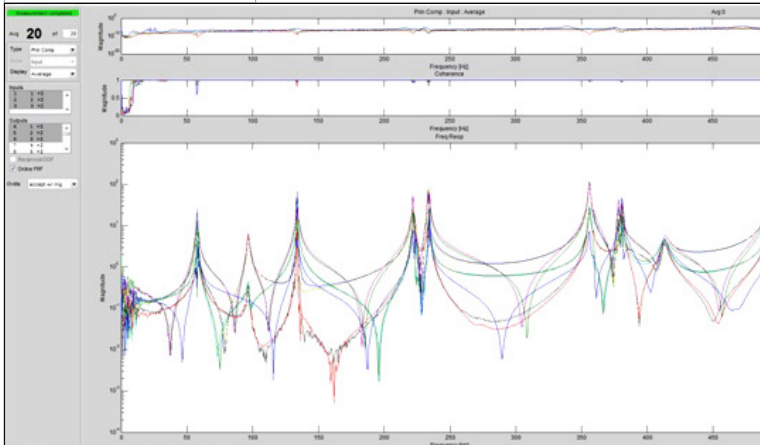# X-Modal III

MODAL ANALYSIS SOFTWARE WITH EMBEDDED DATA ACQUISITION

FEATURES

SOFTWARE FUNCTIONALITY

Autonomous Modal Parameter Estimation Procedure

Multiple Live Parameter Estimation Windows

Task Oriented, Easy-To-Use Interface

Logical Operation Always "One-Click" away

Simplified "Copy & Paste" Data Management

Simplified Units Unification Tool

Based on MATLAB® Computational Engine Environment

Universal File Format (UFF) Data Access

Individual Data Channel Calibration

APPLICATIONS

Modal Analysis

Ground Vibration Testing (GVT)

MIMO Shaker Testing

Multi-Reference Impact Testing

Problem analysis and Troubleshooting

VTI
Instruments

www.vtiinstruments.com

RELIABLE DATA   FIRST TIME   EVERY TIME

OVERVIEW

X-Modal III is a comprehensive modal analysis package featuring intuitive, task oriented user interfaces, extensive modal parameter estimation algorithms, parallel display capabilities, flexible data management, and embedded data acquisition capabilities.

Developed by one of the leading research universities in modal analysis and structural dynamics, and supported by leading structural testing groups in aerospace, defense and automotive industries, X-Modal III is used for the most complicated modal test applications in the world.
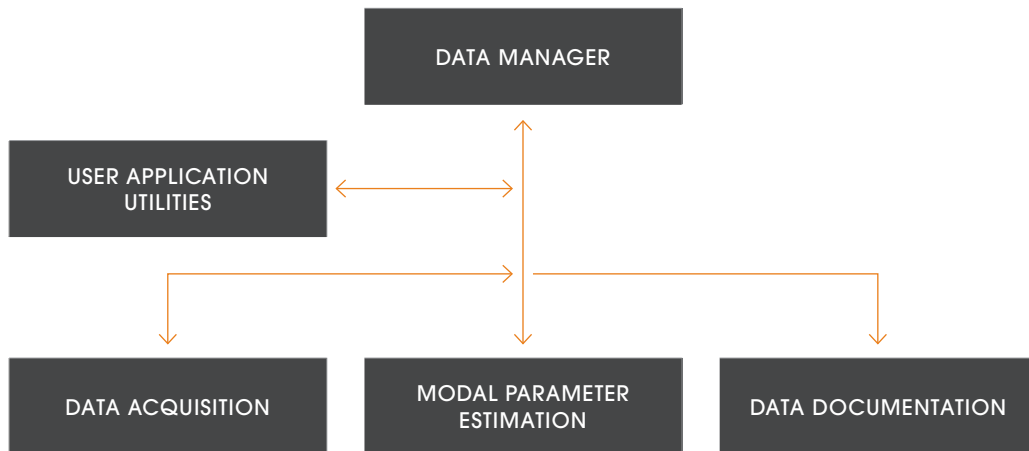
X-Modal III fully supports the SentinelEX Series of Smart Dynamic Signal Analyzers (DSA's), as well as VTI's VT143x family.

