SIEMENS

Siemens PLM Software

LMS Samcef Solver Suite

Enabling you to accurately describe and model the physical behavior of structures and mechanisms

Benefits

- Accurately describe and model the physical behavior of your structures and mechanisms
- Identify what happens during complex kinematic moves
- Assess and control the vibration level acting on your structures and inducing fatigue phenomena
- Better predict fatigue phenomena due to cyclical heating of structures
- Substantially reduce modeling time when a detailed thermal analysis is needed or when material degradation needs to be taken into account
- Treat large-scale problems or mixed composite/metallic structures

Summary

LMS Samtech Samcef™ Solver Suite software is based on the finite element method (FEM) and covers a wide range of mechanical, thermal and thermomechanical applications – from basic to very advanced – primarily in the aerospace, defense and automotive industries.

You can apply the mechanical FEM solver solutions to linear applications, such as static computations, modal and buckling analyses, dynamic simulations, superelement generation, random excitations and shock responses. Nonlinear transient simulations can also be performed with this family of solutions. Material nonlinearities, geometric nonlinearities, contact conditions, large rotations and kinematic constraints can be taken into account. A dedicated module also exists for high-speed rotating machines. Thermal simulations allow solving transient analysis, including convection, conduction, radiation and ablation.

Several levels of modeling are available, including 2D plane stress or plane strain, harmonic and multi-harmonic, cyclic symmetry and full 3D.

As these modules are all part of the same family, you can switch from one analysis to another (convert a linear simulation to a transient nonlinear simulation), combine analyses (thermomechanical and prestressed modal analysis) or conduct co-simulations. With parallel computing capabilities, the LMS Samcef Solver Suite also allows you to solve very large finite element models.

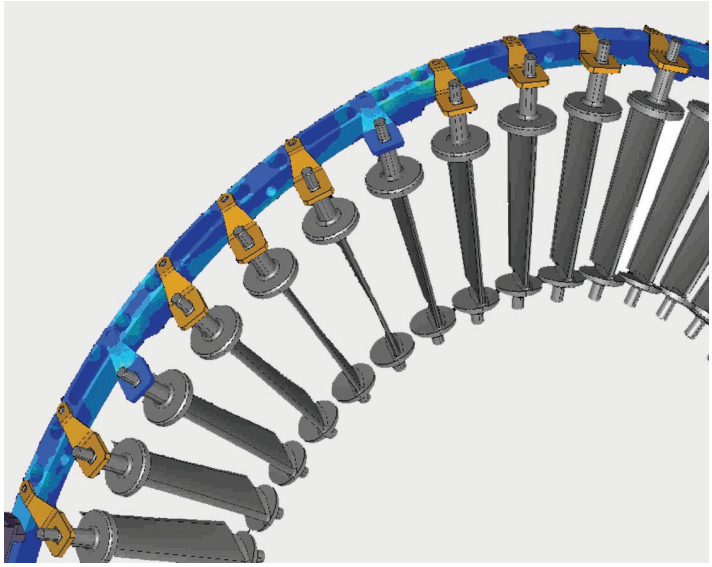
Nonlinear analysis

LMS Samtech Samcef Mecano Motion software enables you to model any articulated mechanism in a transient simulation and improve the dynamic properties of the mechanism. The model can be created by nonlinear flexible beams, superelements or rigid bodies linked through rigid or flexible kinematic joints (such as hinges, sliders, gears and universals) as well as specific elements (such as wheels and general nonlinear forces). The relative motion in the kinematic joints can be controlled by a number of functions, including springs,

LMS Samcef Solver Suite

Features

- Static, kinematic and dynamic analysis
- Seamless exchange between thermal and mechanical analysis
- Defines articulated mechanisms
- Ability to analyze the curing of composites
- Availability of thermo electromagnetic elements (such as a lightning strike)
- Complete XFEM (initiation and propagation) technology that is fully integrated into the LMS Samcef environment



Motion analysis for kinematic and dynamic behavior of flexible and articulated mechanisms.

dampers, contacts and prescribed movements.

