

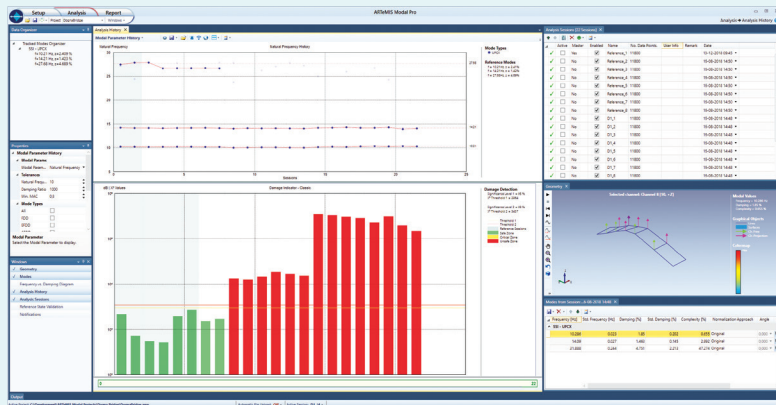


Structural Health Monitoring  
with ARTeMIS Modal

ARTeMIS Modal Pro has a series of plugin modules designed for Structural Health Monitoring purposes. All modules are designed to analyze and present the health of a monitored structure in various manners, and they all rely on the same common Data Manager Base module. This common module administrates the recorded measurement files as well as the results obtained during a periodic monitoring. Each recorded measurement file is uploaded into an Analysis Session that is the container for the measurements and the results

obtained from it. Historical presentation of the results is also made available in a Analysis History Task. It includes statistical values of the measured data as well as 3D visualization of all measurements in frequency domain using SVD.





### SHM of an Italian Highway Bridge

Damage detection of a bridge in Italy, that was measured before and after a damage occurred. There are eight reference measurements that are presented by the first eight green vertical bars in the diagram. The level of these bars shows the level of the damage indicators under normal conditions. From the first six measurements, a baseline (reference) model is determined by the module, and a threshold is automatically estimated based on the statistical evaluation of the damage indices of the six reference measurements. As seen, the last two reference measurements stay under the threshold which indicates that the bridge is still undamaged. The remaining 14 measurements are all acquired after the bridge experienced damage, and the associated damage indicators all pass the threshold significantly and indicate a permanent damage.

### Damage Detection Plugin

The Damage Detection Plugin consists of two damage detection algorithms developed for long-term monitoring of structures. The algorithms are robust to the natural change of a structure's dynamic behavior due to the changes of ambient conditions. The plugin also includes a Control Chart that can take a user-definable set of damage indicators as input and unify them to a single control value with corresponding statistical based threshold. The features are summarized below:

- Classic and Robust Damage Detection.
- Automatic damage indicator updates when new measurements are uploaded.
- Reference State Validation for visual validation of the null space estimation of the reference state model.
- Hotelling Control Chart unifying damage indicators into a single indicator with a single statistical based threshold. Optionally, notification (sounds, emails or web service calls) when the threshold is being passed after an analysis.

### Modal Parameter History Plugin

Modes of the structure can be presented in a historical view using the Modal Parameter History plugin. It presents the modal parameters as a function of the Analysis Sessions. In addition, it can track modes determined in a reference state. The tracked modes are presented by interconnecting the modes across Analysis Sessions. Pointing at the line with the mouse allows further information of the tracked mode.

The features are summarized below:

- Historical presentation of modes. Additional tooltip when pointing at a specific mode.
- Immediate animation of the mode shape of any mode clicked on in the diagram.
- On-the-fly Modal Assurance Criterion between mode shapes.
- Automatic mode tracking based on the estimation of a set of average modes obtained from a specified set of reference Analysis Sessions.
- Historical presentation of the tracked modes (Drawn interconnected). Natural frequencies and damping ratios – absolute and relative to their reference mode. Modal Assurance Criterion of the mode shapes relative to the mode shape of their reference mode.
- Historical export of modal results to SVS and UFF file formats.

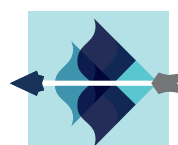
### Automatic File Upload Plugin

The Automatic File Upload plugin is designed to automatically upload and process measurement files arriving in a designated file folder on the user's network. The module allows ARTEMIS Modal Pro to fully plug into any third-party physical data acquisition system and to perform automatic data analysis using any of the above-mentioned analysis modules as well as the native Operational Modal Analysis techniques of ARTEMIS Modal Pro. The features are summarized below:

- Automatic file upload from a specific folder on a specific time interval.
- Support all ARTEMIS Modal input file formats.
- Automatic processing of uploaded measurements.
- Automatic file post processing (Move, Delete, Rename).

### ARTEMIS Modal – SHM

More information about ARTEMIS Modal/SHM is available on our website:  
[www.svibs.com/SHM](http://www.svibs.com/SHM)



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