SIEMENS

Siemens PLM Software

NX FE Model Correlation

Compare simulation with test data

Benefits

- Enables you to determine whether your analysis model is accurate

- Assists you in selecting optimal sensor and exciter locations before performing physical modal tests

- Lowers training costs and increases productivity by enabling you to perform model correlation within a familiar environment that your engineers already use for analysis

- Saves time as changes in the FE model automatically propagate to the correlation calculations

Summary

NX™ Finite Element (FE) Model Correlation software enables you to quantitatively and qualitatively compare simulation and modal test results, as well as compare two different simulations. It provides the tools needed to geometrically align the models, pair the modes from both solutions, view mode shapes side-by-side and calculate/display correlation metrics. In addition to correlation, it includes pretest planning tools to help you better prepare your physical tests. NX FE Model Correlation is available as an add-on to NX Advanced Simulation or NX Advanced FEM, enabling you to leverage the power and ease of use of the NX environment.

When engineers create and simulate a finite element model, they often ask, "How do you know the analysis model is accurate?" NX FE Model Correlation helps answer this question by enabling you to compare the finite element model to measured test data so that engineers can assess the degree of match.

A high degree of match, or correlation, between the analysis results and the test data gives engineers confidence that the analysis model is accurate.

NX FE Model Correlation enables you to perform two types of comparisons.
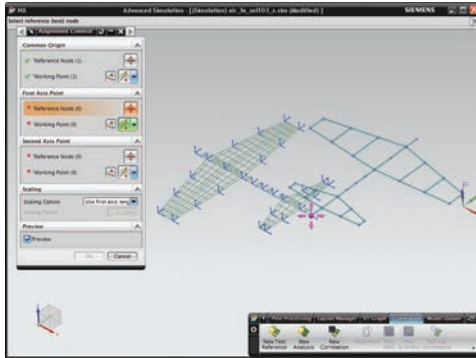
Test-analysis correlation

Analytical results are compared to measured test data, which is considered to be the reference or baseline. A high degree of match provides a high level of confidence that the analytical model accurately represents the physics of the structure.
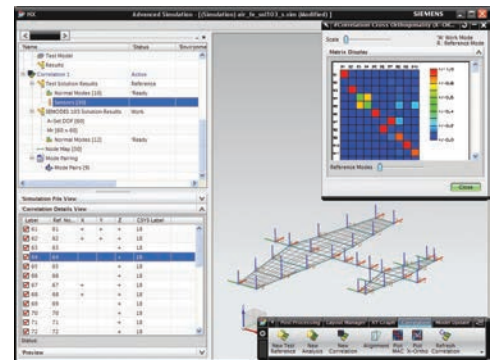
Test/analysis model overlay with sensors and MAC.

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NX FE Model Correlation

Test/analysis alignment with preview.

Analysis-analysis correlation

Two analysis models are compared, with one being the reference or baseline and the other being the working model. Each of the models can originate from different analysis programs. Alternatively, the models can originate from the same analysis program but with different levels of fidelity (e.g., a beam model might be compared to a shell model, or a coarse-mesh model might be compared to a fine-mesh model).

In addition, FE Model Correlation provides pretest planning capabilities that usethe finite element model and a normal mode solution to assist in selecting optimal sensor and exciter locations for modal testing.

Core functionality
NX FE Model Correlation provides the following core functionality.

Analysis normal mode solution access and results viewing

NX Nastran®, Abaqus, ANSYS and MSC. Nastran models are supported as both imported baseline results and NX working models.

## Test solution import through UNV or UFF files

Legacy and current datasets are supported for geometry, mode shapes and frequency response functions. Import features include multiple global and local coordinate systems support (Cartesian, cylindrical or spherical), unit system dataset support, automatic active sensor detection and complex to real mode shape conversion.

Reviewing modal test results

You can review the test frequency response functions, animate the test mode shapes and overlay the test geometry and sensor locations to the analysis model.

