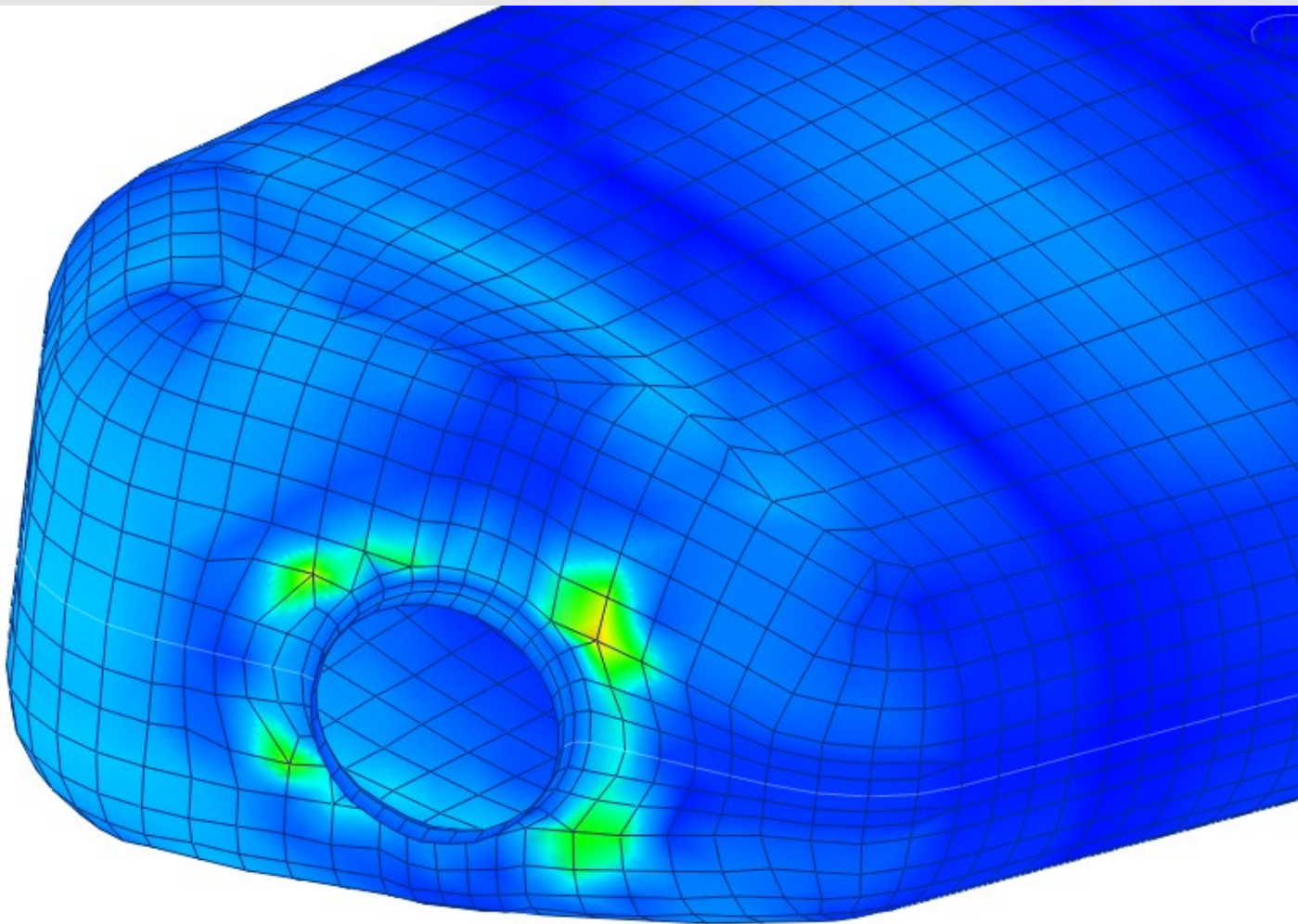


# FEMtools Model Updating

An Integrated Solution for Structural Dynamics Simulation,  
FE Model Verification, Validation and Updating



