S2X SRL

S2 SHM

Software Solution

Structural Health Monitoring

Structural Monitoring at hand
Static, dynamic and seismic monitoring in one software

Fully Automated OMA
To monitor the evolution of natural frequencies, mode shapes and damping ratios

Axial Load
Indirect monitoring by vibration measurements

Monitoring Statistics
Natural frequencies, damping ratios, vibration amplitude

Anomaly Detection
Compensation of environmental effects, control charts

Designed for the final user
Alerts, animated plots, interoperable

www.s2x.it

BRIDGE MONITORING

TAKE INFORMED DECISIONS BASED ON SHM DATA

S2-SHM is the software which can support the optimization of bridge inspections and maintenance by taking informed decision based on structural monitoring data.

S2-SHM makes data processing very easy: it allows remote control of the state of the structure based on measured data while requiring minimum user's interaction.

S2-SHM supports remote anomaly detection from global response parameter monitoring.
It carries out automatic Operational Modal Analysis (OMA) and provides well-established tools for anomaly detection and compensation of environmental and operational effects. This type of monitoring is especially suitable for global check of the health and performance of the monitored structure.

DYNAMIC MONITORING

S2-SHM supports remote control of local response parameters of the monitored structure, offering advanced data processing tools and setting of alarm thresholds. This type of monitoring is especially suitable for remote control of local damage features as well as for getting information about the evolution of known damage over time.

STATIC MONITORING

Vibration-based Monitoring

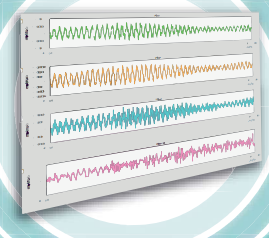
Heterogeneous data

Data from a variety of sensors (accelerometers, strain gauges, tiltmeters, displacement transducers, microphones, temperature sensors, and so on) can be analyzed

Seismic Monitoring

Monitored Structure

Measurement system



Cloud

Data can be stored locally, or remotely (on cloud or database) for scalability and durability purposes

Vibration Monitoring

Static Monitoring

THE BENEFITS OF OUR SHM SOFTWARE SOLUTION

- Effective and reliable automated modal parameter monitoring
- Complete toolset for compensation of environmental effects and anomaly detection
- Continuous vibration-based monitoring of axial force in cables and tie-rods
- Remote notification of alarms when damage thresholds are exceeded
- Static, dynamic and seismic monitoring in a single interoperable software

Continous Data Processing

Data are continously processed by a registered software for automatic modal parameter estimation

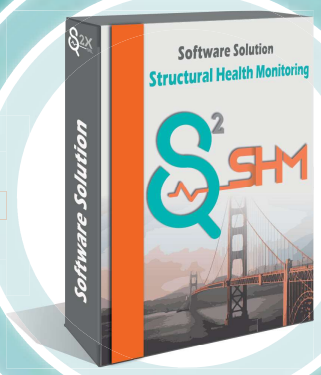
Warnings

The monitoring system sends alerts to remote users in the case of anomalies

3D plot animation

3D animation of the monitored structure

Data processing



Remote surveillance

Remote Connection

Data can be made available to remote platforms and devices (GIS, web-GIS, web-pages, tablet, ...)

Axial load

Continuous monitoring of axial loads from vibration measurements

Anomaly detection

After removal of environmental and operational effects on damage sensitive features

AUTOMATED MODAL PARAMETER ESTIMATION

S2-SHM exploits a proprietary algorithm, fully validated in the context of academic research, to automatically process ambient vibration measurements and return the time series of the modal properties of the structure (natural frequencies, damping ratios and mode shapes) for Structural Health Monitoring purposes.

AUTOMATED OMA

Continuous monitoring of modal parameters (natural frequencies, damping ratios, mode shapes), interactive and animated plots.

STATISTICAL PATTERN RECOGNITION AND ANOMALY DETECTION

Including tools for compensation of the influence of environmental/operational variables, alarm thresholds.

AXIAL LOAD MONITORING

Continuous vibration-based monitoring of the axial force in stay cables or tie-rods.

