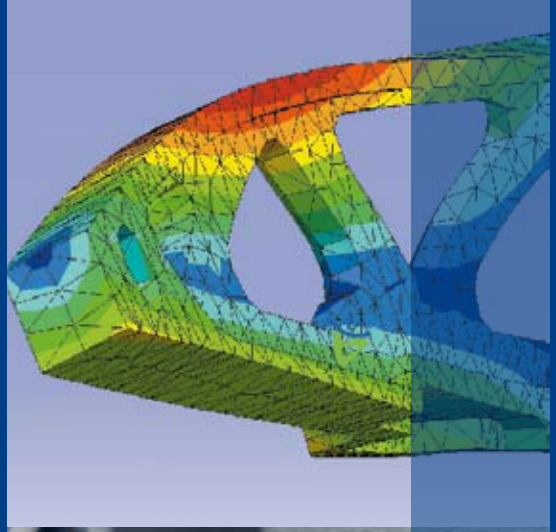

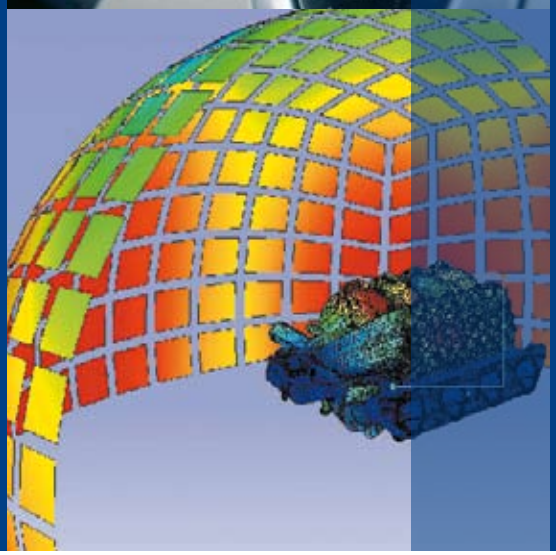

LMS Virtual.Lab Designer

Performance simulation in CATIA V5

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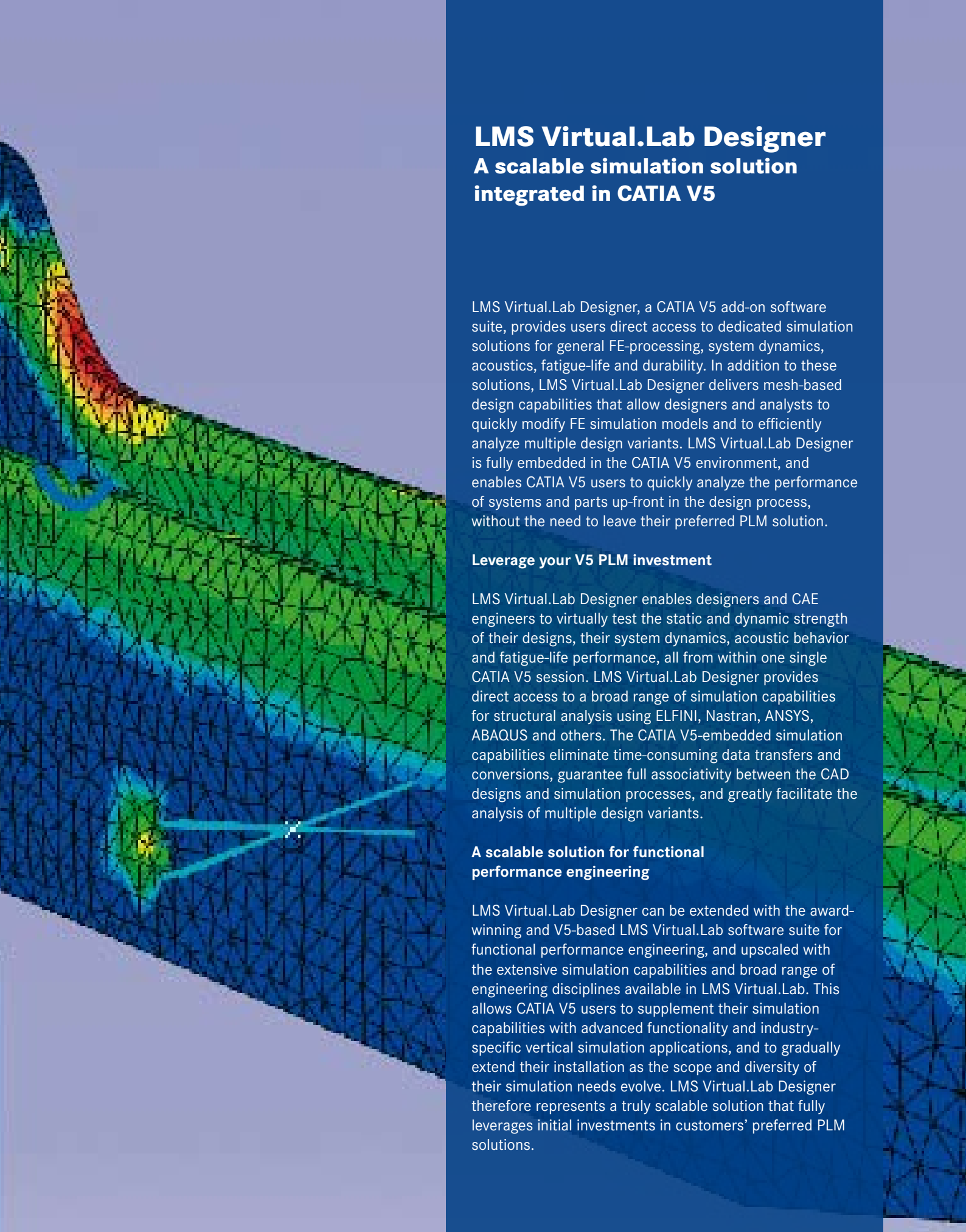
ENGINEERING INNOVATION



