

PRODUCT DATA

Test for I-deas Correlation — BZ-6020

Test for I-deas Correlation software provides well-integrated, complete capabilities for comparing dynamic finite element analysis and experimental modal analysis results. It includes capabilities for FEA correlation and data display on geometry including animation, graphing function data, math processing, data access and management, and open architecture and interfacing.

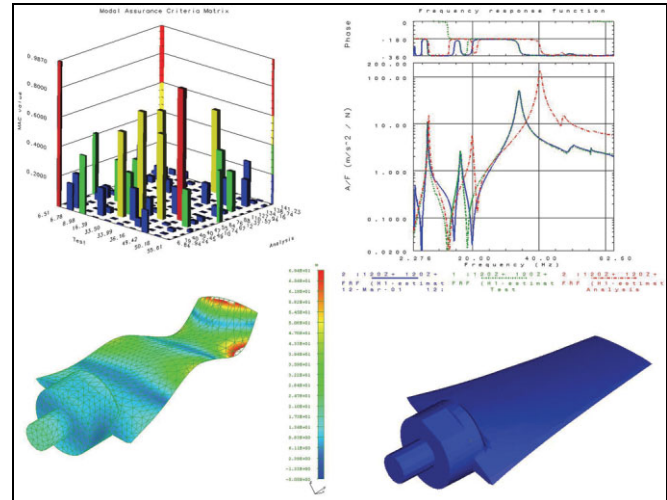
USES

- Comparing dynamic finite element analysis and modal test data
- Pre-test planning

Comparison Tools

A complete set of tools is provided for comparing finite element analysis results with experimental modal analysis results:

- **Geometry mapping:** The finite element model typically contains many more nodes than points measured in the modal test. A node map is automatically generated assigning the appropriate finite element node to the corresponding test measurement point based on the proximity of their global coordinates. Where judgment is necessary, manual interaction is provided
- **Visual comparison:** The test and analysis mode shapes can be compared in side-by-side displays using the Test for I-deas multiple viewport feature
- **Modal Assurance Criteria (MAC):** Modal assurance criteria quantitatively compare all the possible combinations of test and analysis mode shape pairs. The calculation assigns a value of 1.0 to test and analysis mode shape pairs that exactly match and a value of zero to those pairs that are completely independent, or unrelated. Values between 0 and 1.0 are proportional to the degree of correlation between the mode shapes. A 3D bar chart presents the results of this MAC calculation showing which test mode shapes match which analysis mode shapes and the degree of correlation
- **Orthogonality:** This method is similar to MAC except that the calculation is weighted by a reduced mass (or stiffness) matrix. Typically, the classical triple product matrix calculation of the test mode shapes/mass matrix/analysis mode shapes is performed and displayed in a



3D graph. In addition, the orthogonality calculation may be done comparing test to test, or analysis to analysis through either the reduced mass or stiffness matrices. The reduced mass (or stiffness) matrix may be read-in via a universal file, from MSC NASTRAN, or directly from Test for I-deas Model Solution Linear Software

- **Frequency comparison table:** The MAC or orthogonality calculations may be used to automatically match the test modes with the corresponding analysis modes. This matching may also be done by visual inspection and keyboard entry. A frequency comparison table is generated containing test mode number, analysis mode number, test frequency, analysis frequency, percent difference, and MAC or orthogonality value
- **Coordinate Modal Assurance Criteria (COMAC):** This method helps you identify the location of systematic differences between test and analysis results, such as stiffness/mass distributions, material properties, boundary conditions, and transducer mass loading. A geometric display shows the physical locations on the structure where systematic differences exist between a set of test mode shapes and a set of analysis mode shapes. The difference is proportional to the length of the arrow plot vectors. An enhanced version of the COMAC formulation is also included that more heavily weights large differences in a small number of DOFs

- **Response synthesis:** Frequency response functions can be synthesised using the modal test and finite element results and then compared in an overlaid XY graph format. Damping values for the finite element modes may be automatically obtained from the test database or keyed in

Pre-test Planning

When the finite element model is available prior to the test, Correlation may be used with the model to identify a satisfactory set of measurement locations. Proposed measurement locations can be cursor-picked directly from the model. Calculations can then be performed to provide the following test planning information:

- MAC or orthogonality calculations indicate if sufficient test points have been selected and properly located to uniquely identify each mode of vibration
- Frequency response synthesis calculations help select the best exciter locations for identifying all modes

Back Expansion

When a reduced mass matrix is available with the orthogonality calculation, the test mode shapes can be back expanded to the full detail of the finite element model.

User Interface, Graphics, and Data Management

A tight integration between Test for I-deas Simulation Modeling Set and Correlation modules is supported through the use of the Simulation Modeling Set's menu system to display both finite element and experimental modal analysis results. Other common user interface features include programmability, menu structure, and graphic displays.

Geometry-based Data Displays

Presenting data measured at many locations on the structure using a geometry-based display provides a very efficient way of understanding and communicating the test results. The extensive geometry display capabilities of the Test for I-deas system are leveraged to provide convenient ways of displaying test data. Special features, such as an intelligent cursor, highlight the geometry attribute of interest. The model preparation task provides easy-to-use methods for constructing geometry suitable for test applications.

Data Structures

Numerous data management issues inherent to comparing test and analysis issues are completely resolved by the software. These issues include units, coordinate systems, node numbering, normalisation, and mode matching.

Specifications – Test for I-deas Correlation BZ-6020

PREREQUISITE

Test for I-deas Core Test BZ-6000

COMPARISON TOOLS

Geometry mapping, Modal Assurance Criteria (MAC), Coordinate Modal Assurance Criteria (COMAC), orthogonality, frequency comparison tables, response synthesis and visual comparison

DISPLAYS

Geometry-based data displays with single or multiple viewports

Creation of Measurement Points (Nodes):

Keyboard entry, copy/paste, reflect, interpolate, or cursor-picking measurement points from a detailed finite element model

- Data at nodes can be displayed on geometry using either line or colour contours (up to 78 contour levels and intervals)

- Groups of measurement points on different regions of the geometry can be defined to automate data processing/display

Animation Features: Wireframe, hidden line removed, and shaded image deformation displays are available as static plots on all supported graphics hardware devices.

Wireframe and hidden line removed animation are available on most supported devices, and shaded image animation is available on certain advanced graphics devices

- Tracelines supported for wireframe displays
- Elements may be defined for advanced hidden line removed and shaded image displays and animation

Global and Local Coordinate Systems: Cartesian, cylindrical, or spherical systems

Data Types: Results from modal analysis, order track tests, operating tests, or any other type of vector data at measurement points can be displayed

- Displays of transient events defined from time histories can be animated on deformed geometry, providing a clear understanding of the response measurement as a function of time
- Responses at a specified order and RPM, or the total response of order track data from rotating machinery tests can be animated on geometry
- Vector arrow plots of data at nodes and criteria plots showing data above, below, within, or outside of a defined range are available

Ordering Information

BZ-6020-F Test for I-deas Correlation

M1-6020-F Annual Software Maintenance and Support Agreement

M2-6020-F Annual Software Maintenance and Upgrade Agreement

Brüel & Kjær reserves the right to change specifications and accessories without notice

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