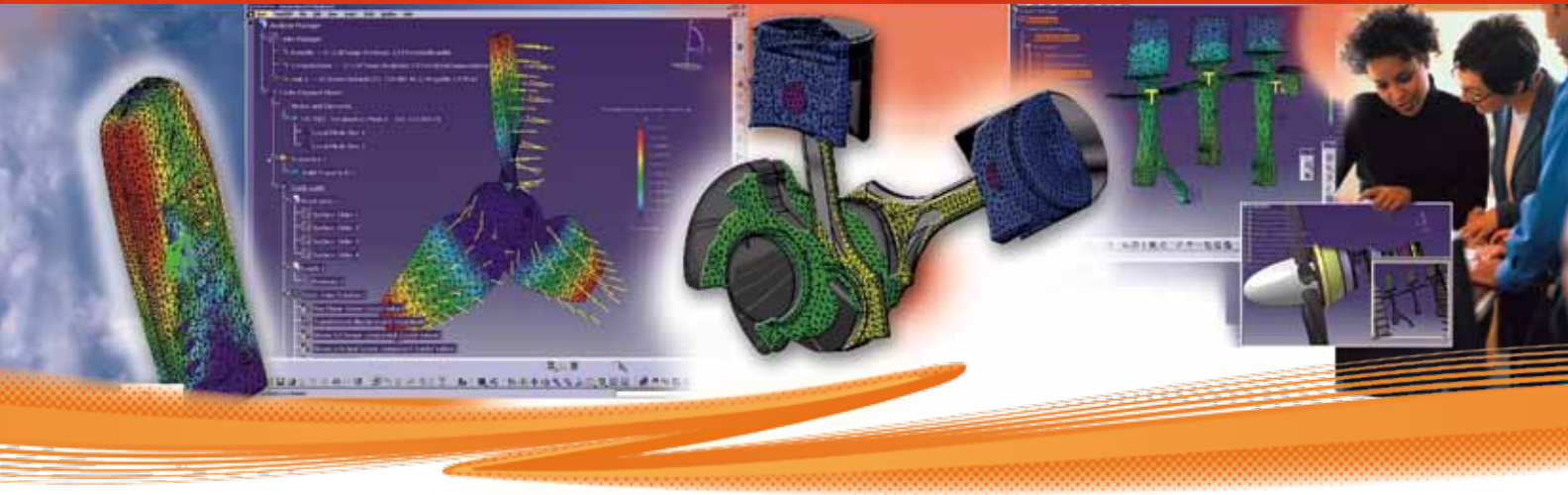


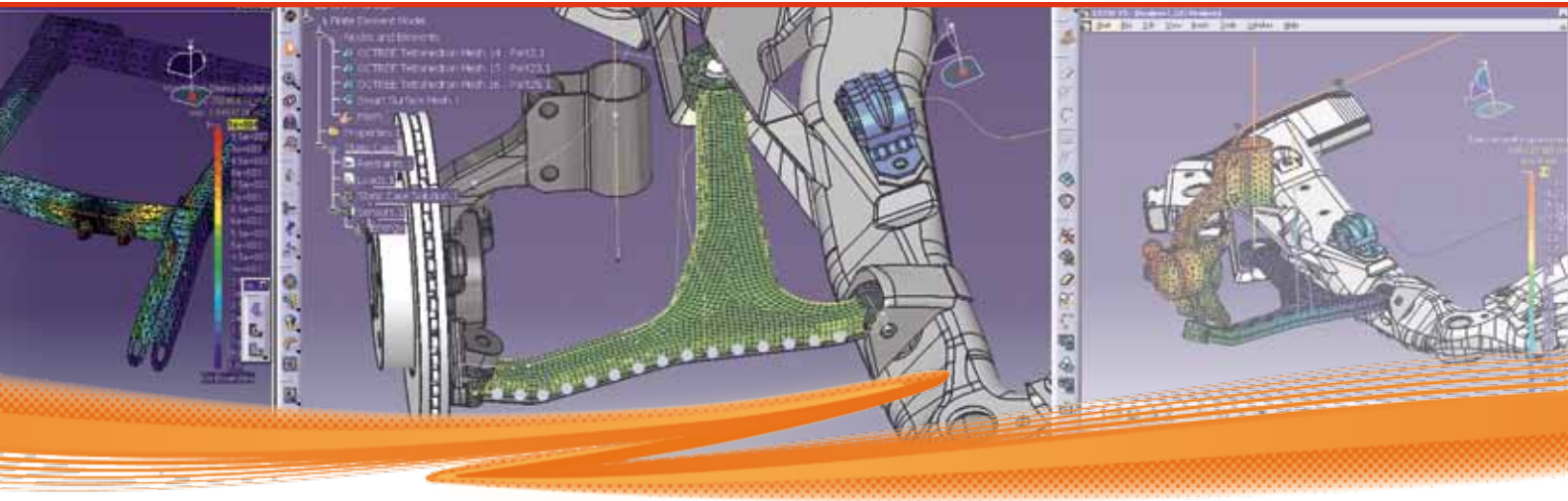
# Design-Integrated Analysis in CATIA V5