Open-source Programming Environment

One of the most unique modal test solutions in the market, X-Modal III is based on MATLAB®, an open-source programming environment, and offers the user the ability to take advantage of leading edge technology for modal testing. MATLAB® offers several advantages:

• General familiarity in industry, organizations and Universities
• Convenient for customization/enhancement at multiple levels
• Gives complete visibility of algorithms and techniques
• Excellent math capability and engineering/science graphic visualization options
• Easy automation using scripts

X-Modal is also not captive to data formats like traditional modal analysis tools. Data can be exported in multiple common file formats to like Universal file format, Excel, MATLAB®, Quicktime movie, or JPG. This ensures that the user is not bound to using proprietary software with expensive maintenance fees in order to access stored data.

DATA MANAGER

USER APPLICATION UTILITIES

DATA ACQUISITION   MODAL PARAMETER ESTIMATION   DATA DOCUMENTATION

Simplified set-up and usage

Time saving functionality like easy to use wizards, task oriented user interfaces always with "one-click" away functionality, simplified "copy & paste" data management, a units unification tool, and the ability to display multiple, live parameter estimation windows in parallel truly differentiates X-Modal III and make it very intuitive and simple to use. Instruments are automatically identified and instrument configuration is simplified using built-in modules.

- Bubble help on all icons
- Written theory documentation available (locally or online)
- Video tutorials for getting started (locally or online)
- Build-in full featured modules and wizards to simplify usage
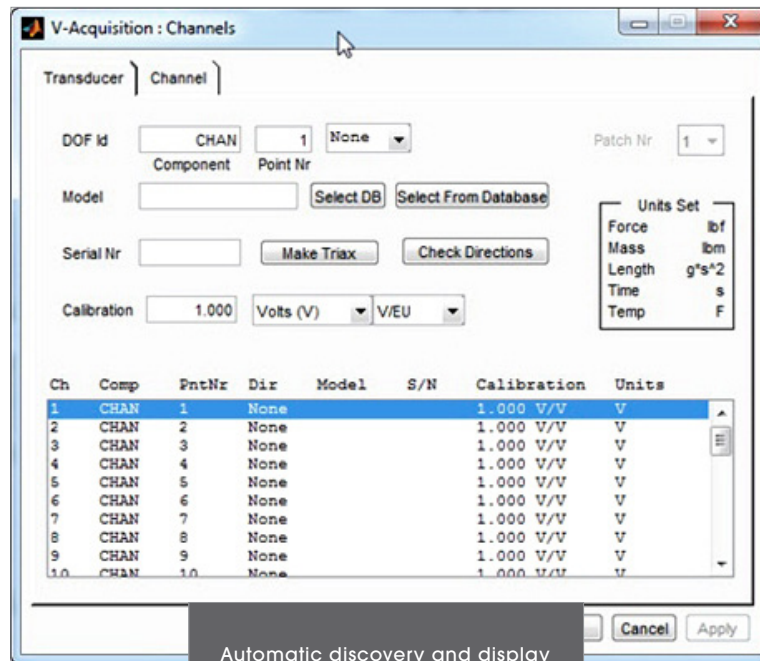
Automatic discovery and display of specific instrumentation configuration details

Data Manager

The Data Manager within X-Modal organizes acquired data into data groups for further processing by application modules like Modal Parameter Estimation. This can be data that's collected by the Data Acquisition module within X-Modal, or collected from another software package like EXLab and imported into X-Modal. While the Universal File Format (UFF), both ASCII and binary versions are the primary open standard data format utilized by X-Modal other non-proprietary formats can be supported via user applications (CSV, Excel, MATLAB® file, etc.)

