MSC Apex® | Structures

Computational Parts Based Structural Analysis

Overview

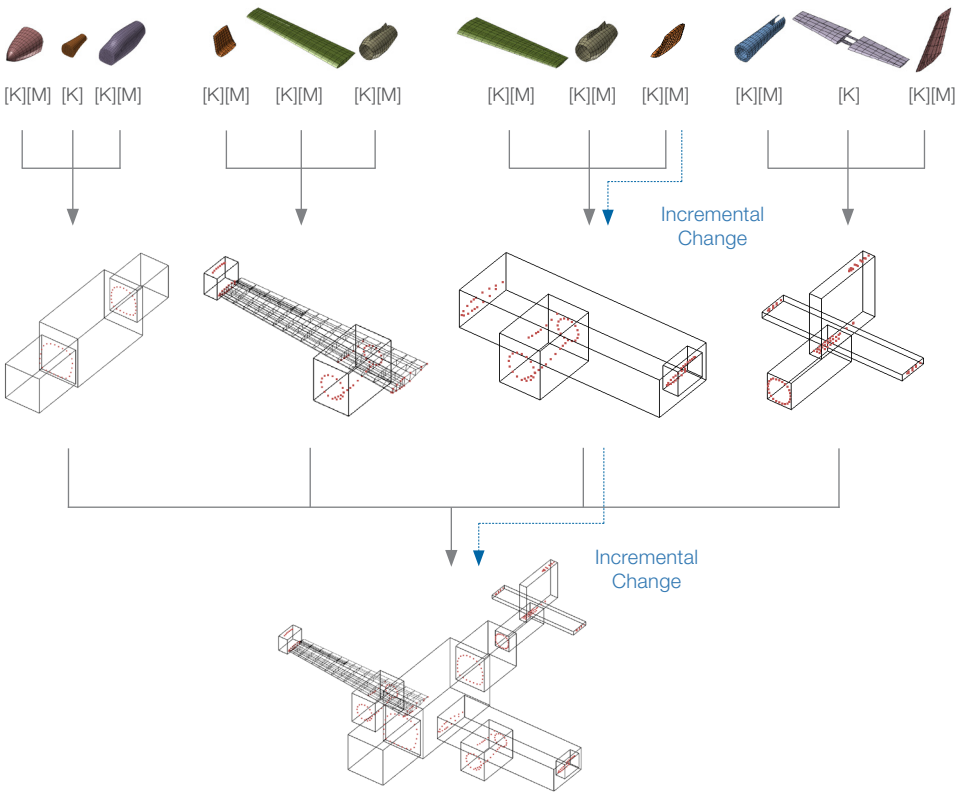
MSC Apex Structures is an add-on product which expands MSC Apex Modeler functionality with capabilities for linear structural analysis.

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, with Computational Parts and Assemblies, MSC Apex Structures is a true parts-based solution, where each part behavioral representation (Stiffness, mass, and damping) can be pre-computed and stored independently. This approach is especially efficient when combined with the MSC Apex generative framework, as the solver execution will only re-compute behavioral representations for parts that have changed since the last solver execution. We call this Incremental Solving. This new solver architecture is especially efficient in the context of trade studies.

Computational Parts Architecture



Each original part is converted to a computational part and arranged to form the computational assembly.

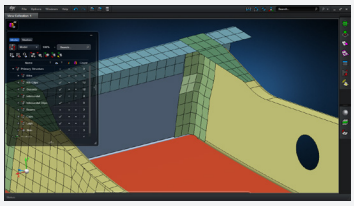
Capabilities

- Generative Framework
  - Geometry, Mesh, Material, Property and Behaviors, Glue, Load and Boundary Conditions, Scenarios and Results
- Linear Structural Analysis
  - Linear Statics and Normal Modes
- Loads & Constraints
  - Concentrated Force and Pressure
  - Fixed Constraint
- Incremental Validation
  - Regenerative Analysis Readiness for mesh, materials, properties, LBCs, interactions, and simulation settings
  - Context specific (Part, Sub-assembly, Assembly)
- Incremental Solve
  - Computational Parts and Assemblies
- Study Manager
  - Manage multiple scenarios (model representations, output requests, analysis type)
- Post-Processing
  - Results display for static and normal modes
  - Results animation, including modes navigator
  - Spectrum controller
  - Results display in Cartesian, cylindrical or spherical coordinate systems