## Design for Real-World Performance



# Design-Integrated Analysis

Improve product performance faster with design analysis in CATIA V5



## Product Development Challenges

Global competition requires the creation of better products faster and at lower costs—without sacrificing quality. To meet these challenges, many companies have adopted computer aided engineering (CAE) to reduce the cost of physical testing, decrease overall product development time, and improve understanding of their product performance. However, CAE has largely been used towards the end of the development cycle, or even after the product has been manufactured, by a small number of highly-skilled specialists using a standalone finite element analysis (FEA) product. This practice has restricted the effectiveness of simulation in the design phase.

For CAE to further improve product development, it needs to be used earlier in the design process and allow designers to explore different design alternatives quickly and reliably. This strategy requires an integrated CAD/CAE environment that is easy to use and focused on the needs of the designer, while leveraging proven CAE technology.

## Your Competitive Advantage

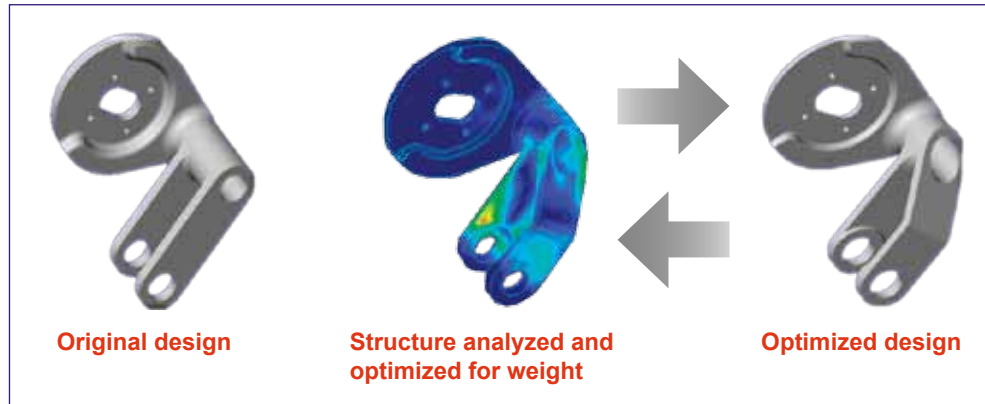
Design-integrated analysis allows CATIA users to leverage the power of proven analysis technology to evaluate and improve their designs. They obtain an accurate understanding of the mechanical behavior by quickly reviewing design characteristics in a virtual design and analysis environment. The CATIA V5 tools and environment—that are common to all CATIA applications and partner solutions—eliminate the problem of lost productivity associated with using multiple applications. The analysis products are scalable from the linear FEA capabilities found in the traditional CATIA Analysis products, to the new nonlinear and thermal capabilities provided in the SIMULIA Analysis products. The combination of these products allows CATIA users to efficiently incorporate the required stress or thermal solution required to solve their problem during the design process.

SIMULIA's scalable design-integrated solutions enable designers and design engineers to confidently deliver the right design, the first time, providing significant time and cost savings.

## Fully Integrated Design and Analysis Environment

SIMULIA provides complete design-integrated simulation capabilities within the CATIA V5 design environment. Designers can use the familiar CATIA user interface to perform analysis directly on their master reference model in CATIA. Data integrity issues are avoided since there is no transfer and translation of geometry.

