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S2SHM

Software Solution

Structural Health Monitoring

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The complete platform for dynamic, static and seismic monitoring



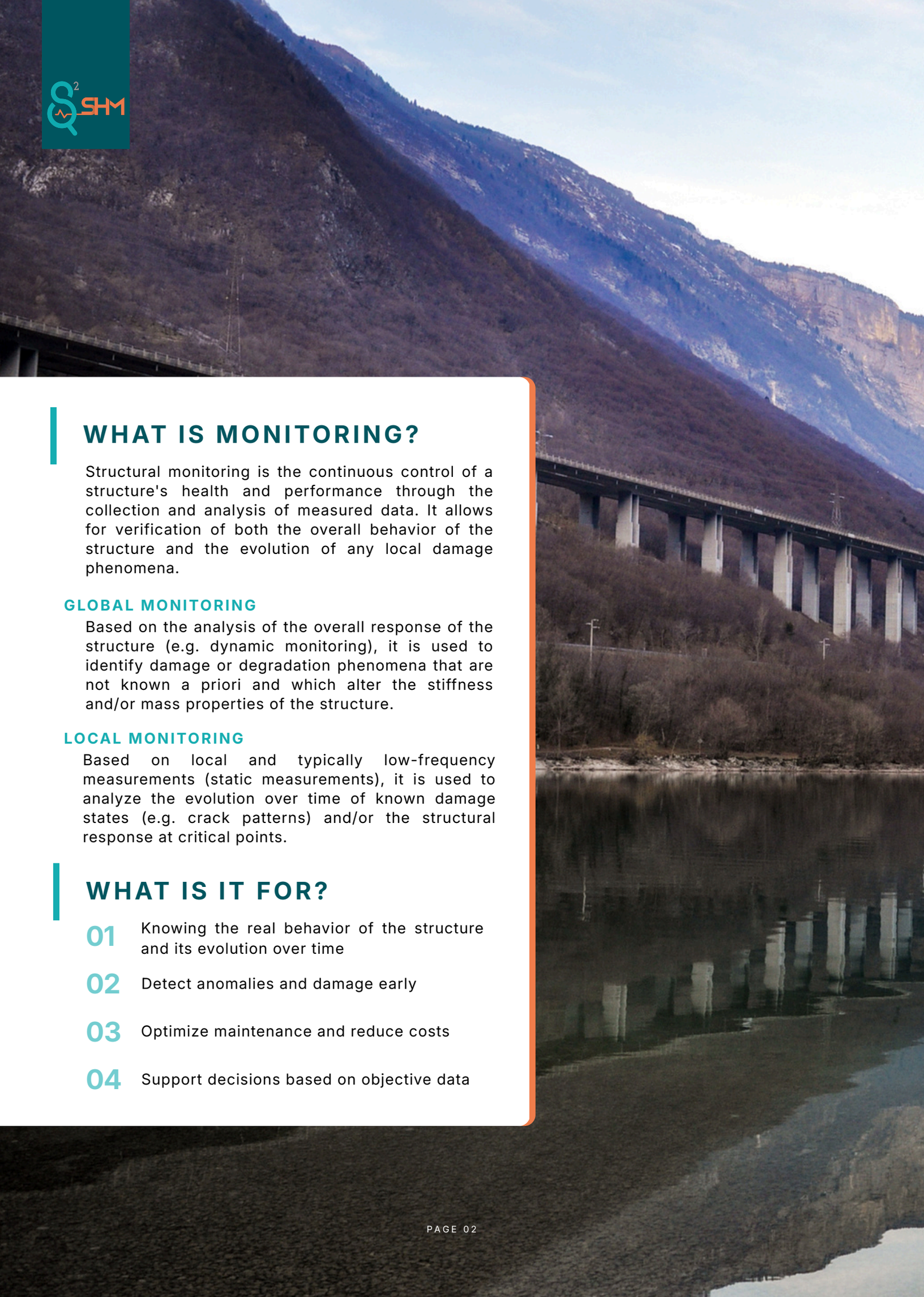
100%
MADE IN ITALY



NATIVELY
INTEROPERABLE



STANDARD
COMPLIANT



WHAT IS MONITORING?

Structural monitoring is the continuous control of a structure's health and performance through the collection and analysis of measured data. It allows for verification of both the overall behavior of the structure and the evolution of any local damage phenomena.

GLOBAL MONITORING

Based on the analysis of the overall response of the structure (e.g. dynamic monitoring), it is used to identify damage or degradation phenomena that are not known a priori and which alter the stiffness and/or mass properties of the structure.

LOCAL MONITORING

Based on local and typically low-frequency measurements (static measurements), it is used to analyze the evolution over time of known damage states (e.g. crack patterns) and/or the structural response at critical points.

