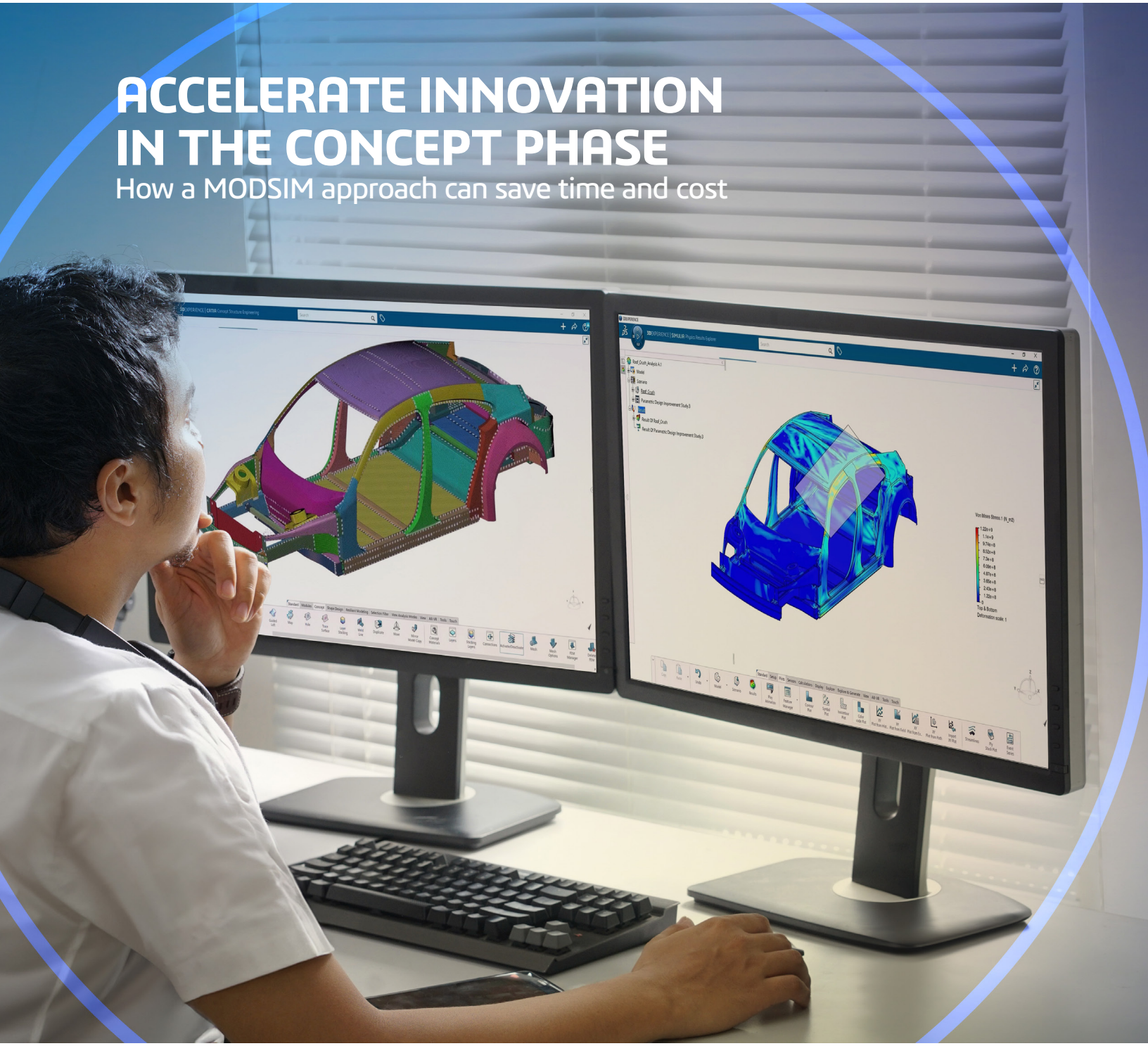
SIMULIA

3DEXPERIENCE®

ACCELERATE INNOVATION IN THE CONCEPT PHASE

How a MODSIM approach can save time and cost



DASSAULT SYSTEMES

OPTIMIZING THE CRUCIAL CONCEPT PHASE

Automakers are under intense pressure to get attractive, innovative and sustainable new vehicles to market before their competitors—while ensuring that every design meets an ever-growing raft of regulatory requirements. As the industry continues to electrify its products, there is also an unprecedented opportunity to create exciting new vehicle designs.

The concept phase is the most critical time for meeting these goals. This phase is where designers innovate and identify their best ideas to take forward—including the challenge of redefining vehicle structures to safely accommodate powerful battery packs. At the same time, they must balance weight, performance and scalability requirements while making sure that the same standards apply across different vehicle configurations. Since altering the design becomes more expensive as the vehicle moves toward production, it's also crucial to maximize the flexibility of this early phase where making changes is more cost effective.

The problem is that for decades, vehicle development has involved exporting and translating data between various systems and interfaces as ideas and specifications pass from designers to engineers, modelers and simulation experts. Processes like concept creation, geometry clean-up, meshing, simulation set-up, solving and evaluation can each take weeks to complete using this unidirectional, disconnected method, even before any changes are factored in.