User applications may be added through Swiss Army Knife Functions
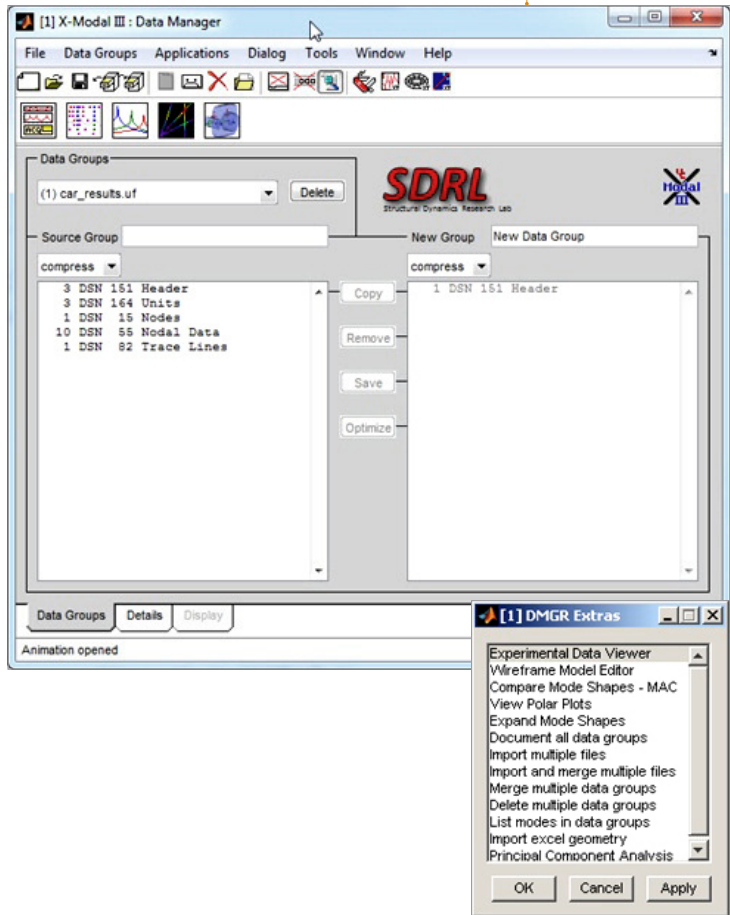
Data can be imported/exported in Universal File Format, the only file format recognized by all vendors
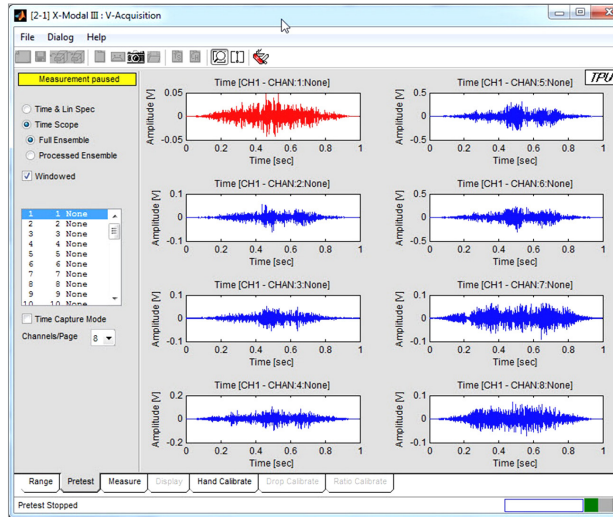
Multiple data groups available

