Solution brief

MSC Apex® Structures

Computational parts based structural analysis

Overview

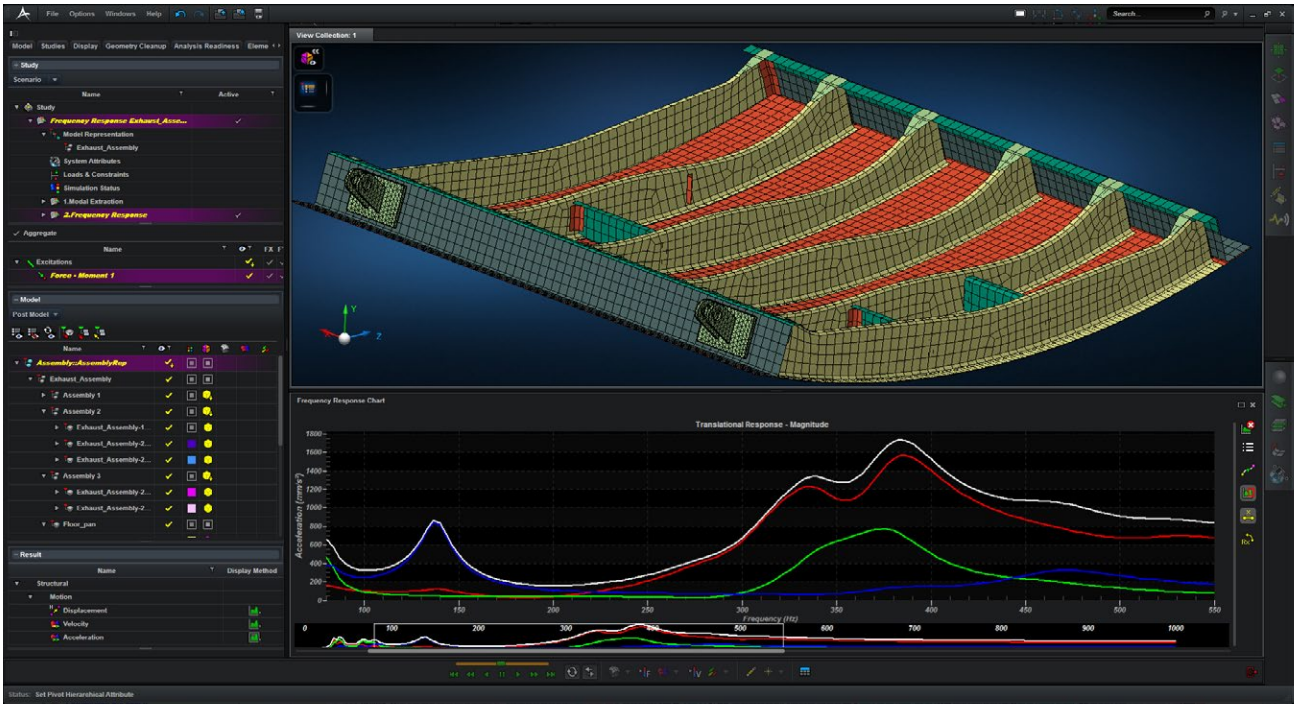
MSC Apex Structures is an add-on product which expands MSC Apex Modeler functionality with capabilities for linear structural analysis.

MSC Apex structures packages a user interface for scenario definition and results post-processing, as well as integrated solver methods. This solution is unique in that it combines computational parts and assemblies technology with a generative framework, which enables interactive and incremental analysis.

The integration of the user interface with solver methods gives the user a unique ability to interactively and incrementally validate that FEM models are solver ready. At the user's demand, a series of solver checks can be run against individual parts and assemblies and the model diagnostics are reported in the Analysis Readiness panel. This Incremental Validation is a radical departure from the very time consuming traditional approach where pre/post processor and solver are separate.

In addition, a frequency response analysis type and a specialized results exploration toolset is available to aid engineers improve the vibration behavior of structures.

The integrated toolset of MSC Apex enables analysts to experiment with mode contributions and develop design solutions to mitigate and control structural vibrations, all without committing to excessive modeling changes and re-analysis.