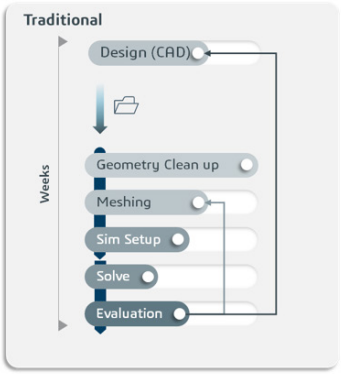
In addition, the tools used to create ideas are often the same ones used for more detailed design phases. Concept designers don't need that level of detail. Instead, they need faster, more agile ways to craft, assess and identify market-leading ideas.

Combining modeling and simulation (MODSIM) can provide those methods.

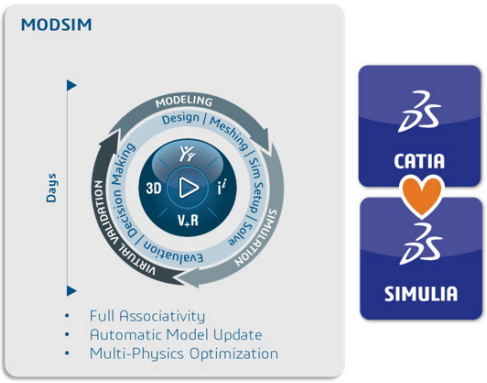
FROM MODELING AND SIMULATION TO MODSIM

A MODSIM approach unifies and automates modeling and simulation on a common data model within a single user experience on the **3DEXPERIENCE®** platform. Instead of a linear, fragmented process, **this approach creates a continuous engineering loop that supports fast, collaborative design changes and rapid generation of simulation-ready models**. It means that more innovation and more changes can be completed during the concept phase, while **reducing** these **processes from weeks to days**.

FROM: TRADITIONAL
Linear Disconnected



TO: MODSIM
Integrated Loops



MODSIM integrates CAD and CAE data so that any changes are instantly factored into the geometry and mesh of a shared model. Everybody involved can see how their ideas will affect the vehicle's key performance indicators and identify the best trade-offs early on.

Automated processes also take care of repetitive, time-consuming tasks so design, modeling and simulation experts can focus on what they do best. This allows them to innovate faster and test more ideas to identify the best ones for development.