Pretest planning

You can graphically select required and candidate measurement locations to support local or global Cartesian, cylindrical and spherical coordinate systems. In addition, the Min-MAC sensor selection algorithm is provided to optimize the AutoMAC matrix and to ensure that each mode of vibration is uniquely identified during the modal test. Pretest planning can also optimize the number and location of exciters to ensure that all modes are adequately excited during the test.
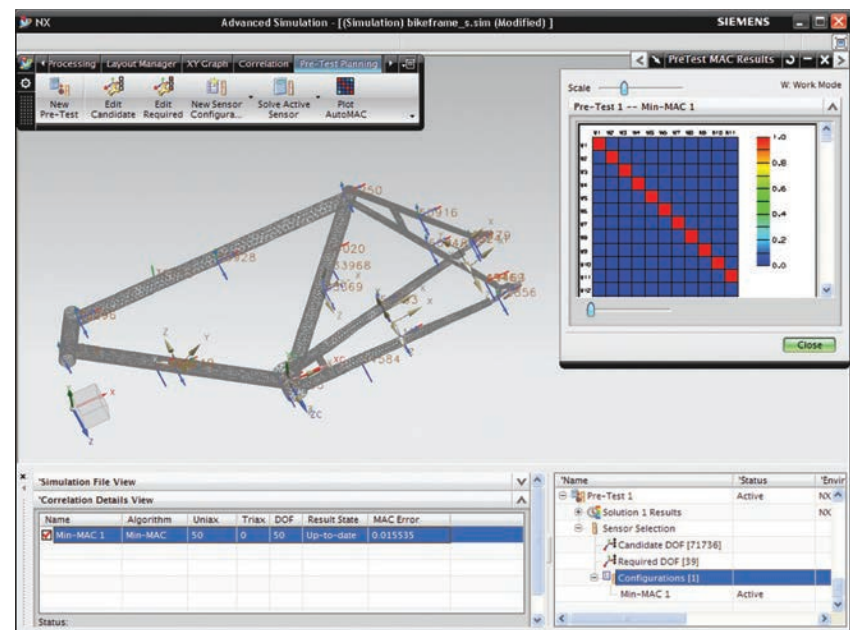
Pretest planning, selected sensors and autoMAC display.

Geometry mapping

The finite element model typically contains many more nodes than points measured in the modal test. The software automatically generates a node map assigning the appropriate finite element node to the corresponding test measurement point based on the proximity of their global coordinates. If required, you can align models interactively.

Modal assurance criteria (MAC)

Modal assurance criteria quantitatively compare all possible combinations of mode shape pairs.

Coordinate modal assurance criteria (COMAC)

This method helps you identify the location of systematic differences between the two result sets.

Cross-orthogonality[1]

The cross orthogonality method is similar to MAC except that the calculation is weighted by a reduced mass matrix. Typically, you perform this calculation for the test shapes, reduced analysis mass matrices and analysis mode shapes. You may also use the orthogonality calculation for comparing analysis-to-analysis through the reduced mass matrix (e.g. to verify sufficient TAM accuracy).

Mode pairing

You can pair the modes by different methods, including manually, and generate a table containing mode numbers, frequencies, percent difference and MAC value.

Visual comparison

You can display shapes and synchronized side-by-side animation directly from the mode pairs table.
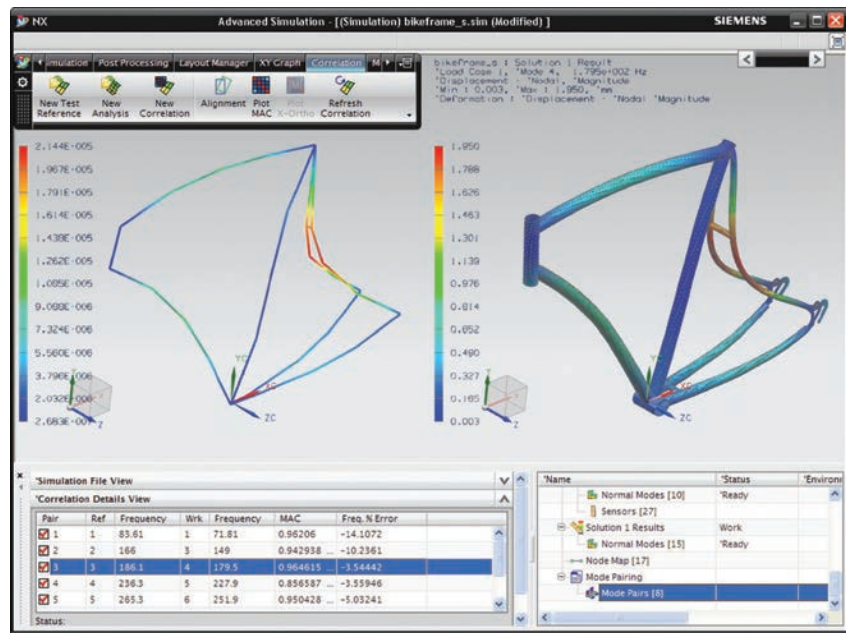
Mode pairs and side-by-side animation test/analysis.

1. Supported only for NX Nastran.