The SIMULIA solutions enables rapid performance of design-analysis iterations—from simple parts to complex assemblies. The software leverages the CATIA V5 knowledge-based architecture, making it easy to optimize designs based on product performance specifications and analysis results. Unbeatable ease-of-use makes SIMULIA's solutions particularly suitable for designers looking to accurately size their designs and quickly improve their products' real-world performance.



## Scalable Solutions

The combination of CATIA V5 Analysis and SIMULIA V5 Analysis products allows designers to understand design behavior enabling them to accurately calculate the displacements and stresses within the part subjected to a variety of loading conditions. Analyses can be performed on volume parts, surface parts and wireframe geometries to evaluate the realistic performance of individual components as well as complete assemblies. CATIA V5 Analysis and SIMULIA V5 Analysis enable users to analyze static, frequency, and buckling, in addition to providing solutions for performing nonlinear structural analysis to include effects, such as large displacements, material nonlinearity, and thermal analysis.

## Meshing Tools

The CATIA meshing tools, FEM Solid (FMD) and FEM Surface (FMS), are intended for the user who wants to mesh complex solid, surface and wireframe geometry quickly and efficiently, while retaining control over the resulting element quality and the number of elements in the mesh. Both products are fully associative with the geometry and provide more control and sophisticated meshing algorithms than the standard solid meshing capability in GPS.

Rule Based Meshing (RBM) is also available to help users automate the creation of high-quality surface meshes for all workflows that use CATIA meshing tools. RBM gives the user a means to globally specify the desired meshing treatment of entities such as holes, fillets, and beads. It also enables users to specify acceptable element quality criteria, such as minimum edge length, aspect ratio, and skewness. After specifying the meshing rules, no additional user involvement is necessary, as the mesh generation is completely automated.

## Knowledge-based Optimization

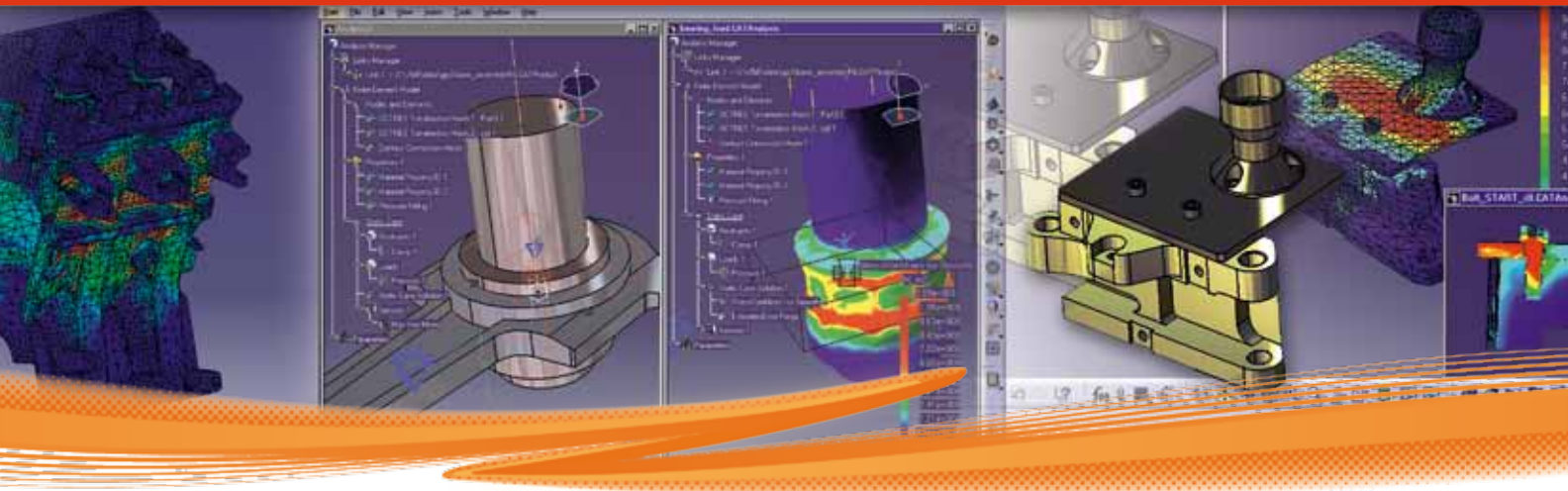
The SIMULIA design-integrated analysis products leverage the native CATIA knowledge-based architecture. They allow designs to be optimized by capturing and studying the knowledge associated with part design and analysis. The reuse of analysis features and the application of knowledge-based rules and checks ensure compliance to company best practices. Automation of standard analysis processes through the use of knowledgware templates dramatically improves the efficiency of the design analysis process.