One Place

- **3DEXPERIENCE®** platform
- Unified CAD/CAE data
- Full traceability

One Common Model

- CAD and CAE data are automatically associated
- Process automation and customization
- Multidisciplinary collaboration with shared goals

One End-To-End Process

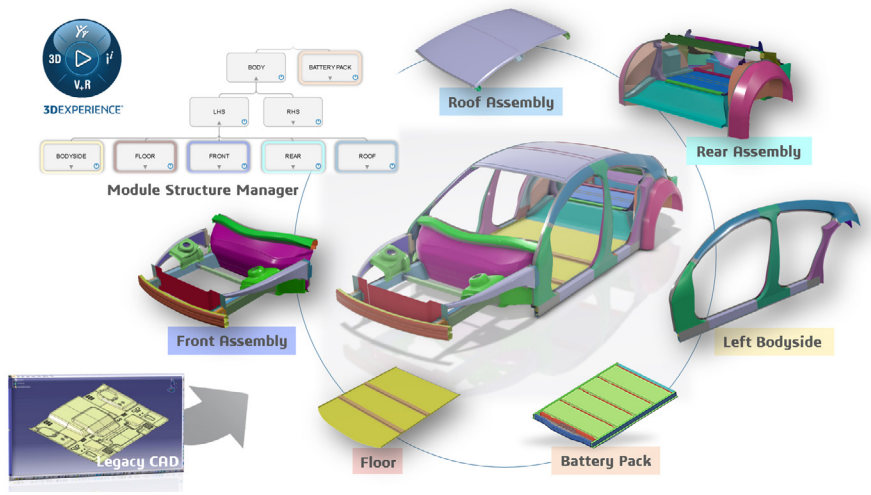
- Seamless design and engineering processes
- Fast, easy test requirements management
- Reusable data models and processes

Let's see how it works.

PROCESS EXAMPLE 1: BODY IN WHITE

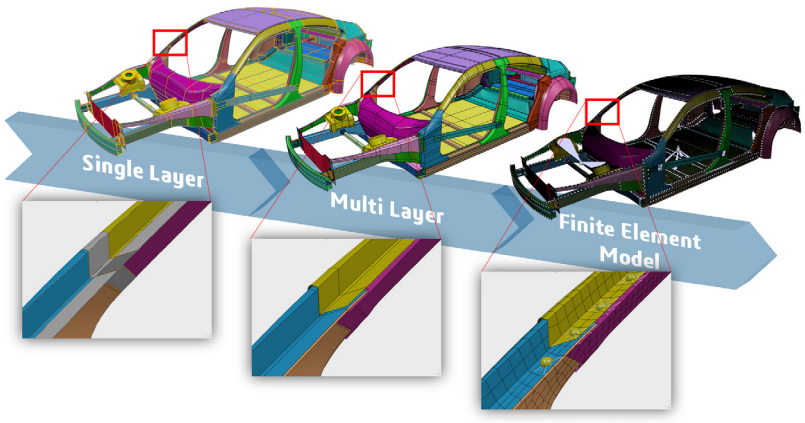
It is quick and easy for the body in white (BIW) architect to create and modify the vehicle design and enrich the model with legacy CAD.

Thanks to a modular approach, the architect can assemble the body structure based on existing entries from a module library or from scratch. The modules connect to each other through semantic relations. This enables the architect to reuse, reconnect and reposition modules to assemble complex structures.

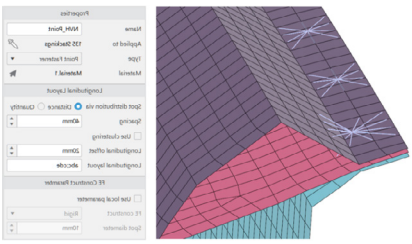


1. The BIW architect creates a simplified, single-layer model of the vehicle or component, associating various elements with each other and indicating which geometries should connect. From this single-layer model of the body structure, **3DEXPERIENCE** generates a multi-layer model based on these attributes for interfaces, materials and thicknesses.

