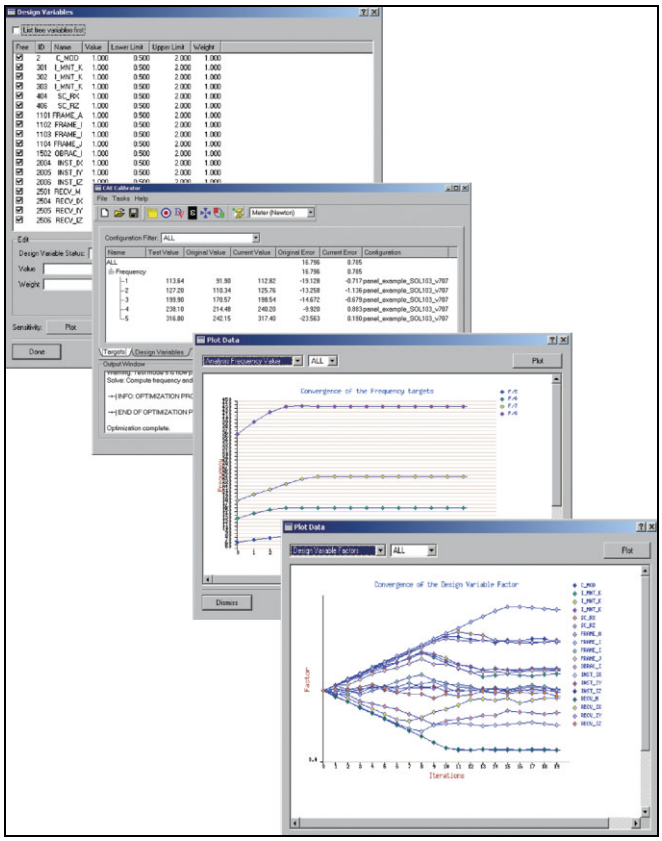
PRODUCT DATA

Test for I-deas FEM Calibrator — BZ-6067

FEM Calibrator for NASTRAN® software, is an advanced correlation tool designed to update finite element models to match real life test data as closely as possible. It significantly speeds up the correlation process, particularly for large models with many test files. The test data may include any combination of frequency, mode shape and frequency reponse function information. Several configurations, each containing separate test and analysis data, may be processed simultaneously.

Using genetic algorithms to achieve a full-scale Finite Element Model (FEM) updating task, and an intuitive, step-by-step interface, FEM Calibrator provides NVH engineers with a tool that reduces correlation process time in an industry where time-to-market is crucial.



USES AND FEATURES

USES

- Match Nastran FEM analysis results with experimental test data
- Update full-scale finite element models to match real life test data
- Speed up correlation process

FEATURES

- Allows the combination of natural frequencies, mode shapes and FRFs as well as multiple test boundary condition settings to be correlated simultaneously
- Embedded complex eigenvalue and FRF solver ensures proper updates of all mass, stiffness, and damping and sensitivity matrices while FEM parameters are being updated – reducing the overall correlation process by at least a factor of three
- Fine-tunes the physical and material properties of a Nastran FEM (analysis design variables) and optimises design variables for minimal errors between analysis and test
- Provides visual inspection of mode shapes
- Capability of automatic model updates
- Full integration with Brüel & Kjær PULSE data acquisition hardware platform

Brüel & Kjær

Description

If you conduct both digital (CAE) simulations and real prototype testing, you will benefit greatly from using FEM Calibrator to update your finite element (FE) model based on test results (or other calibrated FE model results).

FEM Calibrator helps engineers to tune the NASTRAN model's stiffness, mass, and damping in order to match its measured dynamic behaviour. This includes the stiffness (equivalent linear stiffness for non-linear items), mass, and damping properties of:

- Laminate materials
- Non-linear, or unknown materials
- Bolted and riveted connections
- Bonded joints
- Various weld connections
- Various estimated properties

Engineers often rely on previous experiences or estimated properties for modeling bolted connections, bonded joints and welds. FEM Calibrator reduces the uncertainty factor related to those approximations by finding the best stiffness and damping values for each FE variable.

You can also validate your choice of accelerometer location (reduced test model) to make sure the reduced model captures the complete dynamic behaviour within the frequency range of interest. FEM Calibrator significantly speeds up the correlation process, particularly for large models with many test files.