Capabilities

Generative framework

- Geometry, Mesh, Material, Property and Behaviors, Glue: mesh-dependent connection, Load and Boundary Conditions, Scenarios and Results automatically update with changes to the model

Incremental validation

- Context specific (Part, Sub-assembly, Assembly)
- Regenerative Analysis Readiness for mesh, materials, properties, LBCs, interactions, and simulation settings to guide the user on quickly achieving run ready models

Incremental solve

- Computational Parts and Assemblies Linear Structural Analysis

Linear structural analysis

- Linear Statics
- Normal Modes
- Linear Buckling
- Dynamic Frequency Response (including Pre-stiffening)
- Specify a multi-step Frequency Response Analysis: 1) Pre-stiffening (optional), 2) Normal Modes, 3) Frequency
- Response Analysis
- Multiple events

Results view

- Use a hot spot tool to identify critical displacements and stresses
- Animate deformed shapes
- View and interactively switch between multiple normal modes via modes navigator
- Use a Results Manager to view analysis results by study, part, assembly or result type
- Transform results to Cartesian, cylindrical or spherical coordinate systems
- View fringe color plots of displacements, stresses, strains, etc.
- Vector plots of displacements, applied loads, constraint reactions, and more
- Create Sensors and monitor responses at specific points such a displacements and stresses
- Display results in XY plots
- Specific failure criteria

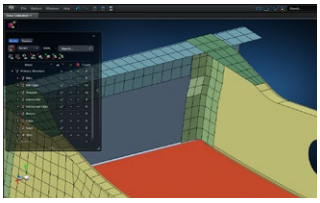
Study manager

- Manage multiple scenarios (model representations, output requests, analysis type)

Structural analysis workflow

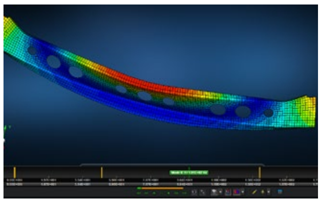
1. Set model and analysis context

Define the analysis type and a subset of parts and assemblies to be the context of evaluation



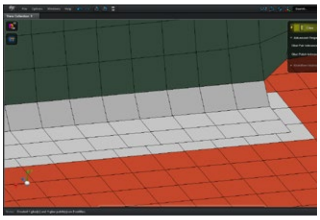
2. Validate models prior to analysis

Use the integrated analysis readiness tool to validate the context has valid model representations for the chosen analysis type



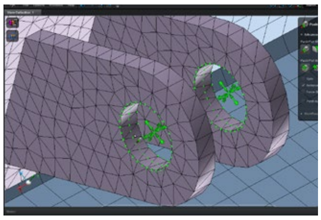
3. Join dissimilar meshes rapidly

Reduce the need to align nodes across mesh parts using mesh independent glue technology



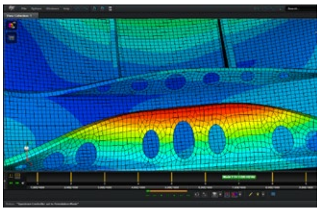
4. Make generative changes

Track the status and manage the update of downstream updates whose parent has been modified



5. Generate and visualize results for Linear Statics

Define a linear static or normal modes scenario and execute the integrated solver methods to generate results interactively

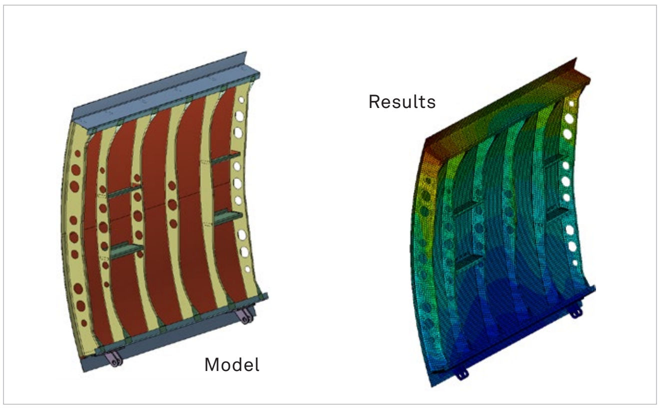


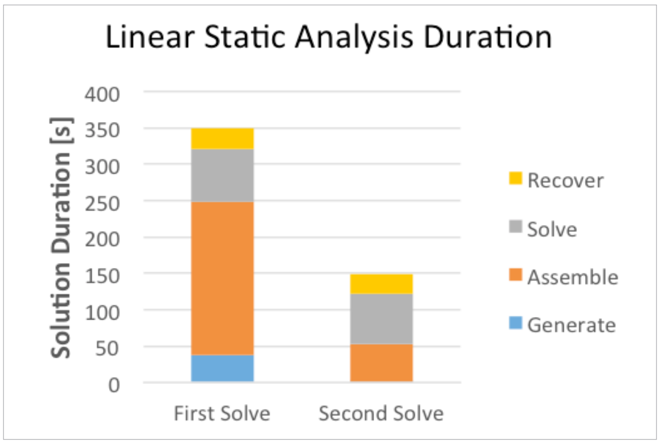
6. Generate and visualize results for Frequency Response

Perform frequency response analysis & use a results exploration toolset to develop solutions to mitigate and control structural vibrations.

Productivity gains

For this landing gear door assembly, Computational Parts technology was used to perform an incremental analysis. After modifying one part of the assembly, an incremental or subsequent analysis completed 2.5x faster than its first solve.





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Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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