ASSOCIATIVITY OF GEOMETRY AND SIMULATION MODEL

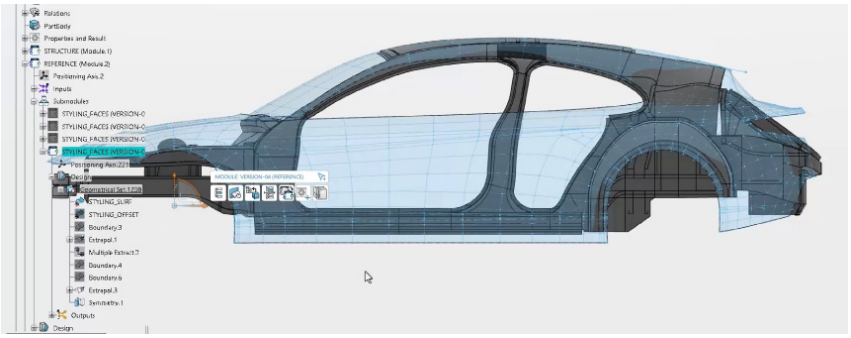


2. Using the multi-layer geometry as well as the properties for the finite element mesh and respective connections—**a parametric, ready-to-simulate mesh is automatically produced**. It includes all the vehicle's connections, such as welds or adhesives.



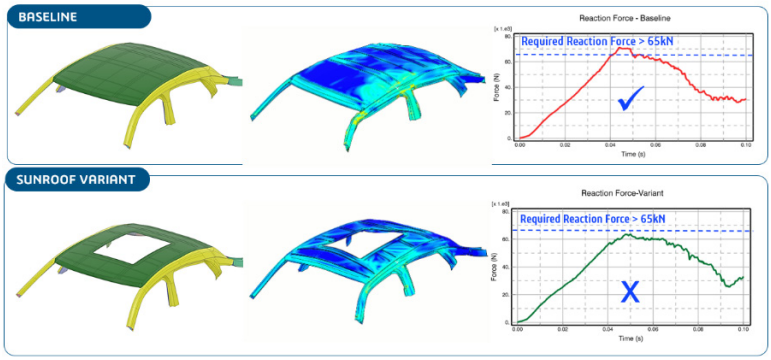
3. Any modifications to connections, material or geometric attributes are reflected in the rest of the model. For example, if an element of the car's exterior surface is changed, the body is updated to meet it.

Modular components can be reused, repositioned and reconnected as needed, remaining fully integrated with the vehicle design and meshing.

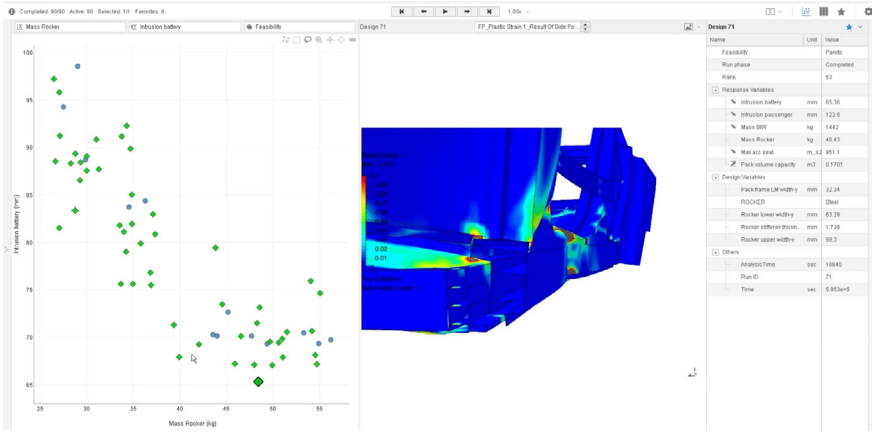


4. Modeling and simulation are linked seamlessly without any need for pre-processing.

This means that the designer can experiment with different options based on parameters like sizing, positioning and properties such as aerodynamics, body stiffness and crash performance.