Test data may include any combination of:

- Frequency
- Mode shape
- Frequency Response Functions (FRFs)

Several configurations of the same FE model, each containing separate test and analysis data, may be processed simultaneously. The NASTRAN bulk data deck's physical and material property cards are parsed, and all common Nastran properties can be used as design variables.

Initially, you need to define which of the model parameters can be changed to improve the correlation – these are the analysis design variables. Optionally, FEM calibrator can help to create the design variables, which can be included in the Nastran input file. A Nastran analysis of the model can now be submitted with the supplied DMAP.

The DMAP writes mass, stiffness and damping matrices, as well as their sensitivities, to an .op2 file. FEM Calibrator reads these linear design variable sensitivities and expresses them as a function of the selected test data, or as targets.

When the targets that are important for each of the configurations are chosen, FEM Calibrator then optimises the design variables to minimise the errors between analysis and test data. Genetic, least squares and gradient-based algorithms can be used to optimise the selected FE model's physical and material properties to best match the test data, while minimising the changes to the FE model.

Finally, the NASTRAN FE model material and physical properties are updated automatically.

You can correlate:

- Test-analysis (main usage)
- Analysis-analysis (for example, reduced model against full model)

Main Features

FEM Calibrator process features (productivity gains) include:

- Nastran design variable creation for both SOL 103 and SOL 200 design variable format (with complete parsing of all NASTRAN input deck fields)
- Automatic update of all material and physical properties contained in the NASTRAN bulk data deck for both SOL 103 and SOL 200
- FE model update based on multiple configurations simultaneously (same test item, same FE model to update, but with different boundary conditions – for example, free-free versus fixed test-based) as well as combined FRFs, frequencies, and mode shapes for all the different configurations
- Sensitivity calculation performed at every iteration according to new eigenvalue solutions allowing larger (non-linear) design variable changes by piece-wise linear updating of sensitivities
- Wide range of FRF, mode shape and frequency test data: all Test for I-deas ADF formats; Universal files for frequency, mode shape, and FRF; ASCII files for frequency, mode shape and FRF; and NASTRAN op2 data support for analysis-analysis correlation
- Wide range of solution data output: ADF formats or ASCII for NX™ and NX I-deas™ visualisation

FEM Calibrator FE-updating technology advantages:

- Runs on Windows® and all NX I-deas UNIX® platforms
- Runs stand-alone or within NX I-deas Test
- Complete support to SOL 103 (DSA)
- Complete support to SOL 200 (no SOL 200 license required)
- Modal and physical domain fully supported
- Powerful genetic optimisation algorithm
- Full support to all NASTRAN (NX and MSC®) versions binary .op2 files on UNIX and Windows® operating systems
- Simultaneous optimisation based on frequencies, mode shapes and FRFs
- FRF correlation with amplitude and phase scaling options
- Automatic filtering or design variable disabling based on user-defined criteria or automatic criteria
- Shape correlation based on Modal Assurance Criteria (MAC) or cross-orthogonality (X-ortho) criteria
- Per iteration plotting of optimisation process
- Multiple methods for complex test mode shape support. Complex mode shapes are automatically converted to real normal mode shapes using the common amplitude method or Niedbal's complex transformation method

Industry Applications

Test engineers and testing standard organisations have long recognised the need for reliable, calibrated measuring instruments, and have developed a variety of methods and operating procedures to meet this need.

FEM Calibrator for NASTRAN software provides a rigourous means for NASTRAN users to leverage test data, previously calibrated models, or other external data to quickly and automatically compare, correlate, calibrate and update computer-aided-engineering (CAE) models for structural dynamics. Engineers from all industries will benefit from validated assumptions and better conditioned FE models.

Specifications – Test for I-deas FEM Calibrator BZ-6067

SUPPORTED HARDWARE AND OPERATING SYSTEMS
Runs on Windows®, UNIX® and all NX I-deas™ platforms
Contact us for any other specific hardware and operating systems support requests. Some additional hardware and/or operating system support may be available. If your hardware/operating system configuration is not listed here, please inquire with one of our engineering support staff

Ordering Information

BZ-6067	Test for I-deas FEM Calibrator

SERVICES

M 1-6067-F	Annual Software Maintenance and Support Agreement
M 2-6067-F	Annual Software Maintenance and Support Agreement

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