## Multidiscipline Collaboration

The SIMULIA design-integrated analysis products support concurrent engineering, allowing users to work closely together. Designers and analysts can collaborate since they have access to the same environment, eliminating data transfer, rework, and the need to maintain multiple applications for design and analysis. The analysis environment also allows method developers to create templates that designers can routinely utilize to perform standard types of analysis.

“Using SIMULIA Analysis, a designer rather than an expert is now able to perform an analysis on an automobile transmission gear assembly. In the past, such an analysis would only take place if serious problems requiring design modification occurred... With today’s improved CAE tools, however, all analysis conditions for the gear assembly can be set within 30 minutes.”

—Dr. Takanao Uchida, leader of the CATIA V5 project at Honda Automotive R&D and one of the pioneers of “Designer CAE” in Japan



## Industry-proven Performance

The speed in which analyses can be performed in CATIA often surprises designers and simulation experts familiar with other applications. The time it takes to create the finite element model, solve it, and display results can be a matter of minutes. The robust, built-in finite element solver and mesh generators balance both accuracy and speed. The adaptive meshing capability automatically adjusts the mesh to obtain accurate results without time-consuming manual involvement.

## Benefits of Design-Integrated Analysis

- **Design and analyze in a single environment**
  - Reduces the need to export models to a stand-alone simulation tool
- **Scalable solutions**
  - Users perform linear, nonlinear, or thermal analysis to meet their design application need
- **Design iterations can be evaluated rapidly**
  - More design options can be considered while staying on time and on budget given the same project timeline
- **Improved product performance**
  - Meet performance and operating specifications

“The superb geometry creation and modification capabilities in CATIA Analysis were particularly beneficial in designing our world record-breaking 20,000-ton gantry crane, as the initial beam design had more than 100 concepts.”

—Lan Gongying, PLM Department Assistant Manager, Yantai Raffles Shipyard

## Design-Integrated Analysis Portfolio

The design-integrated analysis solution from Dassault Systèmes includes the CATIA Analysis products as well as the SIMULIA Analysis products to fit the needs of all users. Partner products provide additional capabilities such as multibody dynamics, computational fluid dynamics, fatigue analysis, and others.

## CATIA V5 Analysis Capabilities

- Linear static stress analysis
- Transient and harmonic dynamic analysis
- Contact analysis
- Buckling analysis
- Assembly of multiple analysis models