Data Acquisition

X-Modal III offers a wide range of capabilities providing virtually every toolset required for performing complex structural tests.
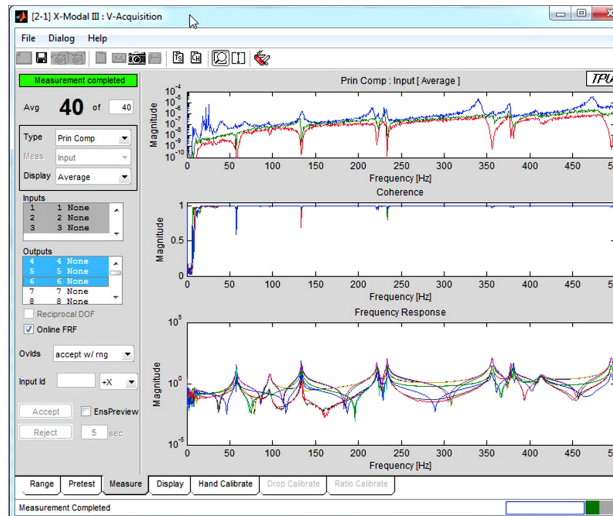
Data Acquisition Modes

- MIMO FRF Estimation
- Multiple Reference Impact Testing (MRIT)
- General Auto/Cross Power Spectra Matrix
- Block Time Domain
- Sensor calibration modules

Data Signal Processing

- General Windowing Support
- RMS and cyclic averaging
- H1, H2, Hv FRF Algorithms
- Pre and post trigger
- Units support
- Multiple source control for MIMO

Modal Parameter Estimation (MPE)

X-Modal supports all commercial MIMO (Multiple Input Multiple Output) MDOF (Multiple Degrees of Freedom) algorithms plus many research options:

• Time Domain: Polyreference Time Domain (PTD), Eigensystem Realization Algorithm (ERA)

• Frequency Domain: Rational Fraction Polynomial (RFP), Polyreference Frequency Domain (PFD), RFP with complex Z mapping (RFP-Z), PFD with complex Z mapping (PFD-Z)

• Unified Matrix coefficient Polynomial Algorithm (UMPA) Method in both time and frequency domains