WHAT IS IT FOR?

01 Knowing the real behavior of the structure and its evolution over time

02 Detect anomalies and damage early

03 Optimize maintenance and reduce costs

04 Support decisions based on objective data



WHY S2-SHM?

S2-SHM is one of the few commercial software packages that offers a robust automated OMA procedure validated in academic research, along with cutting-edge tools for compensating for environmental and/or operational influences and for anomaly detection. Furthermore, the software can alert remote users of detected anomalies. As a result, S2-SHM is a leading software package for effective and comprehensive data-driven structural health monitoring.

100% MADE IN ITALY

S2-SHM is a software developed entirely in Italy, the result of skills and technologies in the field of structural monitoring.

STANDARD COMPLIANT

The software operates in line with the indications given in the "Guidelines for the Classification and Management of Risk, Safety Assessment and Monitoring of Existing Bridges" issued by the Ministry of Infrastructure and Transport - Superior Council of Public Works.

USER-FRIENDLY

The S2-SHM is designed to make data processing very easy, allowing remote control of the state of the structure based on measured data while requiring minimum user's interaction.

DYNAMIC MONITORING

STATIC MONITORING

HETEROGENEOUS DATA

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

CLOUD

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

CONTINUOUS DATA PROCESSING

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

AUTOMATIC CLEANING

Data clustering for higher data series quality.

ENVIRONMENTAL EFFECTS

Compensation for the effects of operating environmental variables.

SEISMIC MONITORING

AXIAL LOAD

THE ADVANTAGES OF THE SOFTWARE

01 Automatic and effective monitoring of modal parameters

02 Comprehensive tools for environmental compensation and anomaly detection

03 Continuous vibration-based monitoring of the axial forse in stay cables or tie-roads.

04 Remote notification of alarms when damage thresholds are exceeded

05 Static, dynamic and seismic monitoring in a single interoperable software

CONTROL DASHBOARD

Continuously updated summary panel.

ANOMALY DETECTION

Attention and critical thresholds for anomaly detection.

ANIMATED 3D MODEL

3D animation of the monitored structure.

WARNINGS

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

MAIN FEATURES



AUTOMATED OMA

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



STATISTICAL PATTERN RECOGNITION

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



AXIAL LOAD MONITORING

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

DATA FORMAT

You can upload data from most common file formats:

(*.tdms, *.lvm, *.csv, *.txt, *.dxd)

AUTOMATIC BASELINE

AI-assisted selection of references for modal parameter tracking.



ANOMALIES DETECTION

Multiple alarm thresholds definable by the user or automatically on a statistical basis.



MANAGEMENT DASHBOARD

All your monitoring system information in one view.



TECHNICAL ASSISTANCE AND UPDATES

Technical assistance is available in Italian and English, via phone, e-mail or video call. Technical assistance and updates for one year are included for all licenses. Video tutorials are also available on the S2X YouTube channel.

APPLICATION EXAMPLES



PEDESTRIAN BRIDGES

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



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).



HISTORICAL STRUCTURES

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

RECENT PUBLICATIONS

- 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.
- 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.

HOSPITALS AND OTHER STRATEGIC STRUCTURES

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



NON-STRUCTURAL ELEMENTS

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



STADIUMS

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



RECENT PUBLICATIONS

- 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.

TECHNICAL DETAILS

License type	BASE	ADVANCED
Uploading data files		
Automatic data reading from files of various formats (.tdms, .txt, .csv, .lvm, .dxd)	✓	✓
Geometry		
3D model drawing	–	✓
3D model import from .dxf file	–	✓
Animated modal shapes	–	✓
General Settings		
Analysis timing	✓	✓
Definition of subprojects	✓	✓
Decimation	–	✓
Data filtering	–	✓
Data analysis		
Static data analysis	✓	✓
Automatic OMA	–	✓
Vibration-based axial load monitoring	–	✓
Automatic baseline	–	✓
Anomaly detection		
Threshold setting	✓	✓
Compensation for environmental effects	✓	✓
Data-driven models	✓	✓

License type	BASE	ADVANCED
Anomaly detection		
Control chart	✓	✓
Statistics	✓	✓
Remote warnings	✓	✓
Multiple analysis strategies	✓	✓
Management dashboard		
Customized control display	✓	✓
Customized time history display	✓	✓
Health status indicators	✓	✓
Sensor layout view	✓	✓

NATIVELY INTEROPERABLE

S2-SHM was designed and developed to be natively interoperable with other S2X software, including S2-VIB for vibration analysis and S2-DDA for data acquisition. It also supports the main data formats returned by commercial measurement systems.



S2X® SRL

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V.2_26_09