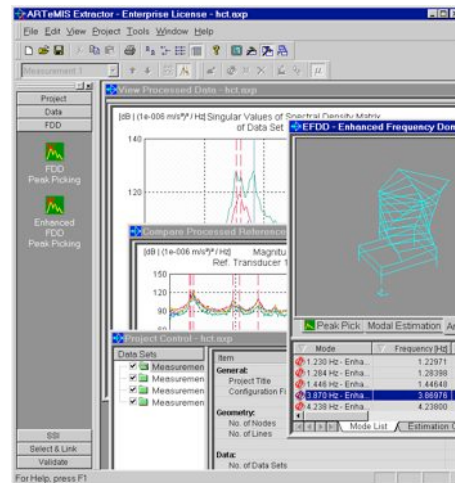


## ARTEMIS Extractor Modal Analysis Software

### Features

- The 4W-drive of Modal Analysis
- It takes you anywhere in Modal Analysis easily and does it well
- Large structures, micro structures, operating structures
- No shaker, no lab, no test rig
- Real boundary conditions, real MIMO
- Take Modal Analysis in the field



### Outline

The ARTEMIS *Extractor* is the effective tool for modal identification of civil engineering structures such as buildings, bridges, dams and offshore structures. The software allows the user to accurately estimate natural frequencies of vibration and associated mode shapes and modal damping of a structure from measured responses only.

In all versions of the ARTEMIS *Extractor* one can generate geometry information and perform measurements in any standard measurement system and then perform modal identification and validation. Response data files can be provided in a flexible ASCII format or by making use of the standard Universal File Format (UFF). All versions of the ARTEMIS *Extractor* run under Windows 95/98/NT/2000 and have the same

logical user interface with OLE support and online help that facilitates a quick and easy start.

All versions include powerful and efficient signal processing tools, capabilities for 2D displaying of spectral densities and correlation functions and for 3D geometry validation and mode shape animation. All plots and tables can easily be exported to other Windows programs such as Word and Excel using copy/paste commands. This also helps producing credible documentation with a minimum amount of work involved.

Three versions are now available, only difference between the three versions of the software is the number of techniques available.

**ARTEMIS Extractor Pro** For those who want all the best techniques available, need the highest accuracy and the best validation of results. With this package one can perform accurate identifications in time domain as well as the frequency domain using the strongest identification tools available today. The safest validation one can perform is to validate frequency and time domain results against one another.

**ARTEMIS Extractor Handy** For those who only need a fast and easy identification of mode shapes and natural frequencies. This version offers the best choice of today: the Frequency Decomposition technique that allows real modal properties with a simple click of the mouse.

**ARTEMIS Extractor Light** For those who want efficiency but can compromise a bit on the possibility to get optimum results in any case. This version includes efficient frequency domain identification tools for optimum user friendliness and computational efficiency.



# Specifications ARTeMIS Extractor

## System requirements

Windows 95/98/2000 or Windows NT with at least Service Pack 4 installed and Administrative privileges  
 Microsoft Internet Explorer, at least ver. 4  
 Pentium Class PC (700 MHz or higher is recommended)  
 256 MB Ram (512 MB ram or more is recommended)  
 1 GB of free hard disc space  
 (required hard disc space is project dependent)  
 SVGA monitor, screen resolution at least 800x600

## Data input

Universal File Format (ASCII)  
 ARTeMIS Extractor configuration file and data file (ASCII). Data file format is the MATLAB /ASCII file format, stored as a matrix, time series stored column by column  
 OLE Automation, geometry and measurement data transfer from all other software with OLE Automation support  
 Factory implemented OLE Automation support for direct input from PULSE and MATLAB  
 Maximum number of channels: unlimited by the software  
 Maximum amount of data: unlimited by the software

## Data output

Copy/Paste and Print functions for all graphics and tables  
 Modal results: Universal File Format (ASCII) including geometry, one or more modes in each file  
 Modal results: ARTeMIS Extractor output files, one or more modes in each file (ASCII)  
 Modal results: Interface to FEMtools updating software through UFF.  
 Animations: export of AVI movie files to e.g. Windows Media Player or Power Point

