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# Simcenter 3D FE Model Updating

## Improve analysis model accuracy

**Benefits**

- Improves accuracy and increases confidence in your FE models
- Saves time as changes made in the working FE model automatically propagate to the correlation and model updating calculations
- Avoids rework as model update automatically propagates results back to the FE model
- Lowers training costs and increases productivity by enabling you to perform model updating within a familiar environment that your engineers already use for analysis


**Summary**

Simcenter™ 3D Finite Element (FE) Model Updating is an advanced correlation tool designed to automatically update FE models to match real life test data as closely as possible. Simcenter 3D FE Model Updating is fully integrated with Simcenter Structures, making the updating process easier and more productive than ever before. It is an add-on to Simcenter FE Model Correlation, enabling you to leverage the power and ease of use of the Simcenter 3D environment, including all correlation capabilities.

Engineers often rely on previous experience and best practices for modeling components, physical properties and materials of a complex nature. Validation procedures, which typically include finite element model correlation, help to confirm that the right assumptions have been made and sound modeling methodologies have been applied.

Once engineers establish sufficient fidelity of a model, Simcenter 3D FE Model Updating provides them with the tools to further improve the model by finding the best values for selected parameters to match the test results (or another baseline analysis result) even more closely.


**Core functionality**

Simcenter 3D FE Model Updating provides the following core functionality.

### Interactive design variable definition

You can choose from a large number of design variables of different types, including material properties (isotropic, orthotropic, anisotropic) and element properties that affect system mass and stiffness. Laminate ply thickness and angle can be used as design variables and may be defined from the ply definition in the Simcenter Laminate Composites module.

### Dedicated DESOPT 200 – Model update solution

Support is provided for static (Guyan) or modal reduction, design variables and A-Set or U-Set DOF to generate OP2 output including reduced model matrices and sensitivities. No manual editing of Nastran® input decks is required. You do not need to separately purchase a DMAP or SOL 200 license.

### Design variable sensitivities

You can compute and plot the sensitivity matrix for all design variables and targets.

### Filtering of design variables

You can effectively manage a large number of design variables during the optimization process using filtering based on user-defined criteria or automatic criteria.

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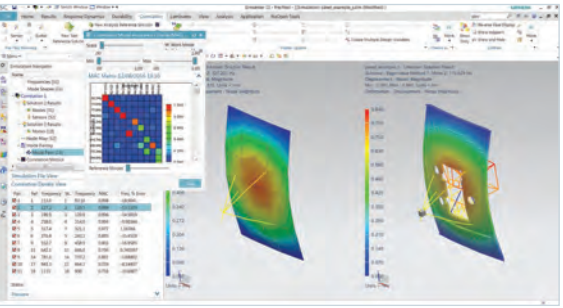


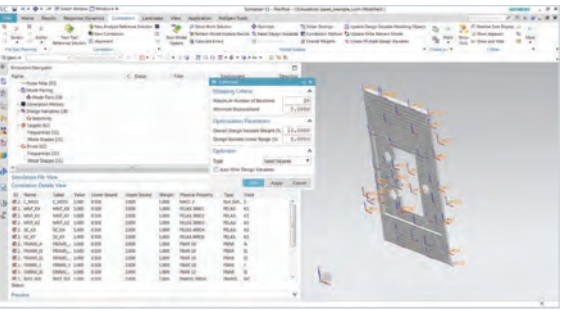
Side-by-side mode shape animation.

## Frequency and mode shape targets

You can choose the frequencies and/or mode shapes that you want to include in the optimization target function with any combination of weights. This capability includes support for mode shape correlation based on modal assurance criteria (MAC) or cross-orthogonality.

## Embedded eigenvalue solver

Simcenter 3D FE Model Updating rarely requires the normal mode solution to be re-solved for the full FE model. Instead, it performs a sensitivity calculation at every iteration according to new eigenvalue solutions allowing larger (nonlinear) design variable changes by piece-wise linear updating of the sensitivities. This approach achieves accurate updating results in only a few iterations.



Optimization with Design Variable listing.

## Multiple optimization algorithms

You have a choice of least squares, steepest descent, and genetic optimization algorithms.

## Accommodation of FEM changes

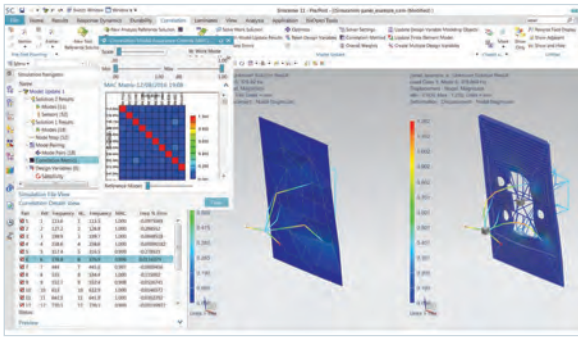
Simcenter 3D FE Model Updating handles any changes you make to the underlying FEM (model geometry, meshing, material or physical properties). After re-solving, Simcenter automatically re-performs spatial correlation (node matching); the entire updating con-figuration is retained so you can immediately continue the updating process.

## Complete FEM and SIM update capability

You can update either the design variable modeling objects or the FE model. After updating the FEM, all other solutions contained in the SIM (e.g., structural static, dynamic) are immediately ready to be solved using the updated parameters.

## Ability to leverage all Simcenter FE Model Correlation's capabilities

Simcenter 3D FE Model Updating leverages imported test data, geometry mapping, sensors and degree-of-freedom sets. It also provides access to correlation metrics (e.g., MAC, COMAC) and side-by-side mode shape animation, just as in the correlation solution process.



Side-by-side mode shapes test/analysis and MAC after model update.

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