LMS Virtual.Lab Designer

A scalable simulation solution integrated in CATIA V5

LMS Virtual.Lab Designer, a CATIA V5 add-on software suite, provides users direct access to dedicated simulation solutions for general FE-processing, system dynamics, acoustics, fatigue-life and durability. In addition to these solutions, LMS Virtual.Lab Designer delivers mesh-based design capabilities that allow designers and analysts to quickly modify FE simulation models and to efficiently analyze multiple design variants. LMS Virtual.Lab Designer is fully embedded in the CATIA V5 environment, and enables CATIA V5 users to quickly analyze the performance of systems and parts up-front in the design process, without the need to leave their preferred PLM solution.

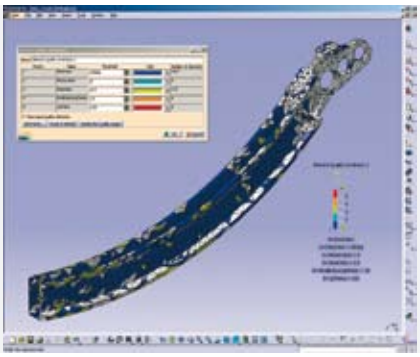
Leverage your V5 PLM investment

LMS Virtual.Lab Designer enables designers and CAE engineers to virtually test the static and dynamic strength of their designs, their system dynamics, acoustic behavior and fatigue-life performance, all from within one single CATIA V5 session. LMS Virtual.Lab Designer provides direct access to a broad range of simulation capabilities for structural analysis using ELFINI, Nastran, ANSYS, ABAQUS and others. The CATIA V5-embedded simulation capabilities eliminate time-consuming data transfers and conversions, guarantee full associativity between the CAD designs and simulation processes, and greatly facilitate the analysis of multiple design variants.

A scalable solution for functional performance engineering

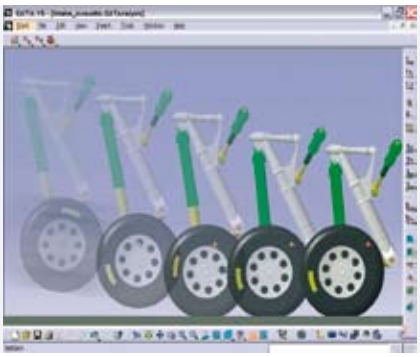
LMS Virtual.Lab Designer can be extended with the award-winning and V5-based LMS Virtual.Lab software suite for functional performance engineering, and upscaled with the extensive simulation capabilities and broad range of engineering disciplines available in LMS Virtual.Lab. This allows CATIA V5 users to supplement their simulation capabilities with advanced functionality and industry-specific vertical simulation applications, and to gradually extend their installation as the scope and diversity of their simulation needs evolve. LMS Virtual.Lab Designer therefore represents a truly scalable solution that fully leverages initial investments in customers' preferred PLM solutions.

LMS Virtual.Lab Designer Solutions



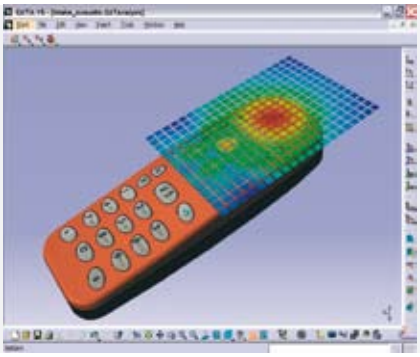
LMS Virtual.Lab Designer Structures

LMS Virtual.Lab Designer Structures provides a solution for general FE pre-processing and post-processing using industry-standard FE solvers, such as ELFINI, Nastran, ANSYS, ABAQUS and others. It enables designers and analysts to simulate the structural characteristics and performance of components and subsystems, all in one single session and within a fully geometry-associative environment.