Autonomous modal parameter estimation procedures are available with all MDOF methods, with statistical mean and standard deviation information available for all modal parameters.
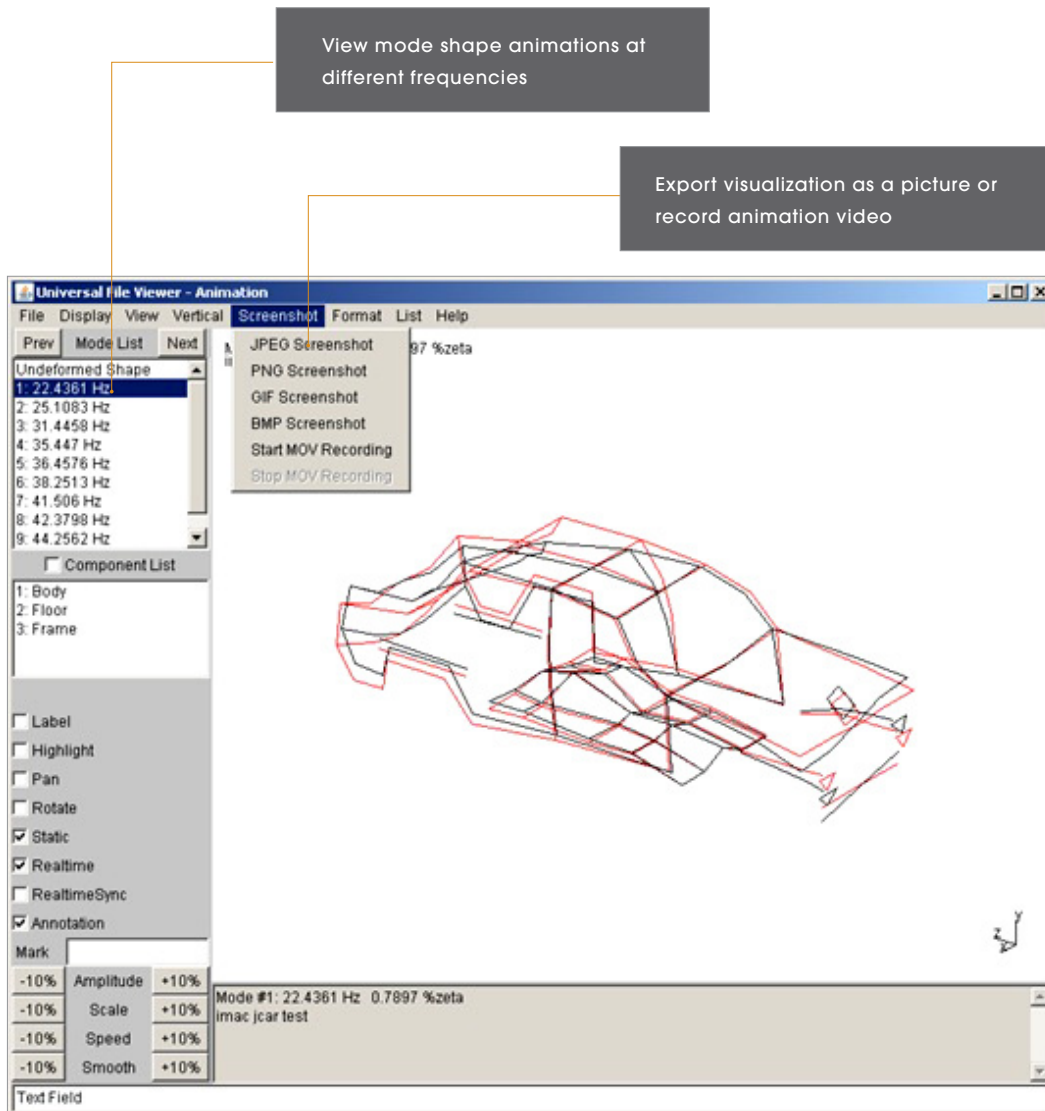
Many SDOF methods are also included.
• Least squares finite difference (local and global)
• Least squares partial fraction (local and global)
• Complex mode indicator function method
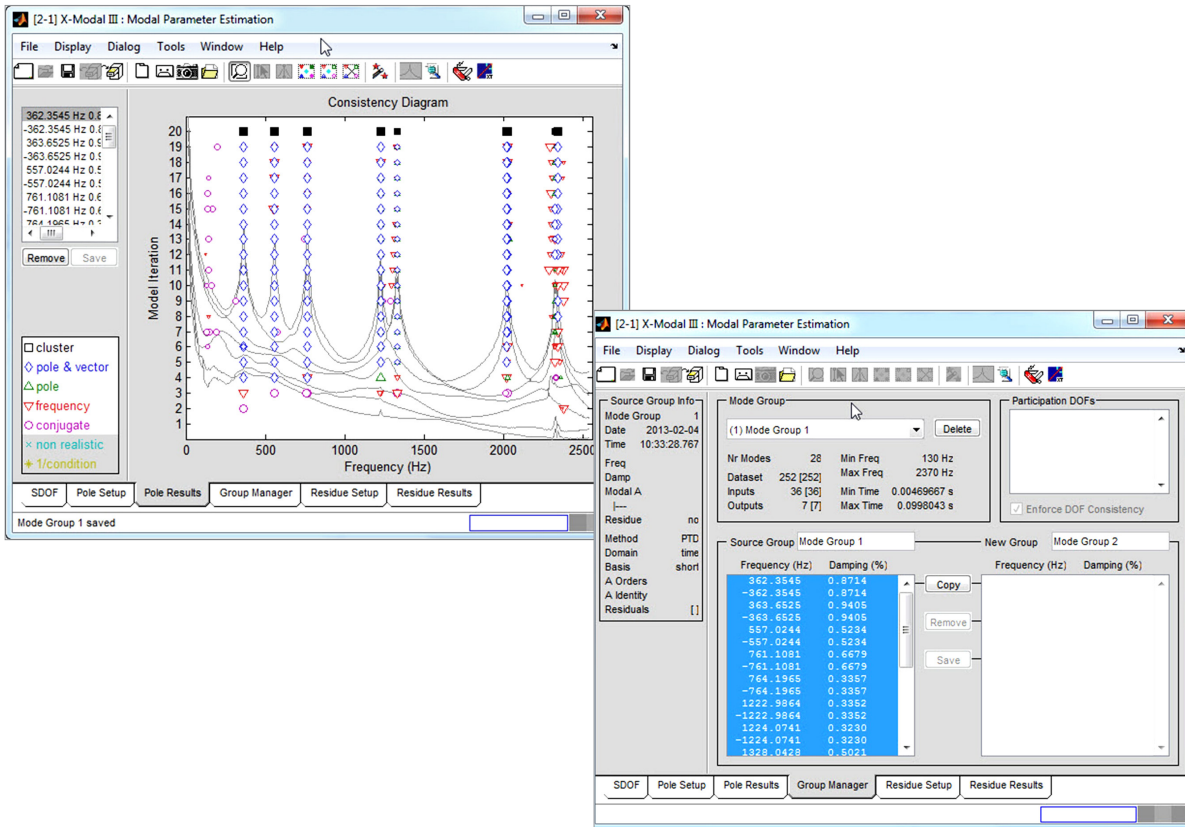
Data Documentation