## Signal processing

Decimation, 1-1000 times, digital anti-aliasing filter, cut-off at 0.8 times Nyquist frequency  
 Filtering: low-pass, high-pass, band-pass, band-stop Butterworth, filter order 1-50 poles, arbitrary cut-off frequencies, test for filter stability  
 Spectral estimation using FFT and Welch's averaged periodogram method.  
 Data segment length: radix-2 only limited by the amount of data, overlap: 66.7 %, window: Hamming. Estimates always the full spectral matrix  
 Correlation function estimation using the unbiased FFT technique.  
 Number of time lags: arbitrary. Estimates always the full correlation matrix  
 Common SSI input matrix estimation to be used in all subspace algorithms.  
 Maximum number of modes: arbitrary, but limited by the amount of data  
 Possibilities for testing the signal processing, data set by data set  
 Data Plotting: Spectral magnitude and phase, singular value decomposition of spectral matrix, average of full spectral matrix, average of diagonal elements of spectral matrix, coherence of spectral matrix, filter characteristic, correlation functions. Cursor read out on all curves

## Operational deflection shapes

Time domain animation data set by data set  
 Frequency domain animation data set by data set or using all data sets for animation of the total structure  
 Units (deflection, velocity, acceleration) and scaling specified by the user  
 Tables and graphical information on movements of selected nodes

## Frequency domain decomposition

Method: Frequency Domain Decomposition  
 User choices: Peak picking  
 Frequency resolution: defined by frequency lines in spectral density function  
 Mode shape estimation: Immediate animation  
 Damping: None

## Enhanced frequency domain decomposition

Method: Frequency Domain Decomposition  
 User choices: Peak picking, MAC level for identification of spectral peak, time interval for identification of damping  
 Frequency resolution: Not limited by frequency resolution  
 Mode shape animation: Immediate animation, mode shape estimate improved by frequency domain averaging  
 Damping: Estimated from free decays corresponding to identified spectral peak

## Time domain identification

Basic Method: Data driven Stochastic Subspace Identification  
 User choices: Implementation: Unweighted Principal components, Principal Components and Canonical Variate Analysis. Model orders: from one mode to the size defined by the common SSI input matrix  
 Stabilization criteria: natural frequency, damping, mode shape, initial amplitude, all limits user defined  
 Physical mode separation: Damping limits are user defined  
 Select and link: Modes from the models chosen from each data set is selected and linked in a separate window with snap functions and editing facilities  
 Uncertainty estimation: In case of several data sets, the empirical standard deviation is calculated for natural frequencies and damping ratios

## Validation

Comparison: Modal model vs. FFT based auto- and cross-spectra  
 Comparison: Modal model vs. unbiased (zero-padded FFT) auto- and cross-correlation functions  
 Modal Assurance Criterion, MAC plots for comparison of mode shapes between same or different estimation techniques as well as between same or different projects  
 Simultaneous animation of different mode shapes  
 Animation of differences between mode shapes

## Graphics and lists

All 2-dimensional plots have cursor readings and can be zoomed on the horizontal axis  
 Annotation feature on data plots  
 All 3-dimensional plots have indication of node numbers and can be arbitrarily rotated, zoomed and translated in horizontal and vertical directions.  
 Graphical indication of measurement DOF's, points and directions  
 Tables with point coordinates, Measured DOF's, modal parameters, mode shape values and mode shape deviations  
 All graphics and list can be exported by Copy/Paste commands to e.g. Word or Excel.

## On-line Help

Tool-tips on all buttons  
 Context sensitive help on controls and plots  
 Introduction to the idea of output-only modal analysis  
 Description of all menus and control bars  
 Detailed description on the identification process, from beginning to end

	ODS <sup>1</sup>	FDD <sup>2</sup> peak picking	Enhanced FDD (with damping)	SSI <sup>3</sup> Unweighted Principal Components	SSI Principal Components	SSI Canonical Variate Analysis
<b>ARTeMIS Pro</b>	●	●	●	●	●	●
<b>ARTeMIS Handy</b>	●	●	●			
<b>ARTeMIS Light</b>	●	●				

1 Operational Deflection Shapes (available from version 3.5)

2 Frequency Domain Decomposition

3 Stochastic Subspace Identification