RECENT PUBLICATIONS INVOLVING OUR SOFTWARE SOLUTIONS

- Sun Q., Rainieri C., Ren W.X., Yan W.J., Fabbrocino G. (2023). Automated operational modal analysis of bell towers subjected to narrowband input. Structures, Vol. 54, pp. 78–88.
- Celano T., Ceroni F., Fabbrocino G., Rainieri C., Casapulla C. (2022). Thermographic investigations and dynamic identification tests for non-destructive structural assessment and enhanced FE modelling of a historical iron-strengthened masonry church. Journal of Civil Structural Health Monitoring.
- Lubrano Lobianco A., Del Zoppo M., Rainieri C., Fabbrocino G., Di Ludovico M. (2023). Damage Estimation of Full-Scale Infilled RC Frames under Pseudo-Dynamic Excitation by Means of Output-Only Modal Identification. Buildings 2023, 13, 948.
- Notarangelo M.A., Gargaro D., Sandoli A., Fabbrocino G., Prota A., Cosenza E., Manfredi G., Rainieri C. (2023). Monitoring the vibration response of the School of Engineering Main Building at University of Naples “Federico II” to an “earthquake of joy”. Proceedings of The 10th International Conference on Experimental Vibration Analysis for Civil Engineering Structures EVACES 2023, Milan, Italy.

SAMPLE APPLICATIONS

HISTORICAL STRUCTURES

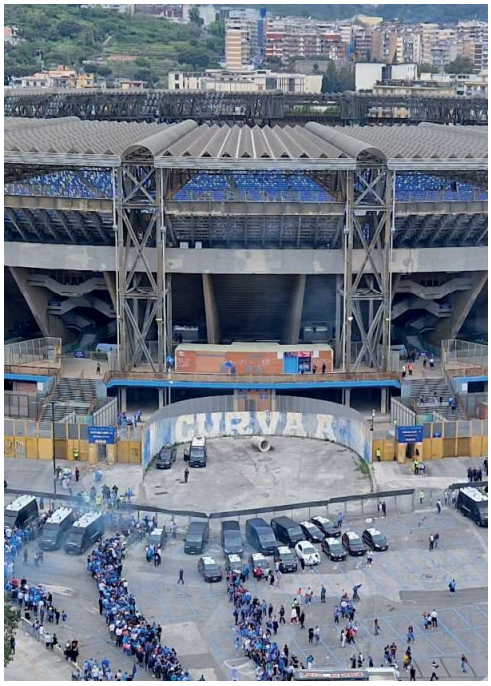
Modal parameter monitoring for detection of damage or degradation phenomena in operational conditions and after seismic events.

STAY CABLES AND TIE-RODS

Continuous vibration-based monitoring of the axial load in stay cables (bridges and special structures) or tie-rods (historical structures).

STADIUMS

Continuous monitoring of the vibration response for functional as well as safety checks.

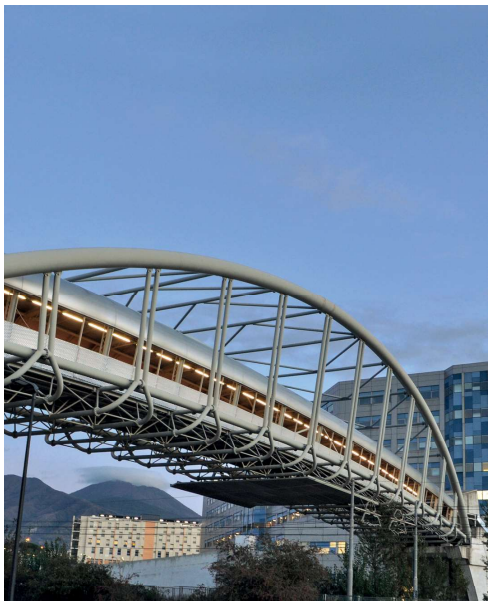


HOSPITALS AND OTHER STRATEGIC STRUCTURES

Remote control of the health state of the structure in the early earthquake aftershock for emergency management support.

PEDESTRIAN BRIDGES

Remote control of vibration levels, structural health monitoring based on the analysis of time variations of selected damage sensitive features.



NON-STRUCTURAL ELEMENTS

Remote functional and safety checks of either displacement-sensitive or acceleration-sensitive non-structural elements.

S2X® SRL

SCAN ME

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