5. To optimize the design, simulation is used to assess multiple variants and explore trade-offs, testing the various alternatives automatically. Once the best options are identified, they can be handed over for further development.



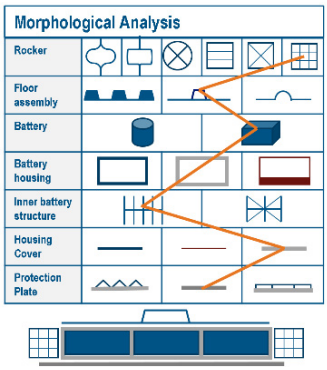
Throughout this process, the BIW architect can collaborate with experts such as the battery architect and performance specialists using the same model, to make sure there are no engineering clashes. Any changes can be factored in quickly during this early phase in the development cycle, as part of the integrated design, modeling and simulation loop that MODSIM creates.

PROCESS EXAMPLE 2: ELECTRIC VEHICLE BATTERY FRAME

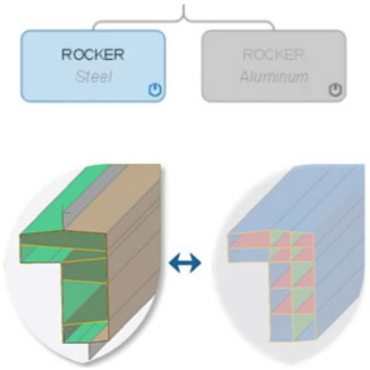
With a MODSIM approach on the **3DEXPERIENCE**, the battery architect can work on the same model as the BIW architect, without having to spend time repeatedly going through different tools and system interfaces.

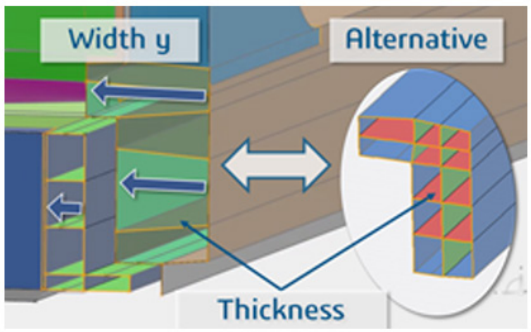
For example, let's say the engineer wants to improve the side-impact crash performance of the battery architecture.

1. The designer builds the battery frame using components from a matrix of choices. With multiple options available, they can quickly find elements with the right topology and identify the best trade-off between crash performance, weight and cost targets.



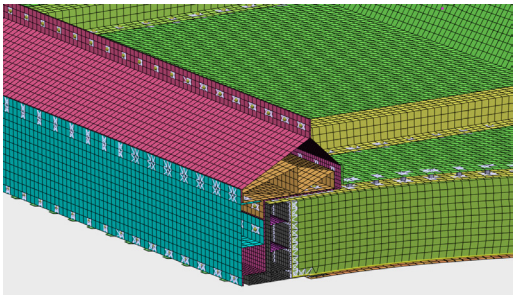
2. Next, the designer changes the part as necessary, for instance the width or thickness of a rocker. The designer can even change the type of the part using a module alternative and respectively change its proximity to the battery pack.





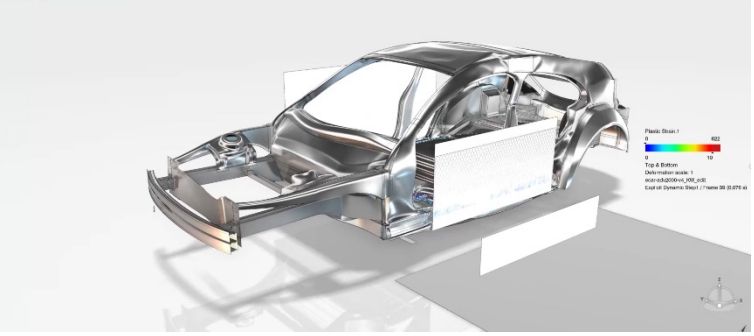
3. Using an automatically generated model of the battery pack in the **3DEXPERIENCE** platform, the designer can make parametric geometry changes. If the length of the wheelbase is changed, for example, the number of battery modules will be altered to fill the relevant space.

