



## DIGITAL INDUSTRIES SOFTWARE

# Simcenter Simsolid for aerospace: 25 to 100 times faster than traditional FEA

### Solution brief

In today's fast-paced aerospace industry, faster design iterations and quicker assessments of computer-aided design (CAD) variants are essential for achieving design maturity and staying ahead of the curve. Traditional finite element analysis (FEA) tools for multidisciplinary, structural and thermal analysis can take days or even weeks to deliver results. Simcenter™ Simsolid™ software revolutionizes this process, delivering highly accurate results in just seconds to minutes. With no need for special training, CAD cleanup, simplification, meshing or high-end graphics processing units (GPUs), Simcenter Simsolid streamlines workflows and empowers you to make faster, more informed decisions, helping you stay ahead of the competition.

### Challenges

- Shorten lengthy CAD preparation and meshing processes
- Reduce reliance on specialized FEA expertise and training
- Model large, complex assemblies without oversimplification

### Solutions:

- Enable rapid "what-if" exploration with seconds-to-minutes solve times
- Run simulations on standard central processing units (CPUs) without specialized hardware
- Empower designers with intuitive, analyst-free simulation tools
- Eliminate analysis bottlenecks that delay design feedback

## Results

- Increased first-pass design success
- Accelerated time to market with 25-100 times faster workflows
- Increased prediction accuracy with high-fidelity connections and realistic load cases
- Lowered development costs by reducing rework and hardware spend

## FEA too slow for design

Simulation for multidisciplinary, structural and thermal analysis has traditionally been used only for validation, not design. The reason is speed, or rather, a lack thereof.

Over the years, many vendors have sought to implement simulation earlier in the development process. Various CAD-embedded structural simulation tools automate some elements of the simulation workflow, but most have significant drawbacks.

Almost all these tools are based on finite element analysis (FEA), a method that has long been used for structural analysis. Unfortunately, FEA methods are difficult to learn, and you need to understand the methodology to use the tools effectively. Gaining that knowledge requires extensive training and practice.

Even after you've acquired the expertise, setting up an FE model is a tedious, time-consuming process. The CAD assembly must be significantly simplified, with substitute load cases defined at interfaces. Individual CAD geometries often require modification before meshing. Mesh size and quality must be carefully considered to achieve an acceptable balance between accuracy and runtime. Even then, calculation runs can take hours.

Moreover, it's difficult to apply FEA solutions to complex systems. Due to the amount of time required for CAD preparation, meshing and runtime calculations, it's time consuming to apply FEA to large assemblies, particularly in the early stages of design.

Nearly every structural analysis solution available today shares these drawbacks, with one exception.

## Simcenter Simsolid: A simpler, uniquely efficient solution

That exception is Simcenter Simsolid. Unlike traditional tools, Simcenter Simsolid is built on a powerful generalization of the finite element method. It leverages a cutting-edge formulation based on deep mathematical research developed over many years, which at its core is a breakthrough extension of the theory of external approximations. This allows Simcenter Simsolid to use arbitrary geometrical shapes as "finite elements," with shape functions that are independent of the geometry and can be of any class. Solution accuracy is controlled by a multi-pass adaptive solver.

This allows the CAD assembly to be used as it is for simulation and eliminates the need for traditional geometry cleanup and meshing.

Simcenter Simsolid delivers industry-trusted accuracy while being significantly faster and easier to use than traditional simulation tools. Unlike conventional FEA, Simcenter Simsolid produces results in seconds to minutes — not hours or days — empowering engineers with rapid design insights when they matter most. Combined with dramatically reduced model preparation time, Simcenter Simsolid delivers simulation workflows **up to 25 to 100 times faster** than traditional FEA, without compromising accuracy. Users consistently report improved prediction quality, thanks to the ability to simulate more complete assemblies and apply realistic load cases, eliminating much of the guesswork involved with simplified boundary conditions. The result is better designs, shorter development cycles, improved performance and lower costs. Simcenter Simsolid enables simulation-driven design.



The speed and accuracy of Simcenter Simsolid and the efficiency of the Siemens Xcelerator suite allowed us to develop the most complex aerostructure assemblies with confidence and faster than ever before, increasing the ROI.

Cristóbal León,  
Head of R&D,  
INESPASA

[Learn more](#)



Simcenter Simsolid is unique in that it's both fast and accurate, helping achieve meaningful design inputs in a fraction of the time it would take using typical, pre-existing tools.

Analysis and Flight Sciences, Astra  
[Learn more](#)

### **Numerous advantages over traditional FEA tools**

Simcenter Simsolid offers several advantages over conventional FEA-based tools.

**No CAD assembly reduction, geometry cleanup or simplification:** Building a reliable FE model requires both time and expertise. Manufacturing-ready CAD assemblies are often far too detailed for simulation, requiring extensive manual simplification — like removing holes, fillets or small features; combining parts; or reducing assemblies. These tasks are not only time-consuming but often require separate tools.

