S²OMA

Software Solution
Operational Modal Analysis

WHY OMA?

ENHANCING THE KNOWLEDGE ABOUT THE DYNAMIC RESPONSE OF STRUCTURES UNDER OPERATIONAL CONDITIONS

Operational Modal Analysis (OMA) has several applications in civil engineering. The most common are:

· Validation and calibration of Finite Elements Models
· Identification of the possible causes of excessive vibrations
· Evaluation of the effectiveness of maintenance interventions
· Non-invasive estimation of tensile load in cables and/or tie-rods
· Damage identification

S2-OMA is a powerful and versatile software already compliant with the most recent standards and codes (DM 204/2022, UNI 10985, UNI/TR 11634, IOMAC Guidelines for OMA in civil engineering).

STANDARD COMPLIANT

S2-OMA is the first 100% made in Italy software specifically developed for the output-only modal analysis in the time as well as frequency domain.
The software is among the most complete of this type on the market, and it definitely holds the most diversified set of OMA methods: this makes S2-OMA a state-of-the-art software for OMA.

100% MADE IN ITALY

S2-OMA was designed and developed to be natively interoperable with other S2X software including: S2-SHM for Structural Health Monitoring and S2-DDA for data acquisition.
It also supports the main data formats commonly returned by other off-the-shelf measurement systems.

NATIVELY INTEROPERABLE

USER-FRIENDLY INTERFACE

An intuitive interface guides the user through the entire analysis process, from data loading to input of geometry and test report generation.

DATA FORMAT

The most common file formats (*.tdms, *.lvm, *.csv, *.txt, *.dxd) for data storage are supported.

IMPORT OF GEOMETRY

Quick input of structural model and test layout. Simplified import of models in .dxf format.

MULTI-LAYOUT ANALYSIS

Process multiple datasets and merge the mode shape vectors obtained from different tests.

OUTPUT-ONLY MODAL ANALYSIS

Well-established operational modal analysis procedures in the time as well as frequency domain are implemented in the software.
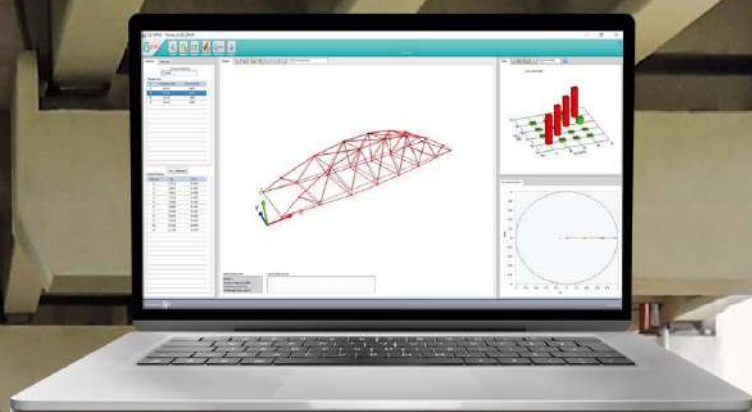
VISUALIZATION AND VALIDATION

State-of-the-art visualization and validation tools, such as animated mode shapes, MAC, AutoMAC, CrossMAC and Complexity Plots, are available

AUTOMATIC MODE PAIRING AND CORRELATION

The software includes tools for a very simple while effective mode pairing. They are particularly useful to evaluate the correlation with the results of FE models following an intuitive approach.

AUTOMATIC REPORT GENERATION

The software is able to automatically generate the test report in editable format. The content of the report is highly customizable.
The report is avilable in Italian and English.

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.

TECHNICAL FEATURES

Type of user license	BASE	INTERMEDIATE	ADVANCED
Data loading			
Data import from different file formats (.tdms, .txt, .csv, .lvm, .dxd)	✔	✔	✔
Geometry			
3D model drawing	✔	✔	✔
3D model import from .dxf file format	✔	✔	✔
Data processing			
Plot time series	✔	✔	✔
Data statistics	✔	✔	✔
Decimation	✔	✔	✔
Data filtering	✔	✔	✔
Data analysis			
Natural frequency estimation	✔	✔	✔
Damping ratio estimation	—	✔	✔
Mode shape estimation	✔	✔	✔
Non-parametric analysis in the frequency domain	✔	✔	✔
Power Spectral Density Matrix	—	✔	✔
Coherence functions	—	✔	✔
Non parametric analysis in the time domain	—	✔	✔
Parametric analysis in time domain	—	—	✔
Support of multi-layout tests	—	—	✔

Type of user license	BASE	INTERMEDIATE	ADVANCED
Validation			
Animated mode shapes	✓	✓	✓
User-selectable views of mode shape	✓	✓	✓
Complexity Plots	✓	✓	✓
AutoMAC	✓	✓	✓
CrossMAC	−	✓	✓
MAC with numerical mode shapes (FEM)	−	−	✓
Automatic mode pairing and correlation	−	−	✓
Report			
Results exported in text format (.txt)	✓	✓	✓
Automatic report generation in editable format (.docx) in IT and EN	−	−	✓
Export results to S2-VIEW	✓	✓	✓

RECENT PUBLICATIONS BASED ON OUR SOFTWARE

- Cieri L., Rosati I., Fabbrocino G., Rainieri C. (2022). OMA tests and setup of the modal based SHM system of the Civitacampomarano belfry. Proceedings of the 9th International Operational Modal Analysis Conference IOMAC 2022, Vancouver.
- Rainieri C., Cieri L., Fabbrocino G. (2023). Monitoring the modal parameters of a historical belfry in earthquake prone region. Proceedings of the 10th International Conference on Experimental Vibration Analysis for Civil Engineering Structures EVACES 2023, Milan, Italy.
- 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.

BRIDGES AND VIADUCTS

Modal analysis of bridges and viaducts also in multi-layout configuration.

CABLES AND TIE RODS

Identification of the fundamental modal parameters for the non-invasive estimation of the tensile load.

HISTORICAL STRUCTURES

Test results can be used for validation and calibration of numerical models, seismic vulnerability assessments, identification of the causes of excessive vibrations.

HOSPITAL AND STRATEGIC STRUCTURES

Evaluating possible dynamic interaction effects, supporting advanced numerical simulations.

PEDESTRAIN BRIDGES

Evaluation of possible vibration problems due to pedestrian-structure interaction.

WIND TURBINES

Identification of modal parameters in operating conditions and at rest.

VISUALIZE OMA RESULTS AND CORRELATE WITH FEM

S2-VIEW is an interactive viewer of the results of Operational Modal Analysis by the S2-OMA software.

Uploading test results in S2-VIEW gives the final user the opportunity to interact with information usually reported in print in the test report.

The user can visualize and interact with animated mode shapes, and evaluate the correlation among test results obtained by different OMA methods as well as the correlation between experimental and numerical modal properties. The latter can be directly uploaded by the user.

S2-VIEW can be downloaded for free.

INNOVATION IN TECHNOLOGY FOR CIVIL ENGINEERING AND STRUCTURAL SAFETY

S2X® SRL

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