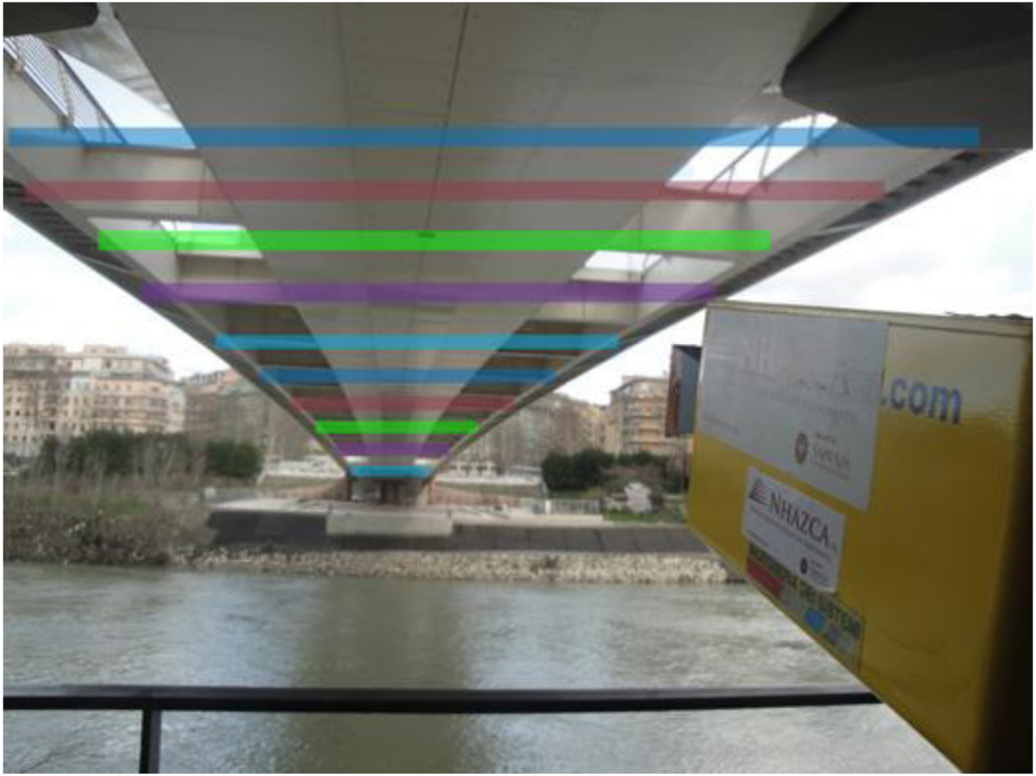

.com
NHAZCA

Integrating Contact and Remote Sensing Techniques For Quick Recognition Of Bridge Dynamic Behaviour

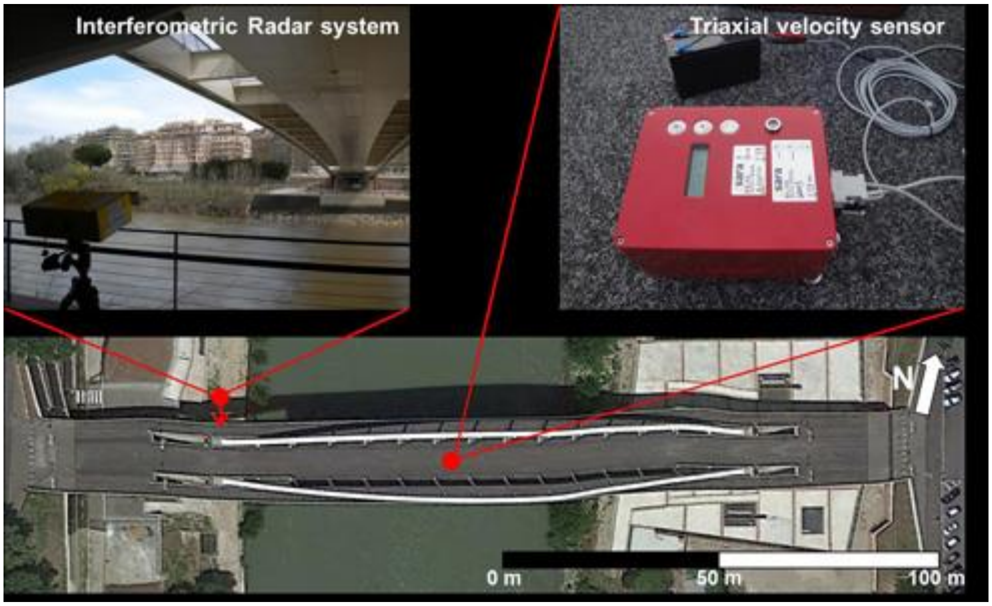
Paolo Mazzanti, Ph.D. and Alessandro Brunetti, Ph.D., NHAZCA S.r.l., spin-off "Sapienza" University of Rome
Eng. Giacomo Buffarini and Eng. Giovanni Bongiovanni, ENEA UTPRA Natural Risk Prevention and Effect Mitigation

