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Software

Attune™ v2.4 | Automated Test-Analysis Correlation and Model Updating

Attune

Overview

The goal of many modal surveys is to obtain a test-verified finite element model for use in coupled loads, flutter, control system, and other advanced analyses. Modal testing provides a measurement of the actual dynamic characteristics of a structure. The finite element model is then adjusted to provide better agreement between the predicted (analysis) and the actual (test) results.

Most correlation methods involve a trial-and-error approach in which model parameters are adjusted and the results reviewed to see if the test-analysis agreement has improved. Often, this process requires a great deal of both engineering and computer time.

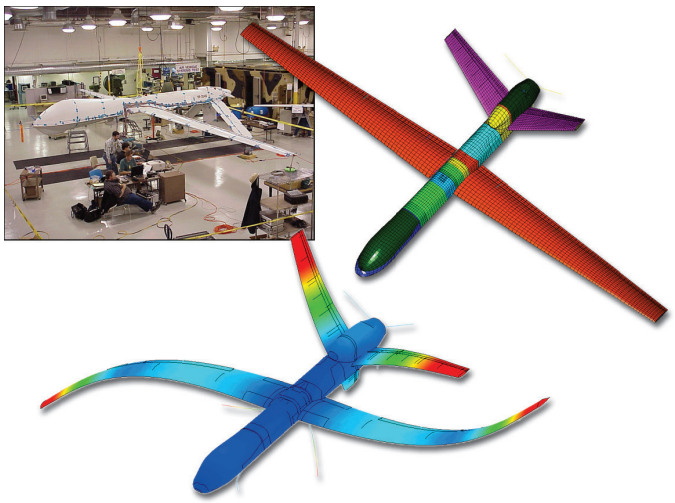
Attune is a stand-alone highly automated test-analysis correlation and model updating software tool which combines over forty years of experience in this field into a user-friendly, flexible, MATLAB®-based toolkit. By automating the correlation process and providing a suite of leading-edge optimization tools, Attune provides the user with a powerful, efficient method of generating accurate test-verified finite element models.

Attune: The Next-Generation Correlation Toolkit

Attune v2.4 represents a leap forward in the area of automated correlation and model updating. By providing the user with a suite of powerful tools, test and analysis models can be easily and rapidly compared and analysis models automatically optimized to correlate closely with test data.

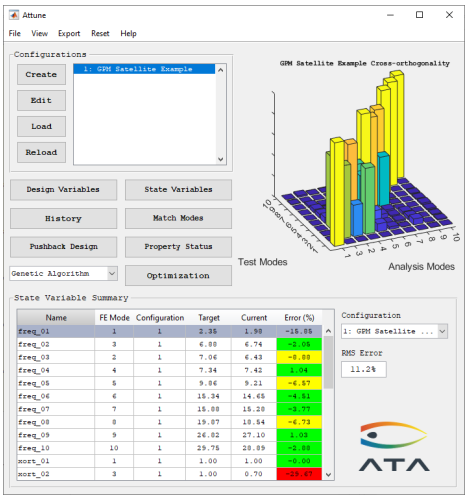
Unlike other correlation tools that use mode shape sensitivities in the optimization process, Attune uses the sensitivities of reduced model matrices in its calculations. Not only does this decrease the solution time for each iteration, but the variation in the reduced model matrices is much more linear with respect to the design sensitivities. This results in greater accuracy in the optimization process and a reduced number of iterations to converge to an optimized solution.

Users can correlate analysis models and test data based on modal frequencies, mode shape cross-orthogonality, modal assurance criteria (MAC), or various combinations of these. Attune permits the correlation of frequencies without requiring the associated shape data, so users have the capability of tuning frequencies in the design phase before any testing has been done. Attune provides the most complete set of state-of-the-art optimization routines available for model updating, including gradient-based and genetic algorithms. In addition, multiple configurations may be optimized simultaneously to improve accuracy and further reduce correlation time. Attune allows the user to visually compare mode shapes, simplifies the creation of design variables, and



➤ Attune's powerful features allow quick, automatic generation of test-verified analysis models.

Attune™



➤ Attune provides instant, informative summaries on the correlation progress.

automatically updates ready-to-run bulk data or input decks for sensitivity analysis and the final optimized model.

Users can employ advanced history tracking to investigate the design space and reevaluate designs based on new criteria, as well as to visualize what tradeoffs were made between changes in design variables and improvements in the objective function. The Attune interface allows users to automatically create XML charts and tables editable from within Excel that document the correlation.