X-Modal makes it very easy for users to export data for documentation.

• Data plots can be exported in most electronic file forms or Matlab figure files

• All plots can be pulled from the graphic user interfaces (GUIs) as "tear-away plots"

• Animated visualization of mode shapes can be viewed and exported as video or static images

• Data can also be exported as text outputs, tabular lists and Excel file formats

• Plots and screenshots can be exported to electronic file formats or sent directly to the printer

View mode shape animations at different frequencies

Export visualization as a picture or record animation video

General Specifications

USER INTERFACE

FUNCTIONALITY

Task oriented

Logical "one-click" away design

Intuitive mouse driven graphical user interfaces

Function driven icons with parallel drop down menus

Interactive, cursor driven bubble help

On-Line Technical Help (PDF References)

On-line video tutorials

HARDWARE CONNECTIVITY

INSTRUMENT SUPPORT

EMX-4350 "Smart" Dynamic Signal Analyzer, 4 Chan

EMX-4251 "Smart" Dynamic Signal Analyzer, 8 Chan

EMX-1434 Arbitrary Waveform Source with Dual Tach

VT1432B Dynamic Signal Analyzer

VT1435 Dynamic Signal Analyzer

VT1436 Dynamic Signal Analyzer

VT1434A Arbitrary Waveform Source

INSTRUMENT DISCOVERY

Automatic discovery and display of specific instrumentation configuration details

INSTRUMENT CONFIGURATION

Automatic configuration of base hardware

Channel slot and clock frequency reconfiguration

DAQ AND DSP MODES

ACQUISITION MODES

MIMO FRF Estimation

Multiple Reference Impact Testing (MRIT)

General Cross Power Spectra Matrix

Block Time Domain

Post-Processing of Time Data Files (SDF, UFF, MAT)

CAPABILITIES

DIGITAL SIGNAL PROCESSING

    Windowing

    Averaging, Triggering

    Cyclic Averaging (Digital Comb Filtering)

    MIMO Source Control (with Random, Burst Random, Periodic Random, Pseudo-Random)

STRUCTURAL AND OPERATIONAL MEASUREMENTS

    Power Spectra

    FRF (H1, H2, Hv)

    Single/Multiple Input

    Coherence (Ordinary/Multiple)