The application of remote sensing techniques for Structural Health Monitoring purposes is gaining more and more interest in the scientific community. Remote techniques allow undisputable advantages to be achieved with respect to conventional contact monitoring systems, such as operational safety and quick data collection.

Here, we present the results achieved through an experimental activity performed by NHAZCA S.r.l. (spin-off company of "Sapienza" University of Rome), in collaboration with ENEA (Italian National Agency for new technologies, energy and sustainable economic development) for the fast dynamic characterization of "Ponte della Musica," a pedestrian bridge across the Tiber River in Rome.

To this goal, the project used a coherent interferometric radar system (IBIS-S by IDS S.p.A.) that is able to collect high frequency (up to 200 Hz) and highly accurate (up to 0.01 mm) displacement data along the instrumental line of sight with a spatial resolution of 0.5 m and the SARA SS20 triaxial velocity sensor.

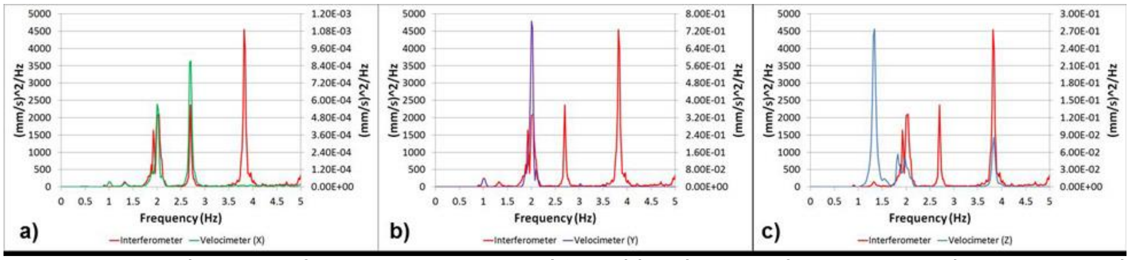
The IBIS-S system was installed on a tripod beneath the deck of the bridge, allowing an overall view of the structure and the simultaneous monitoring of a large number of points. Figure 1 (photo above) shows the acquisition scheme of the interferometric radar system and the monitored deck, while the SARA SS220 system, installed above the bridge in the central part of the deck, is shown in Figure 2. The sensors simultaneously started collecting data at 100 Hz sampling frequency for 15 minutes.



Survey configuration (Figure 2)

By using suitable data processing, information on the frequency spectra of the bridge was collected from both systems. Specifically, 3 frequency spectra (along the x, y and z axis of the bridge) was achieved by the triaxial velocity sensor, while a single spectrum was collected by the interferometric radar system (as data were collected along the line of sight by a unique surveying position).

By using the pick picking method (Peeters and Ventura, 2003), the resonance frequencies identified by the two techniques were compared (Figure 3).



Comparison between frequency spectra achieved by the interferometric radar system and the velocity sensor along the x direction (a), y direction (b) and z direction (c) (Figure 3).

The main resonance frequencies were cross-checked using the two surveying techniques. However, the interferometric data do not discriminate between the three components of the vibration. At the same time, the high spatial resolution of the interferometric sensor allowed for accurate static and dynamic widespread information to be simultaneously achieved on a large number of points.

By using a combination of the two techniques, the main resonance frequencies in the three spatial directions were identified in only 15 minutes, demonstrating the efficacy for quick dynamic inspections.

For further information, please contact Dr. Paolo Mazzanti and Dr. Alessandro Brunetti at info@nhazca.com or Mr. Giacomo Buffarini at giacomo.buffarini@enea.it or Mr. Giovanni Bongiovanni at giovanni.bongiovanni@enea.it.

References

Peeters B., Ventura C. E., 2003. *Comparative study of modal analysis techniques for bridge dynamic characteristics*. Mech. Syst. Signal Process. 17 965–88.