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Attune is directly compatible with Simcenter Nastran, MSC.Nastran®, I-deas® NX, Abaqus®, B&K® Test for I-deas software, and universal data sets.

Features

Attune allows the user to

- Carry out correlation and model updating through a user-friendly graphical user interface (GUI).
- Correlate test and analysis data based on modally reduced model mass and stiffness.
- Simultaneously optimize the design of multiple configurations.
- Correlate frequency, cross-orthogonality,[1] and MAC.
- Correlate model frequencies during the design phase (without test data).
- Visually compare analysis and test mode shapes.[1]
- Automatically map test node numbers onto analysis node numbers.
- Back-expand test mode shapes for visualization and/or correlation.
- Control the method for automatically identifying mode matches.
- Control the objective function that drives the optimization.
- Easily create Nastran design variables and set up a Nastran optimization deck.
- Graphically display cross-orthogonality[1] and cross-MAC.
- Use a variety of optimization algorithms, including Monte Carlo, gradient-based, and genetic algorithms.
- Include user-defined optimization algorithms in the Attune interface.
- Request that closely spaced modes be taken into account in computing cross-MAC or cross-orthogonality values.
- Use advanced history tracking to investigate the design space and reevaluate designs based on new criteria.
- Import analysis data from a variety of Nastran files, I-deas NX files, Abaqus files, and universal data sets.
- Export ready-to-run updated Nastran bulk data and Abaqus input decks of optimized analysis models.
- Interface with Excel for easy documentation of correlation process.

[1] Nastran-only feature

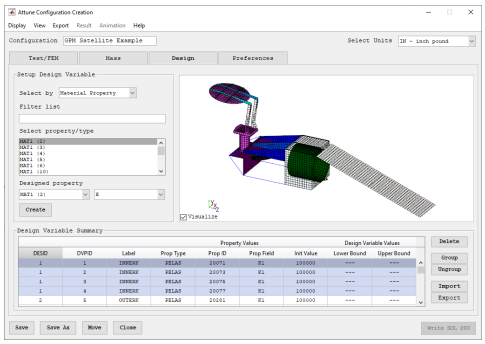
Supported Data Types

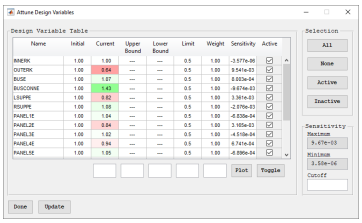
Attune reads the following data types:

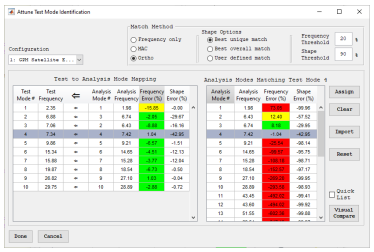
- Nastran punch and OUTPUT2 files
- Nastran DMI and DMIG matrices
- Abaqus input (.inp) files
- I-deas NX shape files
- Universal data sets

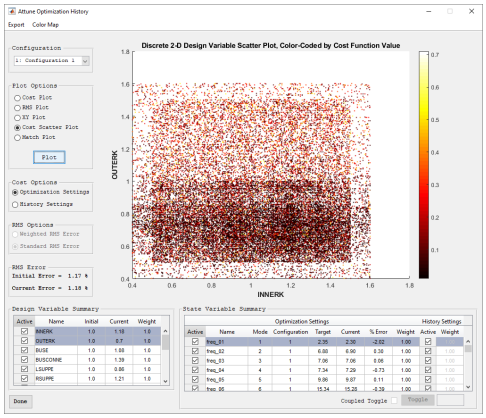
Attune directly writes the following data types:

- Updated Abaqus input (.inp) decks
- Updated Nastran bulk data files
- Formatted XML data files for Microsoft Excel









- Efficiently create, monitor, and modify design and state variables through easy-to-use graphical user interfaces.

Attune supports both Simcenter Nastran and MSC.Nastran 2001 (or higher) formats and Abaqus v6.5 (or higher).

Hardware Platforms

Attune is written primarily in the MATLAB scripting language. MATLAB R2018b or higher is a prerequisite. Attune is available on Windows 7/8/10 and Linux platforms.

About ATA

ATA has over forty years of experience in the field of structural dynamics analysis and testing and is a world leader in the area of test-analysis correlation and model updating. For more information visit www.ata-e.com.

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