil characteristics, the evolution of settlements was expected and properly considered for the design of the civil engineering infrastructures, so that the vacuum tubes can be readjusted to keep the original alignment. However, along 20 years of time life, the initial estimates of the expected displacements were continuously compared with the observed effects. The measured settlements have been regularly monitored and adopted for implementing the necessary realignment activities.
This paper reports the monitoring activities conducted over the years, mainly consisting of regular high accuracy levelling measurement campaigns, periodically integrated by GPS and classical theodolite measurements. These sets of measurements allowed to perform the Virgo realignment procedure (finalized to keep the interferometer rigidly tied in a 3x3km plane) and required displacements reduced in a relative reference system with respect to the optical center of the interferometer, located in the Central Building.
In order to improve the understanding on the on-going settlements process, the evaluation of the deformation pattern based on satellite interferometer techniques using Synthetic Aperture Radar (SAR) data has been performed and compared with the outcome from in-situ data.

Summary

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