## CATIA V5 Analysis Products

### Workbench – Generative Structural Analysis

#### Generative Part Structural Analysis (**GPS**)

*Generative stress and modal analysis on single parts*

#### Generative Assembly Structural Analysis (**GAS**)

*Generative stress and modal analysis on hybrid assemblies*

#### Generative Dynamic Analysis (**GDY**)

*Generative structural dynamic response analysis*

#### ELFINI Structural Analysis (**EST**)

*Complementary advanced options for preprocessing, solving, and postprocessing*

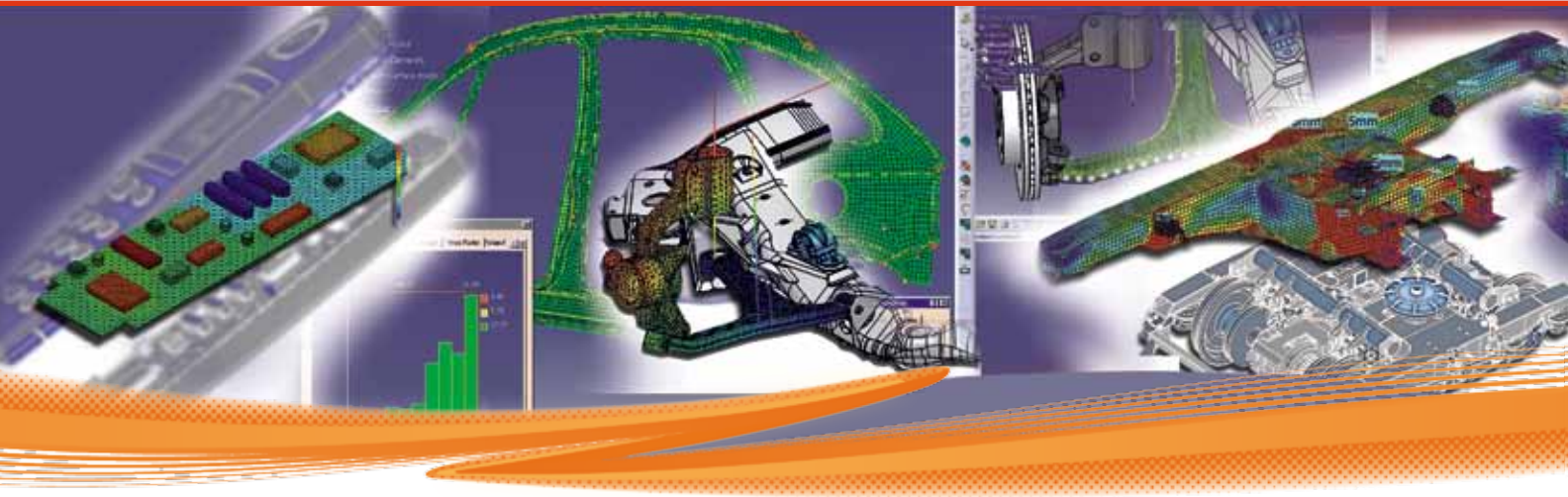
### Workbench – Advanced Meshing Tools

#### FEM Surface (**FMS**)

*Complementary advanced options to generate associative mesh from surface design*

#### FEM Solid (**FMD**)

*Complementary advanced options to generate associative mesh from solid design*



## SIMULIA V5 Analysis Capabilities

- Nonlinear static stress analysis
- Steady-state and transient thermal analysis
- Thermal-stress analysis
- Advanced contact analysis, including friction and large-sliding
- Rule-based, fully automatic meshing of complex surface geometry

## Complementary Partner Solutions

- Acoustic analysis
- Computational fluid dynamics (CFD)
- Noise and vibration (NVH) analysis
- Multibody dynamic analysis
- Ride and handling analysis
- Durability and fatigue analysis
- Stamping analysis
- Gateway interfaces to external solvers

## SIMULIA V5 Analysis Products

### Workbench – Thermal Analysis

#### Thermal Analysis (**ATH**)

*Heat transfer analysis on hybrid assemblies*

### Workbench – Nonlinear Structural Analysis

#### Nonlinear Structural Analysis (**ANL**)

*Nonlinear stress and frequency analysis on hybrid assemblies*

### Workbench – Rule Based Meshing

#### Rule Based Meshing (**RBM**)

*Enable automatic meshing of complex surface geometry based on pre-defined meshing rules*

For further information on our partners, please visit:  
[www.3ds.com/alliances/software-partnership](http://www.3ds.com/alliances/software-partnership)

## SIMULIA World Headquarters

166 Valley Street  
Providence, RI 02909 USA  
+1 401 276 4400  
E-mail: [simulia.info@3ds.com](mailto:simulia.info@3ds.com)  
[www.simulia.com](http://www.simulia.com)



### About SIMULIA

SIMULIA is the Dassault Systèmes brand that delivers a scalable portfolio of Realistic Simulation solutions including the Abaqus product suite for Unified Finite Element Analysis, multiphysics solutions for insight into challenging engineering problems, and SIMULIA SLM for managing simulation data, processes, and intellectual property. By building on established technology, respected quality, and superior customer service, SIMULIA makes realistic simulation an integral business practice that improves product performance, reduces physical prototypes, and drives innovation. Headquartered in Providence, RI, USA, SIMULIA provides sales, services, and support through a global network of regional offices and distributors.

For more information, visit [www.simulia.com](http://www.simulia.com).

The 3DS logo, SIMULIA, CATIA, 3DVIA, DELMIA, ENOVIA, SolidWorks, Abaqus, Isight, Fiper, and Unified FEA are trademarks or registered trademarks of Dassault Systèmes or its subsidiaries in the US and/or other countries. Other company, product, and service names may be trademarks or service marks of their respective owners.  
Copyright Dassault Systèmes, 2010