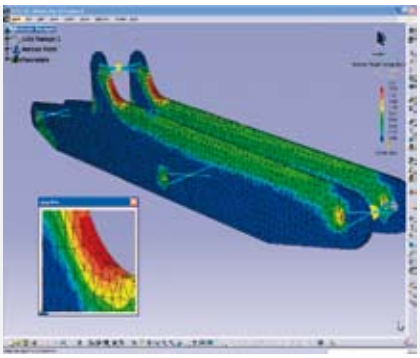
LMS Virtual.Lab Designer Motion

LMS Virtual.Lab Designer Motion is a complete and integrated solution to simulate the realistic motion and loads of mechanical systems. It permits design engineers to quickly analyze and optimize the real-world behavior of mechanical designs and to guarantee that they perform as expected, before committing to expensive physical prototype testing.



LMS Virtual.Lab Designer Acoustics

LMS Virtual.Lab Designer Acoustics is an easy-to-use acoustic simulation solution for predicting and improving sound and noise performance of a broad range of systems. With the straightforward models and embedded solver technology, engineers can receive their results more quickly, without compromising accuracy.



LMS Virtual.Lab Designer Fatigue

LMS Virtual.Lab Designer Fatigue provides a solution for companies that want to check and improve the fatigue-life and strength performance of mechanical systems. It improves simple stress analysis by the application of varying load time histories, to identify stress peaks and durability problems early in the design stage.

LMS Virtual.Lab Designer Structures

LMS Virtual.Lab Designer Structures provides a solution for general FE pre-processing and post-processing using industry-standard FE solvers, such as ELFINI, Nastran, ANSYS, ABAQUS and others. It enables designers and analysts to simulate the structural characteristics and performance of components and subsystems, all in one single session and within a fully geometry-associative environment. LMS Virtual.Lab Designer Structures is integrated in the CATIA V5 environment and is completely complementary to CATIA CAE. Its simulation capability complements the functionality scope that is currently covered by the CATIA V5 CAD-based simulation environment, and extends it further with dedicated mesh-based simulation functionalities, interfaces and drivers, etc. When using these mesh modification extensions, the associative link with CAD geometry is retained, which significantly improves the efficiency of design efforts.

With the Mesh Based Design tools of LMS Virtual.Lab Designer Structures, designers and analysts are able to modify or extend existing meshes from CATIA CAE, or even import and manipulate orphan meshes. With the same ease, users can define loads and restraints directly on the geometry or mesh, or reuse loads and restraints that are already defined.

LMS Virtual.Lab Designer Structures offers the capability to intuitively define and automatically drive external FE solvers from within the CATIA environment, without requiring expert users to set up and run specific ANSYS or Nastran jobs. Among its comprehensive post-processing solutions, LMS Virtual.Lab Designer Structures is capable of indicating extreme values or “hot spots”, or displaying results in dedicated 2-dimensional graphs.

Overall, the functionality of LMS Virtual.Lab Designer Structures includes:

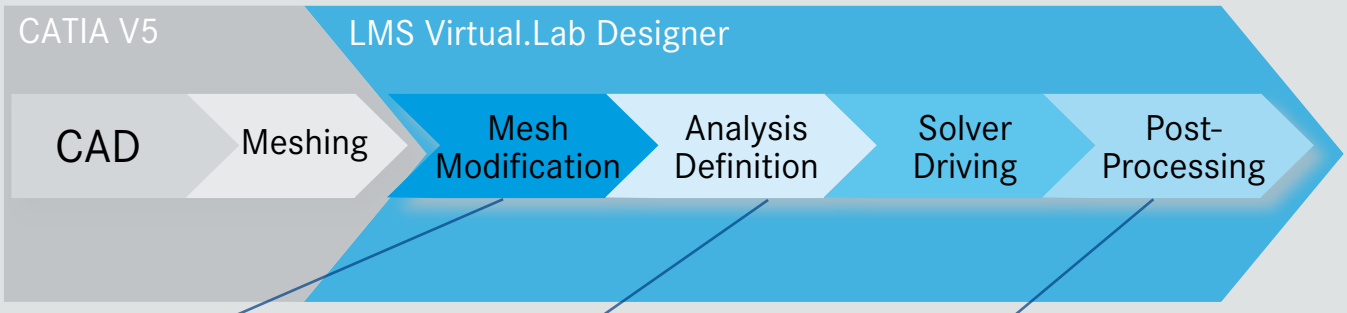
- Intelligent interface (mesh, loads, restraints, etc.) that allows working with orphan mesh parts
- Extensive mesh-based design capabilities
- A driver offering an associative link to any external solver or structural analysis package