    Uncertainty Quantification

    MIMO Transmissibility

    Principal Gain Evaluation (SVD)
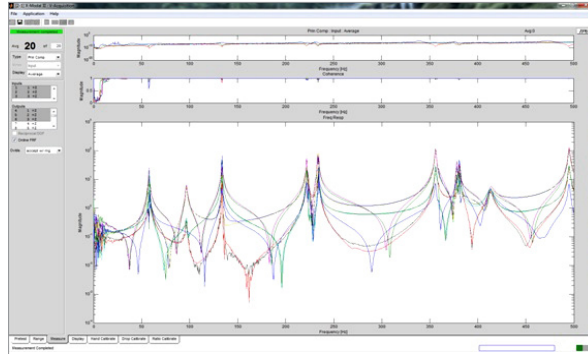
EXCITATION TECHNIQUES

    Shaker Testing

    Optimum Input Evaluation (Virtual Forces)

    Impact Testing

General Specifications

CAPABILITIES

ROTATIONAL ANALYSIS MEASUREMENTS (POST PROCESSING)

    Cepstrum, Quefrency

    Time Spectral Map (Color Spectragram)

    RPM Spectral Map (Color Spectragram)

    Time Cepstral Map (Color Spectragram)

    RPM Cepstral Map (Color Spectragram)

MODAL PARAMETER ESTIMATION

GENERAL EXPERIMENTAL MODAL ANALYSIS CAPABILITIES

RESPONSE ONLY MODAL ANALYSIS (VIA POWER SPECTRA)

REPEATED ROOT DETECTION AND SOLUTION

MODAL PARAMETER ALGORITHMS

   ° Numerous SDOF Methods

   ° Numerous MDOF Single/Multiple Reference Methods

   ° Time Domain Methods
     Polyreference Time Domain (PTD)
     Eigensystem Realization Algorithm (ERA)

   ° Frequency Domain Methods
     Rational Fraction Polynomial (RFP)
     Polyreference Frequency Domain (PFD)
     RFP with complex Z mapping (RFP-Z)
     (LS Complex Frequency implementation like LMS Polymax®)
     PFD with complex Z mapping(PFD-Z)

AUTONOMOUS MODAL PARAMETER ESTIMATION PROCEDURES

MODAL PARAMETER VALIDATION

   ° Modal Assurance Criterion (MAC)

   ° Mode Indication Functions (MvMIF, CMIF)

   ° Synthesis Correlation - Error Evaluation
     Modal Assurance Criterion (MAC)
     Mode Indication Functions (MvMIF, CMIF)
     Synthesis Correlation - Error Evaluation

Specifications

DATA MANAGEMENT AND VISUALIZATION

MANAGEMENT

Multiple mode groups and data groups Cut/Paste/Edit/Save capability

AIMPORT/EXPORT FORMATS

Universal File Formats (UFF)

MATLAB file format
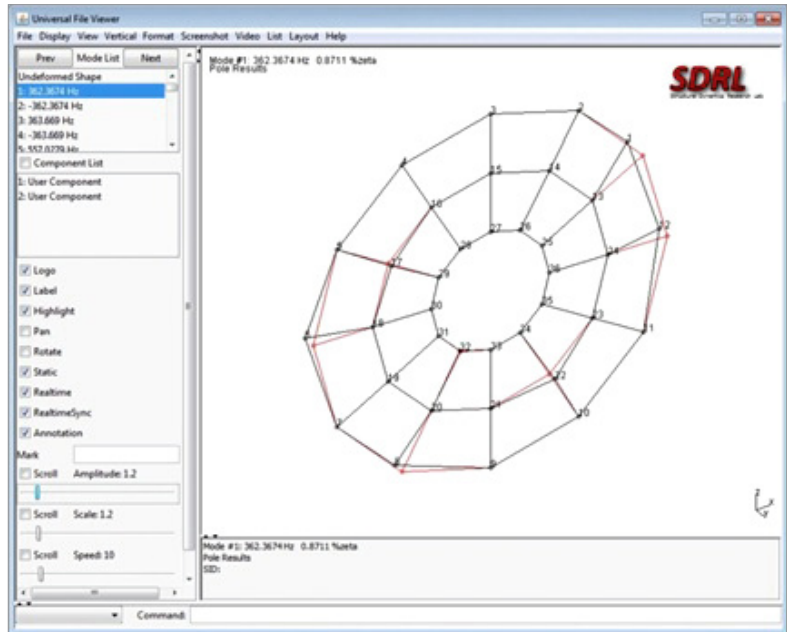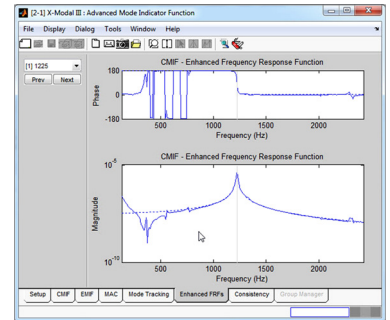
Excel Import
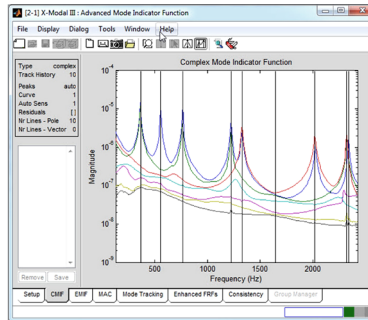
Animation plotting in 2-Dimension (wire frame)