Structural Analysis Workflow

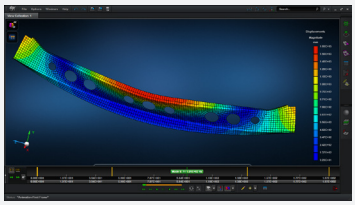
1 Set model and analysis context

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



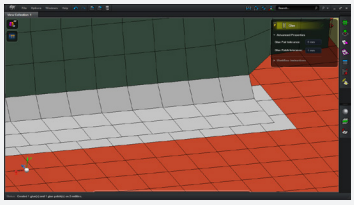
2 Validate models prior to analysis

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



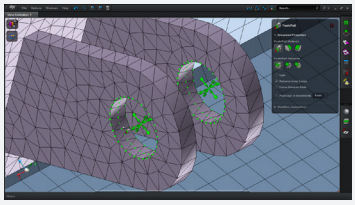
3 Join dissimilar meshes rapidly

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



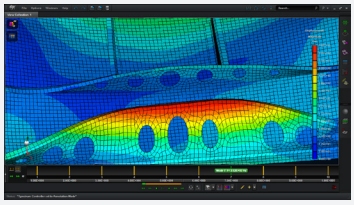
4 Make generative changes

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



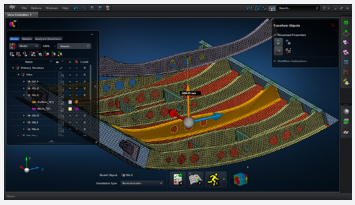
5 Generate and visualize results

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



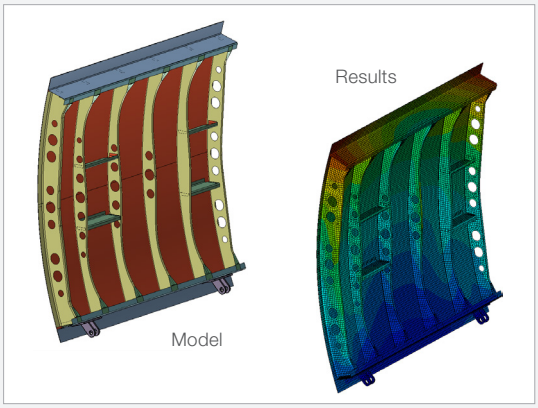
6 Evaluate different design variants

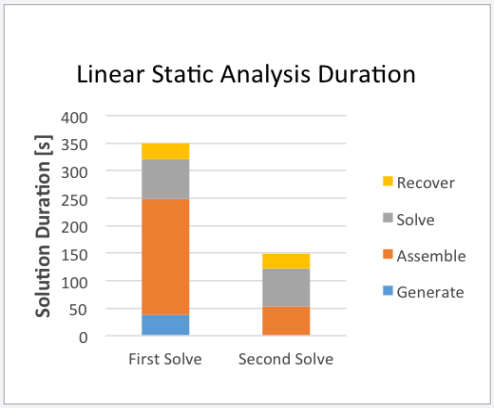
Modify parts interactively and incrementally generate results to explore a design space



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.





Corporate
MSC Software Corporation
4675 MacArthur Court
Suite 900
Newport Beach, CA 92660
Telephone 714.540.8900
www.mscsoftware.com

Europe, Middle East, Africa
MSC Software GmbH
Am Moosfeld 13
81829 Munich, Germany
Telephone 49.89.21093224
EXT. 4950

Japan
MSC Software LTD.
Shinjuku First West 8F
23-7 Nishi Shinjuku
1-Chome, Shinjuku-Ku
Tokyo, Japan 160-0023
Telephone 81.3.6911.1200

Asia-Pacific
MSC Software (S) Pte. Ltd.
100 Beach Road
#16-05 Shaw Towers
Singapore 189702
Telephone 65.6272.0082

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