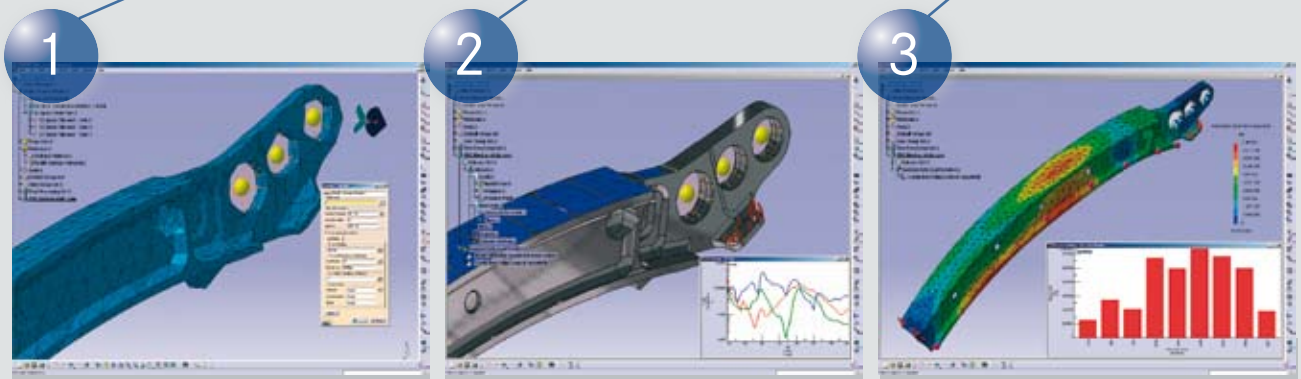
Features

- Fully geometry-associative environment
- Extensive range of pre-processing and post-processing features that are integrated in CATIA V5 and are complementary to its simulation offering
- Intelligent interface (mesh, properties, loads, restraints, FEM model checks, FEM grouping, etc.) that also allows working with orphan mesh parts
- Availability of general analysis cases and integrated drivers to well-known analysis solvers

Benefits

- Leverage the general FE pre-processor and post-processor capability available in the CATIA V5 environment
- Drastically speed up the execution of engineering iterations, and significantly increase productivity by using the integrated FE-mesh manipulation and editing solutions
- Perform analyses much earlier in the development process in order to reliably assess the impact of specific design variant characteristics
- Increase and leverage the consistency of analysis results by sharing the same environment and analysis codes for general and specialist assessments
- Improve teamwork across companies by facilitating the data exchange between OEMs and suppliers





Create the mesh and model load attachment for an aircraft slat track component.

Set up Nastran static case and define boundary conditions, pressure loads and frequency dependent forces.

Post-process stress results and analyze deformation variation along the slat-track.

LMS Virtual.Lab Designer Motion

LMS Virtual.Lab Designer Motion offers a complete and integrated solution that predicts the dynamic motion and internal loads of mechanical systems. It enables design engineers to quickly analyze and optimize the real-world behavior of CATIA V5 mechanism assemblies before committing to physical prototype testing.

LMS Virtual.Lab Designer Motion extends the kinematics capabilities of the CATIA V5 Mechanism Simulation 2 (MS2) configuration by offering efficient means to model system dynamics characteristics. It is also capable of predicting how mechanisms with multiple degrees of freedom will operate under real-life loading conditions, such as gravity, friction and contact.

Starting from the CATIA V5 kinematics mechanism, the model can be easily enriched with dynamic elements, such as springs, friction and contact forces, and an extensive list of motion constraints and initial conditions. The integrated robust dynamic solver processes the equations of motion accurately and timely in order to compute all displacements, velocities, accelerations and forces for all bodies in the simulated mechanism. 3D animations of the CATIA assembly and synchronized cursor animation on 2D plots help engineers easily identify and solve the root causes of problems. Additionally, users can efficiently detect part collisions, analyze motion envelopes and evaluate force vector animations. Parametric analysis allows efficient analysis of different design variants. The main advantage is that the multibody simulation model is completely associative with the CATIA geometry, making geometry design changes immediately verifiable after re-running the analysis in the motion simulation workbench.

For more advanced dynamic simulation, options such as CAD contact and flexible bodies are also available for LMS Virtual.Lab Designer Motion. The Flexible Bodies option uses CATIA V5 GPS finite element data to account for component deformation during mechanism motion and predicts dynamic stresses on all flexible parts.