QuickTime movie export

Extensive electronic data capture (text, JPG, BMP)

Personalized organization logos on all graphic output formats

PROGRAMMING ENVIRONMENT

MATLAB®-BASED APPLICATION

Computational engine environment. Access to full programming environment (p-code or full source) available with license and/or Consortium membership.

Ordering Information

X-MODAL III SERIES	
X-Modal III Single User	Single user license. Comprehensive Modal Analysis software package supporting unlimited channels, extensive modal parameter estimation algorithms, flexible data management capability, based on the MATLAB computational engine. See Note 1 for details
X-Modal III Multiple User	10 user license. Comprehensive Modal Analysis software package supporting unlimited channels, extensive modal parameter estimation algorithms, flexible data management capability, based on the MATLAB computational engine. See Notes 1 and 2 for details.
X-Modal III Site	User site license. Comprehensive Modal Analysis software package supporting unlimited channels, extensive modal parameter estimation algorithms, flexible data management capability, based on the MATLAB computational engine. See Notes 1 and 2 for details.
X-Modal III Education	Educational user site license. Comprehensive Modal Analysis software package supporting unlimited channels, extensive modal parameter estimation algorithms, flexible data management capability, based on the MATLAB computational engine. See Notes 1 and 2 for details.
X-Modal III Maintenance	Annual Maintenance/Distribution Fee for X-Modal III. Includes periodic feature set enhancements and updates. First year required with all licenses to receive initial software; subsequent maintenance optional.

Notes:

1. Software includes Matlab Computational Engine plus X-Modal III in an execute only configuration. Programmable version using p-code with user supplied Matlab license available as an option. Full source availability is available through Consortium membership. For further details, please visit: http://www.sdrl.uc.edu/Consortium.

2. Multiple User, Site and Educational licenses require signed paper execution of the license.

RELATED PRODUCTS

EMX-4350	4-Channel, 625k Sa/s DSA Digitizer with IEPE support
EMX-4380	4-Channel, 625k Sa/s DSA Digitizer with Charge and IEPE support
EMX-4250	16-Channel, 204k Sa/s DSA Digitizer
EMX-4016	16-Channel Break-out-box for EMX-4250
EMX-4251	8-Channel, 204k Sa/s DSA Digitizer
EMX-4008	8-Channel Break-out-box for EMX-4251
EMX-1434	4-Channel, 204 kSa/s Arbitrary Waveform Source with Dual Tach
EMX09	9-Slot Gigabit Ethernet LXI Data Acquisition Mainframe
EMX18	18-Slot Gigabit Ethernet LXI Data Acquisition Mainframe

Specifications contained within this document are subject to change without notice

RELIABLE DATA   FIRST TIME   EVERY TIME