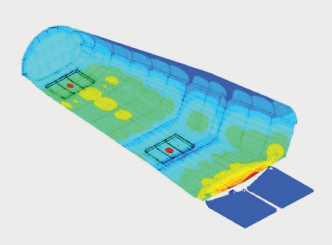
This multibody approach is based on an implicit finite element theory. Combined with the LMS Samtech Samcef Mecano Structure Analysis module, the nonlinear motion solution lets you replace rigid bodies with meshed flexible components. This process allows you to take into account local nonlinearities, such as prestressed components, contact friction between two flexible components and hyperplastic materials.

Linear analysis
LMS Samtech Samcef Linear software provides a large library of finite element solvers combined with a wide selection of loads and boundary conditions to provide you with a best-in-class modeling tool. The linear structural analysis solution includes a complete selection of single or multilayer elements that can be isotropic, orthotropic, anisotropic or composite. Elements can be solid, shell, membrane, beam (in the context of plane stresses), plane strains, axisymmetric with original multi-harmonic shape functions, 3D cyclic symmetry or full 3D formulation.

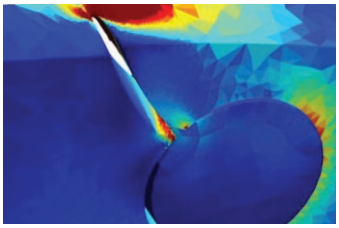
The powerful finite element solvers in LMS Samcef Linear help you avoid issues with large sizes on a standard computer as well as in a high-performance computing environment. In addition, some chaining capabilities are available in the suite of finite element solvers to perform analyses after a static or modal analysis.

Thermal analysis
LMS Samtech Samcef Thermal software enables you to model thermal and thermo-mechanical problems affecting structures. The thermal solver models conduction and advection are subjected to convection and radiation boundary conditions. The finite element library consists of many element types, allowing anisotropic and multilayer composite properties.

You can apply the convection boundary conditions directly to the structure or via flow channels using correlation formulas. You can also apply thermal contact between dissimilar meshes as well as perform a view factor calculation using a ray tracing algorithm. The surface radiation calculation includes wavelength dependent thermo optical properties and the application of a solar flux, including shading.



Complex thermal and thermomechanical problems, including contact and radiation.



Model structural integrity, including crack propagation using XFEM.

In addition to basic thermal elements, fully coupled thermo electromagnetic elements are available. This modeling is used to calculate heating of a structure (and possible degradation) while solving Maxwell equations.

Thermal response

All properties in LMS Samcef Thermal (material, boundary conditions and contact conditions) can be a function of temperature resulting in the creation of a nonlinear problem. The thermal solution shares parallel nonlinear solver technology with LMS Samtech Samcef Mecano and LMS Samtech Samcef Amaryllis software. This common platform is beneficial when performing a thermomechanical analysis. With a fully coupled approach, you can model heat generation by material deformation (plasticity) as well as friction. You can use LMS Samcef Amaryllis to study the thermal response of the heat shield of atmosphere reentry vehicles or composite structures subjected to fire.

Fracture mechanics

LMS Samtech Samcef Fracture Mechanics software has standard modeling capabilities that are dedicated to the study of the propagation of cracks in materials, or fracture mechanics. The fracture mechanics solution includes specific elements that allow you to capture the stress field singularity, as well as some that are dedicated to postprocessing so that you can compute stress intensity factors, the components of Rice's J-integral and the energy release rates by mode.

An extended finite element method (XFEM) provides 3D modeling of crack propagation (independent of the mesh). You can model several cracks with automatic fatigue crack propagation (Paris, Elber, Forman and Nasgro) with automatic remeshing during propagation. With this XFEM approach, it is easier to define the crack because the model doesn't require a change to the geometry or mesh due to the accuracy of the solution.

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