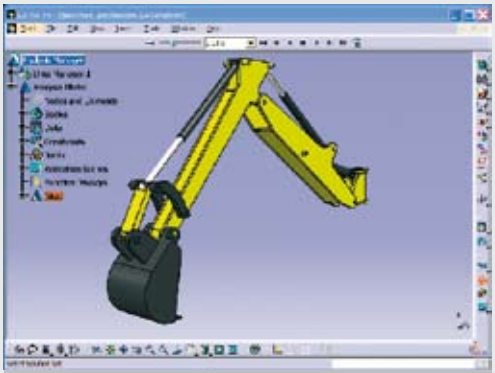
Features

- A complete library of kinematic joints and motion drivers for predicting the idealized kinematic motion of CATIA V5 assemblies
- An extensive library of force connections, including springs, dampers, friction, bushings, beams and contact forces
- Accurate definition of part inertia properties by using CATIA V5 solid geometry (and material density for dynamic simulation)
- The integrated LMS DADS solver guarantees fast, accurate and stable dynamic, kinematic, static and pre-load analyses
- A wide range of simulation results, including forces, displacements, velocities and accelerations
- 2D engineering data displays, which are fully embedded in the CATIA V5 environment

Benefits

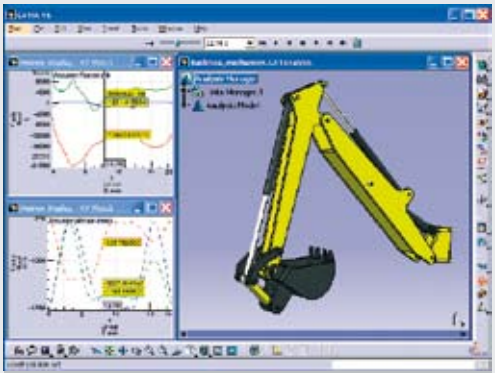
- Gain insights into the dynamic performance of designs from force vectors and component stresses displayed in mechanism animation sequences
- Dimension motors and actuators
- Obtain accurate component loads for use in CATIA V5 GPS stress predictions and LMS Virtual.Lab Designer Fatigue simulations
- Identify and optimize the parameters that most significantly impact the real-life motion performance of designs
- Use CATIA V5 GPS based flexible bodies to increase the accuracy of dynamic system simulations
- Explore design safety limits without putting people or expensive equipment at risk

VD-MOT.00.1

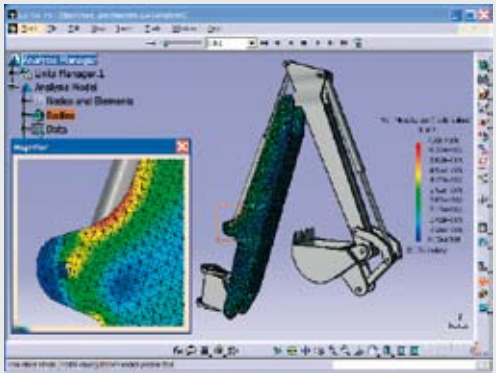


Extend CATIA V5 assemblies with joints, forces, motion drivers and gravity.

Create motion envelopes of the moving mechanism.



Synchronized animation and graphing of motion and force results.



Visualize component deformations and stresses during mechanism motion.

LMS Virtual.Lab Designer Acoustics

LMS Virtual.Lab Designer Acoustics is an easy-to-use acoustic simulation solution for predicting and improving the sound and noise performance of a broad range of mechanical systems. With its straightforward models and embedded solver technology, users can obtain results faster, without compromising simulation accuracy. With LMS Virtual.Lab Designer Acoustics, design engineers and analysts can prepare the acoustic model starting from CATIA CAE models, apply acoustic sources and boundary conditions, run the embedded acoustic solvers, and post-process the results – all in one CATIA V5 environment with complete geometric associativity.

LMS Virtual.Lab Designer Acoustics offers two different yet equally powerful simulation methods for predicting sound and noise performance – the Boundary Element Method (BEM) and the Finite Element Method (FEM). BEM is for exterior acoustics; it predicts radiated sound levels from external vibrating surfaces. On the other hand, FEM is for interior acoustics; it predicts sound levels in enclosed volumes surrounded by vibrating surfaces. Both BEM and FEM are solver options in LMS Virtual.Lab Designer Acoustics; however, at least one these options is required.

Acoustic results generated by LMS Virtual.Lab Designer Acoustics are presented through relevant 2-dimensional charts, which typically include sound pressure level (SPL) with root-mean square (RMS) values, dB-weighting and 1/3rd-octave bands. The post-processing capabilities of LMS Virtual.Lab Designer Acoustics comply with today's best practices in acoustic engineering and can be easily tuned to specific needs of product design and engineering teams.