Any changes to the geometry are reflected in the model and the mesh, bringing components and connections into line with the new design at the click of a button.



4. Simulation is then used to assess the crash performance of the new design.

Enabling impact simulations at the concept phase empowers designers and engineers with crash performance metrics much earlier when compared to current tools and methodologies. **Assessing non-linear crash load cases at this phase has the potential for limiting design changes later in the development timeline and avoiding the associated cost**.



If changes are needed, it's easy to adapt and assess the model in the **3D**EXPERIENCE platform.

It would take weeks to make and evaluate each of these changes using a traditional file-based system process. With a MODSIM approach that is reduced to days.

As a result, **more changes can be made during the concept phase—enabling more experimentation and innovation, while reducing the time it takes to identify the best design for development**.

MANY DISCIPLINES, ONE PROCESS

Transformed processes are the foundation for business transformation. An **integrated, associative development loop allows more collaboration between disciplines, greater agility for innovation and huge efficiency gains**.

In the concept development phase, MODSIM provides the agility to make multiple changes and explore more variants before sending the vehicle for further development. Making any changes at this early stage drastically reduces the time and cost associated with amendments later in the cycle.

Accelerated concept model development

- Reduce geometry creation time by up to 90%
- Flexible and fully parameterized concept models
- Reuse existing assets and grow your module library

Continuous MODSIM engineering loop

- Automatic generation of simulation-ready models (mesh and connections)
- Definition and reuse of multidiscipline simulation scenarios
- Massively reduce concept evaluation time

Process automation and result analytics

- Automated design space exploration
- Drastically increase the number of evaluated concepts
- Intuitive trade-off and decision making

Harmonized end-to-end platform

- Associative integration of requirements, space reservations and engineering inputs
- Continuous and seamless design from concept to detail

A MODSIM approach empowers different disciplines to work as one team. Instead of being restricted by CAD, CAE and other systems, designers, engineers and simulation analysts are brought together with a common data model, automated processes and a unified user experience. In this shared space, experts from different fields can innovate with confidence to create market-leading vehicles faster.

To find out more about MODSIM, visit: go.3ds.com/MODSIM

Do you want to talk about a MODSIM journey and the applications of our Dassault Systèmes roles Concept Structure Engineer and Concept Structure Analyst? Contact us.

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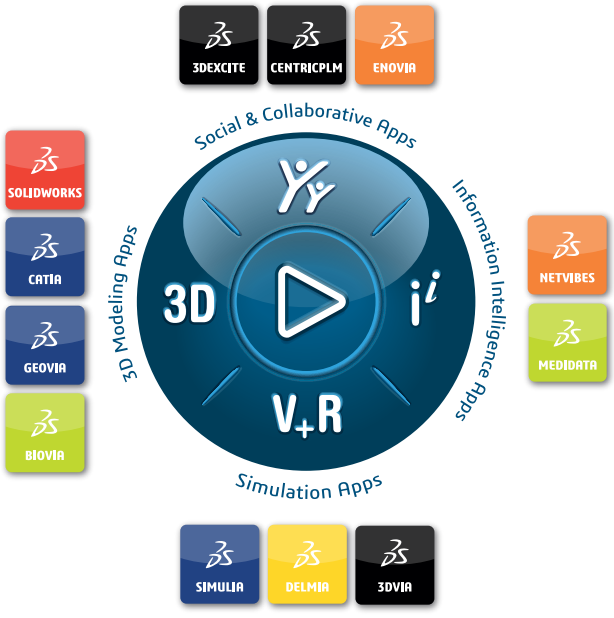

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