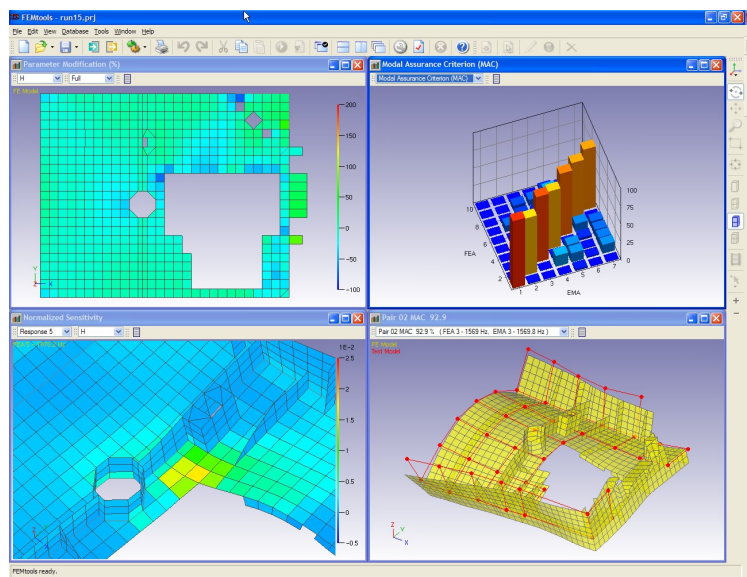
# Integrating Test and FE Analysis: Needs and Solutions

Designing products today offers many challenges: they must be stronger, lighter, safer, quieter, or using new materials. Products have to satisfy a widening range of design criteria, including environmental impacts.

To keep development time and cost competitive, companies rely on simulation tools. Finite element analysis (FEA) is a powerful technique to simulate the mechanical behavior of a product. The FEA method has matured to a point where design, meshing, analysis and post-processing are highly integrated and automated. This predictive approach relies on the quality of the model, the software to analyze it and the engineering judgment of the analyst.

Experimental analysis methods are based on prototype measurements under laboratory conditions or testing real-life situations. They are effective to learn about the product and the environmental conditions.

*“There can be no simulation without a reality check.”*



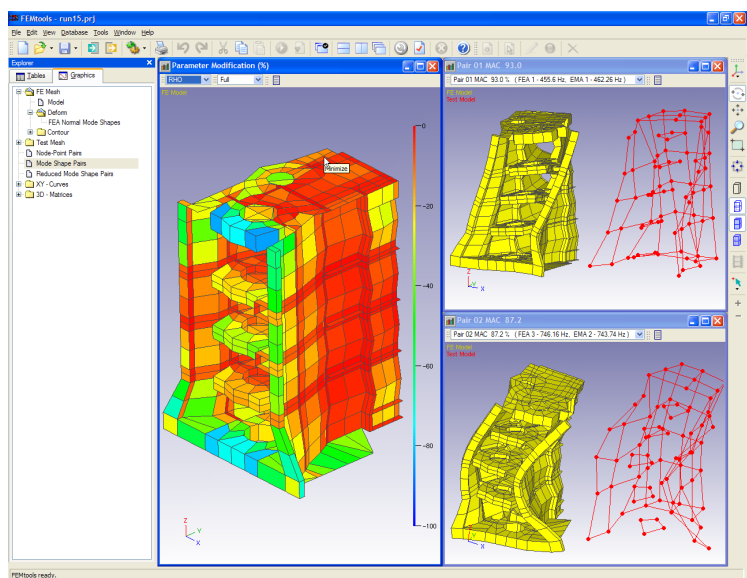
*Validation of modeling revealing too coarse meshing of corners.*

## What is FEMtools Model Updating?

FEMtools is a solver- and platform-independent CAE program providing advanced analysis and scripting solutions. With its unique tools to bridge test and FEA, the best of both worlds are combined to check and improve the validity of FE simulation models.

By including parameter identification, model validation and updating in design and analysis, information about the model and the required level of refinement is obtained in a more efficient and productive way than costly trial-and-error approaches.

FEMtools supports analysts and test engineers in this knowledge and decision-based process, offering a unique collection of tools that complement the general-purpose finite element analysis codes and test systems.



*Modal correlation and sensitivity analysis of an engine block.*

# Essential Tools for FE Model Verification, Validation and Updating

FEMtools is a modular application software designed around a relational database that can include analytical data and experimental data. All tools needed to correlate between two models, validate modeling assumptions, update input parameters and analyze uncertainty are included:

## Direct Data Interfaces

Bi-directional interfaces with most popular finite element analysis and test codes assure natural integration in an existing CAE environment. Models are not limited in size.

## Database Management

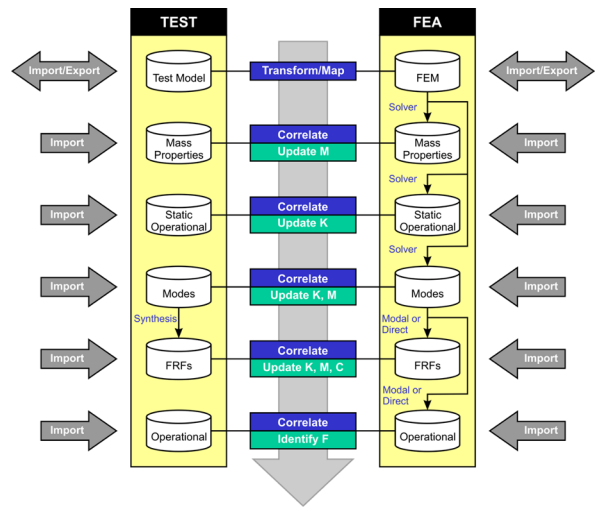
Utilities for interactive definition, editing and transforming data. Includes alignment of finite element and test models, expansion and reduction of databases.