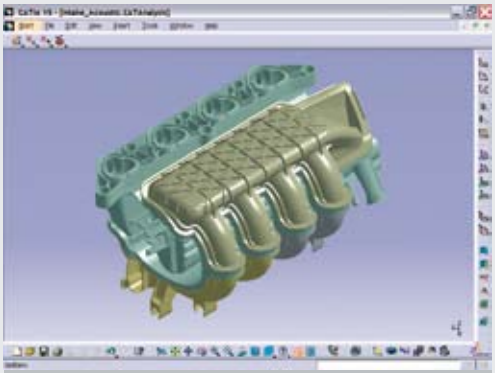
Features

- Exterior acoustics (BEM)
- Interior acoustics (FEM)
- Boundary conditions including surface vibrations and pressure distributions
- Acoustic sources such as monopoles and waves
- Plotting and 3-dimensional imaging including SPL, RMS, dB-weighting and 1/3rd-octave bands

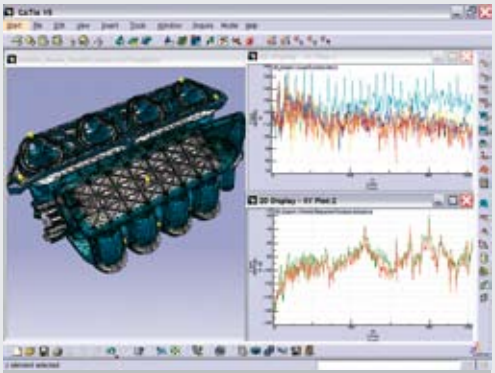
Benefits

- Find the cause of noise problems quickly, while reducing modeling efforts and retaining full associativity with the underlying geometry
- Accurately predict the acoustic performance of products and significantly reduce design risk
- FE Coarsening and High-Speed BEM options are available to further speed-up the process

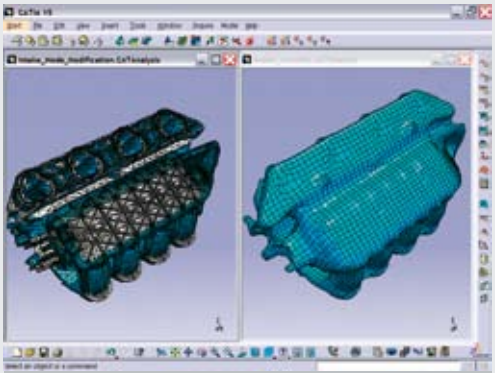
VD-ACM.01.1



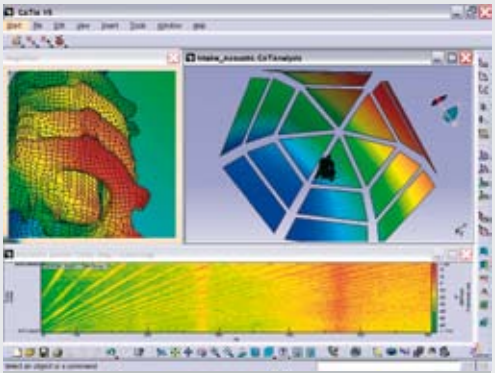
CAD representation of an enigne intake model created by CATIA Mechanical Design.



Create dedicated 2D plots of noise levels.



An acoustic coarsened mesh is generated automatically starting from a structural mesh.



Create 3D acoustic images and analyze noise radiation patterns on the fly.

LMS Virtual.Lab Designer Fatigue

LMS Virtual.Lab Designer Fatigue is an easy-to-use fatigue-life prediction solution for predicting and improving the fatigue performance of a broad range of systems. It is applicable to a wide range of industry segments, including automotive, aerospace, consumer appliances and other mechanical products.

With LMS Virtual.Lab Designer Fatigue, designers and analysts start from static or dynamic stresses predicted using CATIA CAE models, apply varying load time histories to the component models, run the embedded fatigue-life prediction solver and post-process the results, all in a completely geometry-associative process. This solution drastically improves simple stress analysis as it allows the identification of dynamic stress peaks and fatigue problems very early in the design stage.

LMS Virtual.Lab Designer Fatigue offers different fatigue-life analysis capabilities, including assessment of low-cycle fatigue (strain-life), high-cycle fatigue (stress-life) and infinite life (Dang Van). Fatigue material parameters are estimated using the uniform material law or based on the embedded fatigue material parameter library. As the fatigue-life prediction solver supports both proportional as non-proportional loading conditions, real-life loading conditions can be simulated. Dedicated durability post-processing functionalities including dynamic stress animation, hot-spot detection and local time series analysis allow users to quickly zoom in on critical areas and to determen the root cause of fatigue problems.

The CATIA V5-based associativity concept of LMS Virtual.Lab Designer offers users the capability to automatically execute consecutive simulation runs, which enable different design options and/or load cases to seamlessly flow through the complete analysis process. Evaluating a new design only involves plugging in the modified structure, upon which the analysis is automatically restarted, thereby avoiding tedious re-definitions of load input points, constraints and other parameters. These capabilities support design teams in their efforts to experiment with multiple design options and identify the best solutions before physical prototyping starts.