Simcenter Simsolid eliminates these bottlenecks. There's no need to simplify geometry, manually prepare assemblies or worry about meshing errors. You can work directly with full-featured CAD models — no cleanup required.

**No more meshing around:** FEA tools rely on meshing. But meshing presents several obstacles to achieving satisfactory results.

First, there's the trade-off between accuracy and runtime. Generally, the finer the mesh, the more accurate the results. Of course, the more elements one has, the longer the runtime. Deciding what element size and mesh quality to use requires expert know-how. Particularly for thin solids, other tools often rely on an extremely high number of elements, making simulations computationally expensive or even overwhelming system memory — effectively locking up the machine for the duration of the analysis.

Second, the FE model must be simplified to make it computationally practical. For example, experienced simulation engineers often represent thin-walled structures — such as truck frame and its attachments — using mid-surface models with 2D Shell elements. This approach demands time, expertise and significant prep work. With Simcenter Simsolid, none of this additional effort is required.

Third, meshing is time-consuming. As we'll see in the next section, Simcenter Simsolid greatly reduces the time required for CAD prep and modeling by factors of 10x or more. Thanks to its advanced mathematical formulation, no meshing is needed within Simcenter Simsolid — the manufacturing-ready CAD model is the simulation model. And the solution is computationally lightweight, allowing users to perform other work in parallel during the solve. This cutting-edge formulation makes simulation with Simcenter Simsolid much faster than other FEA tools, including CAD-embedded FEA.

**Simulate complex assemblies accurately:** Building connections between parts is time-consuming and requires expertise. As a result, connections are often idealized, allowing for more approximations in the solution. Other tools lack the means to create welds or fasteners between parts, apply tightening, or introduce friction. Their results are therefore inaccurate, since the interactions between parts and the behavior around connections aren't captured correctly.

Simcenter Simsolid, on the other hand, takes advantage of all the data available in CAD files and uses high-fidelity connections to ensure accurate representation and simulation of real-world behavior. It automatically locates, classifies (holes, fasteners, nuts, bolts, washers, springs, thin sheets, bearings and welds) and creates connections as defined in the manufacturing-ready CAD model. For connections that may not be present in CAD, such as seam welds, spot welds, laser welds and adhesives, users can easily create them inside Simcenter Simsolid.

**Drive early design decisions:** Simcenter Simsolid brings simulation to the forefront of the design process, enabling faster design cycles and more informed decision-making. It empowers both designers and analysts to make validated, data-driven changes early in development — when adjustments are less costly and more impactful. With Simcenter Simsolid, teams can rapidly explore multiple design alternatives without risking project delays. By maximizing first-pass design success and reducing reliance on traditional assumptions, the tool helps achieve robust, high-quality results faster. Traditional workflows often leave designers waiting days or weeks for simulation feedback due to analysis bottlenecks. Simcenter Simsolid eliminates this delay by placing simulation directly in the hands of the design team, significantly improving design performance, reducing costs and accelerating time-to-market.

**Flexibility to run on a standard PC, in the cloud or on HPC:** Other tools use your computer's GPU as well as its CPU in making their calculations. They require a high-end GPU that can cost thousands of dollars — a significant investment for every user running them.

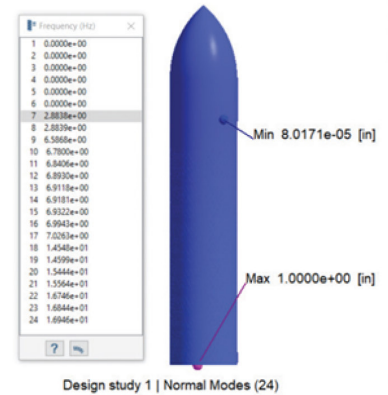
Simcenter Simsolid, on the other hand, runs all calculations on your computer's CPU without the need for expensive GPUs.

As organizational needs change and evolve, you can also leverage cloud and high-performance computing (HPC). While most models can be simulated on a standard PC, Simcenter Simsolid offers the flexibility to leverage HPC and gain optimal performance for very large models as well.

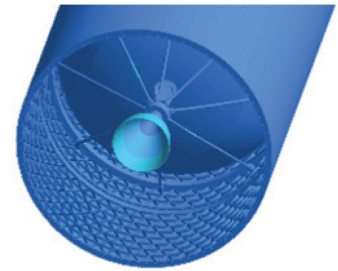
### Simulation for all

Because Simcenter Simsolid is easy to learn and use, more people in your organization can take advantage of it. You don't have to be an analyst. You don't need to know anything about the mathematics behind the method; that's all transparent to the user. You don't even need a lot of training or experience to get the results you need.

In short, Simcenter Simsolid delivers world-class simulation to everyone on your team.



Design study 1 | Normal Modes (24)



A representative rocket model in Simcenter Simsolid

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