## Static and Dynamic Analysis

Solvers, time and frequency domain response analysis, and powerful substructuring methods are available to compute analytical predictions for comparison with experimental reference data. FEMtools also seamlessly integrates external solvers.

## Pretest Analysis

Interactive add-on tools are available for extracting rigid body properties from FRFs or modal parameters from FRFs or cross power spectra (OMA).



## Correlation Analysis

Quantitative and qualitative analysis of correlation between static and dynamic analysis data coming from different sources. Global correlation is used to identify matching shapes. Local correlation is used to select updating variables or to identify structural damage.

## Structural Dynamics Modification

Tools to rapidly estimate the influence of structural changes on modal parameters of a structure.

## Sensitivity Analysis

Shows which parametric changes are effective and which are not. Supports boundary conditions, material properties, spring stiffness, and element geometry. Sensitivity information is used for design improvement and model updating.

## Automated FE Model Updating

Iterative process that modifies updating variables in order to minimize the 'distance' between test and simulation results. Results are used for mesh refinement, or identification of materials, joint stiffness and equivalent properties for use with low fidelity models.

## Uncertainty Quantification and Propagation

Probabilistic methods to predict random properties of responses from random input properties.

## Force Identification

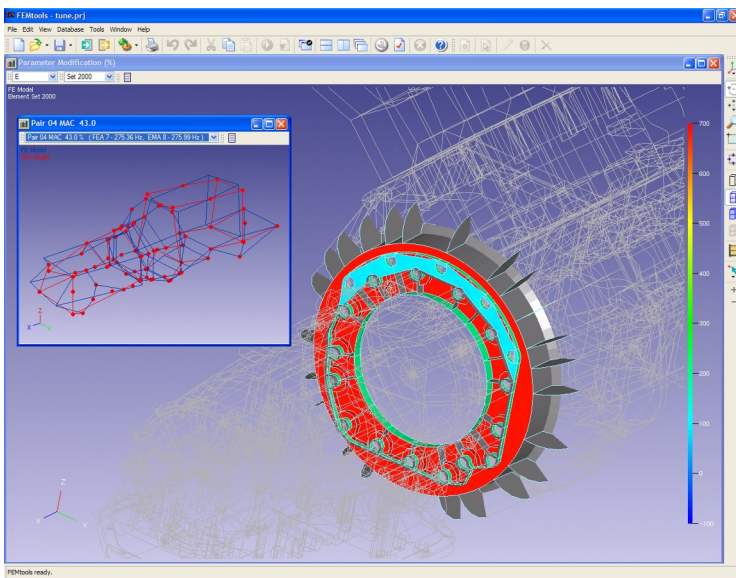
Identification of harmonic forces from measurement of harmonic responses using an updated finite element model.

## Graphics Viewers

Highly interactive tools for dynamic 3D visualization of finite element and test models, animated shapes and all FEMtools analysis results.

## User Interface and Scripting

All tools are available through an easy to use menu interface. Procedures can be automated or customized using an integrated scripting language and API for database access, process control, and user interface programming.



Local stiffness adjustment of a powertrain after modal correlation with test.

### Supported Platforms

- Windows 7, 8, 10 (64-bit)
- Linux (64-bit)

### Software Licensing

Flexible node-locked or network licensing of annual or paid-up licenses.

FEMtools licenses are sold and supported directly by Dynamic Design Solutions and by FEMtools Solutions Partners worldwide. Check the web pages or contact us to find out which partner serves your area.

### DDS Customer Services

- Regular software maintenance
- Installation, training and customization
- Hotline support by e-mail and phone
- Internet support site
- Custom software development
- Project research
- Engineering services

### About Dynamic Design Solutions

Dynamic Design Solutions ("DDS") is an independent and privately owned company that develops CAE software tools for validating simulation models, optimizing engineering designs, modal testing and automating simulation processes.

We provide solutions that help FEA and test engineers to improve the fidelity of FE models, identify structural properties, assess uncertainty of variables and incorporate variability into models. These validated models can then be used with more confidence to improve performance under real world conditions.

Dynamic Design Solutions is a technology leader in Finite Element (FE) model updating using static or dynamic reference test data. We service a wide spectrum of industries including aerospace, automotive, defense, marine, manufacturing, power, sports and education.

Many prestigious companies and institutions have relied on our unique and proven technologies combined with the best possible support and technical expertise by a dedicated team of specialists.



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