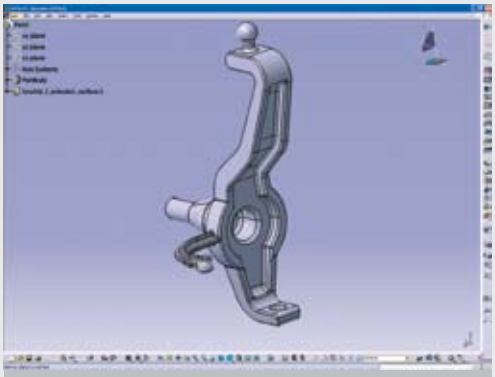
Features

- Seamless access to structural FE meshes and stresses from CATIA CAE
- Direct access interfaces to ASCII and LMS time history formats
- Stress analysis and varying loads (proportional and non-proportional, uni-axial and multi-axial), including
  - Graphic animation
  - Creation, analysis and export of local stress tensor histories
  - Hot-spot analysis of critical regions
- Fully featured, fast and accurate fatigue analysis
  - Stress-life
  - Strain-life
  - Dang Van
  - Stress-gradient correction
  - Combination of events
  - Static and modal superposition

Benefits

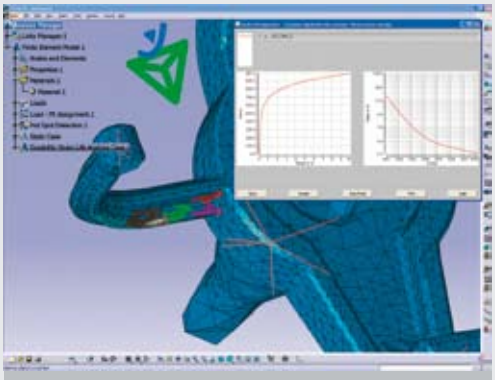
- Reduce the time that is required to perform a complete fatigue analysis
- Perform fatigue-life prediction analyses quickly and accurately, based on realistic loading conditions
- Get immediate feedback on critical fatigue areas
- Explore multiple design options and optimize the fatigue performance of your designs
- Work error-free by using a solution that is tightly integrated in CATIA CAE

VD-DUR.02.1

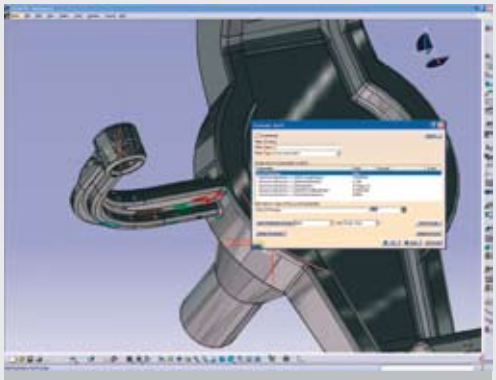


Starting from a component designed in CATIA V5...

...users interactively define the load case to be applied to the component.



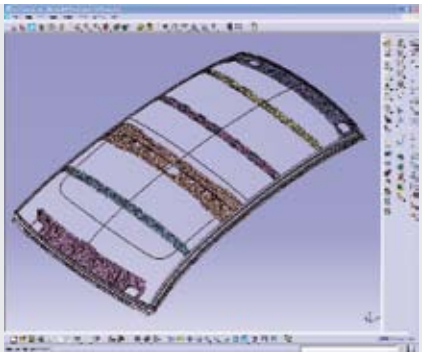
LMS Virtual.Lab Designer runs the fatigue analysis within CATIA V5 and identifies the critical regions.



Based on the analysis results, users can change their design and evaluate the impact on the fatigue resistance.

LMS Virtual.Lab Designer Structures - Options

VD-MDC.29.2

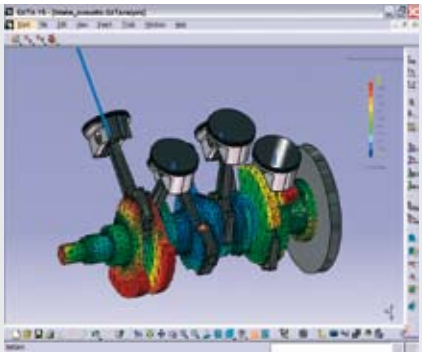


LMS Virtual.Lab Designer AFC Interoperability

AFC Interoperability is a required option if you want to drive the Abaqus solver for non-linear analysis from within LMS Virtual.Lab Designer Structures. This product ensures interoperability with Dassault Systemes' 'Abaqus for CATIA' (which is a prerequisite) and extends the application coverage with advanced pre/post-processing (e.g. 2D visualization of non-linear materials, loads, results, real time animation...), mesh or CAD/mesh based analysis, interoperability with Nastran scenarios and import from orphan *.inp Abaqus input files.

