

Operational Modal Analysis  
with ARTeMIS Modal

ARTEMIS Modal Basic

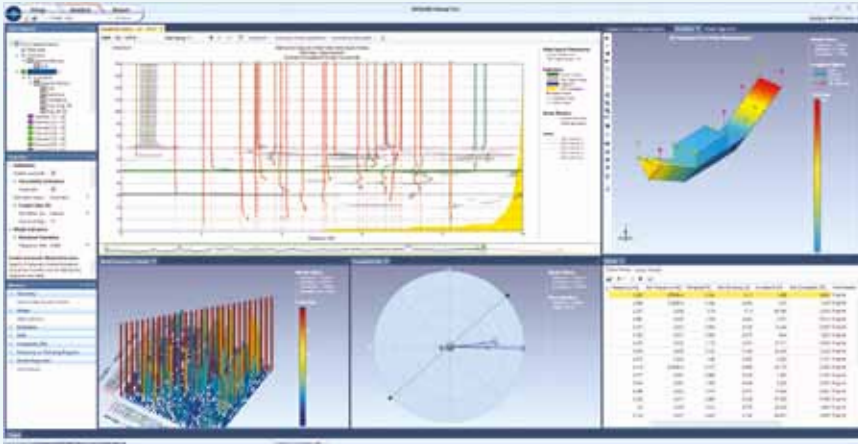


ARTEMIS Modal includes up to eight methods for Operational Modal Analysis. From the user-friendly Frequency Domain Decomposition (FDD) methods to the powerful Crystal Clear Stochastic Subspace Identification (CC-SSI) methods. All versions also include Time and Frequency Domain Operating Deflection Shapes analysis (ODS).

The modal estimation methods are designed to account for the presence of deterministic signals (harmonics) in case of rotating structural parts or another sinusoidal excitation.

ARTEMIS Modal Basic includes the Frequency Domain Decomposition (FDD) peak picking method. ARTEMIS Modal Standard includes all features of the Basic version and adds the Enhanced Frequency Domain Decomposition (EFDD) and Curve-fit Frequency Domain Decomposition (CFDD) peak picking methods.

ARTEMIS Modal Pro includes all available methods and adds support for Structural Health Monitoring (SHM) plugins used for long term monitoring of structures.



**Modal Analysis of a Ship during Operation**

*Operational Modal Analysis of a ferry build at Flensburger Schiffbau Gesellschaft. The measurements have been made under fully operational conditions; the responses are recorded using a 16-channel acquisition system and sampled with 128 Hz. The data has been analyzed up to 12.8 Hz as there are no modes of interest above this frequency. Harmonic detection has been applied to help the FDD methods estimating the structural modes. This showcase covers the results of the SSI-UPCX method including the uncertainty estimation of all modal parameters.*

**BENEFITS OF THE SUPPORTED ALGORITHMS**

**Frequency Domain Decomposition methods:**

- Intuitive modal parameter estimation based on manual or automatic peak-picking in frequency domain.
- Immediate results even in case of large number of measurement points and modes.
- Extremely robust being based on the Singular Value Decomposition of the spectral density matrices.
- EFDD and CFDD methods provide estimates of damping ratios as well as improved estimates of natural frequencies and mode shapes.

**Crystal Clear Stochastic Subspace Identification methods:**

- Modal parameter estimation based on estimation of state space models in time domain. Estimation can be done on even large channel counts using Projection Channels.
- Very fast estimation and limited user interaction required. Can be fully automated.
- Unbiased modal parameter estimation using least-squares or the Crystal Clear SSI® solver.
- Estimation of uncertainties of extracted modal parameters (SSI-UPCX).
- Modal parameters can be extracted in the presence of deterministic (harmonic) signals from e.g. rotating machinery.
- Extraction of global mode estimates can be made manually or automatic.
- Estimated state space models can be validated against data in frequency domain. Both spectral response and prediction errors can be validated.

- Modal Alignment diagram shows the modal parameters for all similar modes in the stabilization diagram.

**Modal Validation:**

- All modal estimation methods are supported by the validation features available in the ARTEMIS Modal.
- Available validation features are: Modal Assurance Criterion (MAC), Complexity Plot with possible normal mode estimation, Mode Shape Animation, and Frequency versus Damping diagrams.
- For the ARTEMIS Modal Standard and Pro versions there is an additional Validation Task with more validation features such as: Overlaid Mode Shape Animation, Mode Shape Difference Animation, Cross Modal Assurance Criterion, and validation against other estimators or projects.

**Operational Modal Analysis of Rotating Machinery:**

- ARTEMIS Modal Standard and Pro versions include Harmonic Detection techniques that both help visually to distinguish structural modes from harmonics, and makes it possible to apply the frequency domain modal estimators even if spectral densities contain peaks of the harmonic excitation.
- ARTEMIS Modal Pro includes the powerful Harmonic Reduction technique. This technique can reduce, and in some case completely remove, the harmonic excitation from the measurements. This makes the modal estimation much easier afterwards.

**ARTEMIS Modal – OMA**

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



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