LMS Virtual.Lab Designer Motion - Options

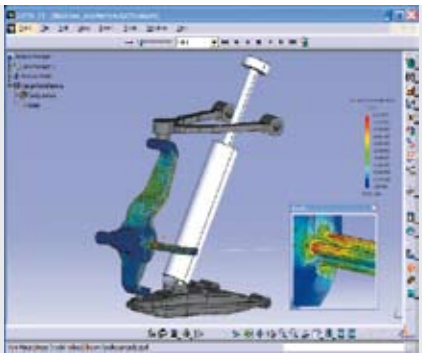
VD-MOT.70.2



Flexible Bodies

Flexible Bodies provides a very efficient way to represent structural flexibility for even the most complicated geometry. The method is based on an advanced numerical algorithm using "modes" – based on either FEA or test measurements. The flexible behavior for any number of parts in the simulation can be represented and visualized by graphing and animating the results. The collection of flexible body modes for each part are used to define the total deformed shape, velocity and acceleration. The resulting mode amplitudes can be used to define time varying stress, durability fatigue-life, and even acoustic radiation from surfaces.

VD-MOT.78.3



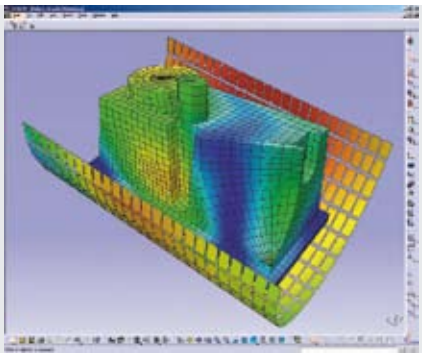
Flexible bodies advanced

The flexible bodies advanced product provides four advanced flexible body modeling capabilities:

- Automatic flex generation: to automatically mesh and use the Craig-Bampton modes (based on CATIA GPS, which is a pre-req for LMS Virtual.Lab Designer).
- Automatic substructuring: to automatically divide a mesh from a body which strongly deformes (e.g. a stabilizer bar in a car) into different flexible bodies to take into account the large deformations.
- Flexible contact: for contact force modeling when a flexible body makes contact with another body.
- Structural analysis pre-post: for pre- and post-processing capabilities of FE meshes.

LMS Virtual.Lab Designer Acoustics - Options

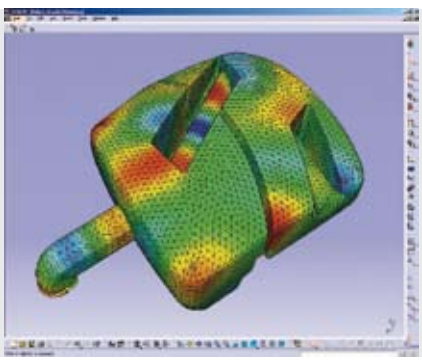
VD-ACM.21.2



Exterior Acoustics: Boundary Element Method (BEM) Solver

The boundary element method (BEM) is intended for exterior acoustics with external vibrating surfaces. BEM effectively reduces complex 3-dimensional to 2-dimensional surface dimensions. The 2-dimensional surface mesh can either be obtained through CATIA CAE products (GPS or FMS), the optional FE Coarsening tool from LMS, or external CAE packages. With BEM, only the surface areas of the structural systems that are vibrating or radiating sound need be modeled. BEM models typically contain significantly less finite elements since only vibrating surfaces are modeled. As a result, BEM models are relatively small and thus easy to create, verify and manage.

VD-ACM.23.2



Interior Acoustics: Finite Element Method (FEM) Solver

The finite-element method (FEM) is intended for interior acoustics in enclosed volumes surrounded by vibrating surfaces. FEM models the enclosed volume with solid 3-dimensional acoustic finite elements. By using these elements, the properties of the fluid medium, such as air or noise-absorbing materials and objects (e.g., car seats) can be modeled accurately. The acoustic FEM mesh can be generated by CATIA V5 Analysis Solutions (GPS or FMD), which retain full associativity with the underlying geometry, or by external CAE packages.

LMS Virtual.Lab Designer Overview

		Structures VD-MDC.05.1	Motion VD-MOT.00.1	Fatigue VD-DUR.02.1	Acoustics* VD-ACM.01.1
Pre/Co-requisites					
CATIA - General Part Structural Analysis 2 (GPS)		✔	✔	✔	✔
CATIA - Mechanism Simulation 2 (MS2)		—	✔	—	—
Options					
AFC Interoperability (")	VD-MDC.29.2	O	—	—	—
Flexible Bodies	VD-MOT.70.2	—	O	—	—
↘ Flexible Bodies Advanced	VD-MOT.71.3	—	O	—	—
Acoustic Harmonic BEM Solver	VD-ACM.21.2	—	—	—	✘
Acoustic Harmonic FEM Solver	VD-ACM.23.2	—	—	—	✘

* requires BEM or FEM Solver ✔ pre-requisite for installation ↘ Product with pre-requisite
✘ one of the options required

O available as an option — not applicable

(") requires ABAQUS For CATIA (AFC)

Any option from the equivalent LMS Virtual.Lab configuration can be added to these configurations.

Prerequisite: the LMS Virtual.Lab Desktop needs to be licenced to enable adding-on LMS Virtual.Lab options.

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CAA V5 BASED

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