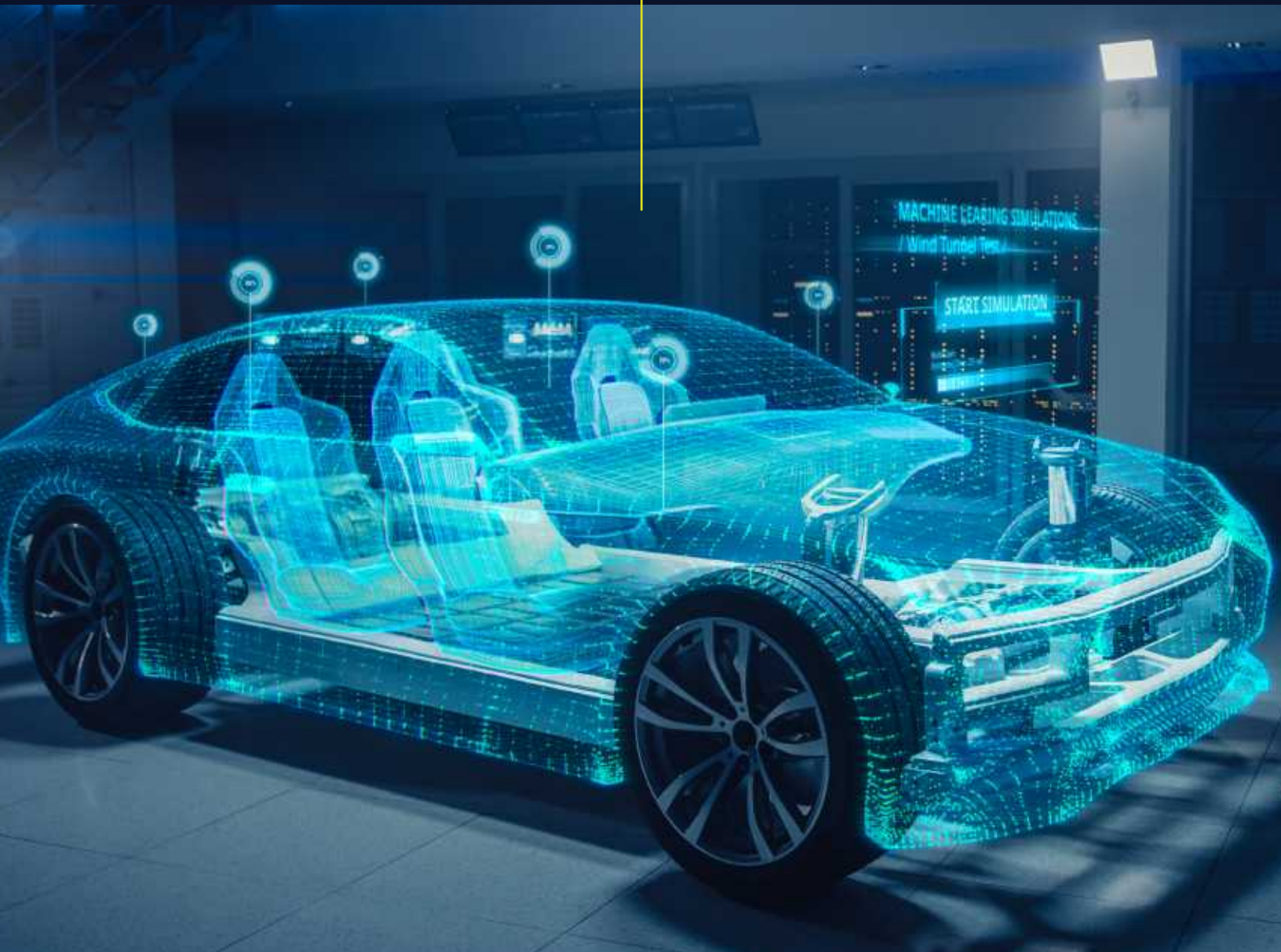# Automating the Engineering Chore to reduce 3D CAD data in Plant Layout and AR/VR

Automating the Engineering chore to reduce 3D CAD data in plant layout and AR/VR

Executive Overview

While augmented reality (AR) and virtual reality (VR) applications have long been associated with gaming, they're now moving into manufacturing. Production employees now can use small, user-friendly headsets to train in the virtual world, executives visualize all types of manufacturing data in meaningful ways, and technicians and service people train using AR service manuals.

Companies enable all of these applications by reusing 3D models. However, such models are incredibly large and intricately detailed. Reducing these models to make them viable for these applications is incredibly time consuming and just isn't feasible for engineers. It prevents them from working on other projects.

The automation of these reduction tasks is beneficial. However, the result must still be of high quality.

A salesperson can't show off a poorly rendered AR model to a potential buyer. Those looking to reap the value of reusing 3D models are turning to 3D_Evolution® from CoreTechnologie, which converts computer-aided design (CAD) data into high-quality, readily usable, AR and VR depictions.

This publication explains how the reuse of 3D models is spreading to a wide range of applications across manufacturers. It expounds on the challenges of this task, especially from an engineering perspective. It then makes the case to automate the simplification and reduction of 3D models while maintaining a high level of quality.

Manufacturers that reuse 3D models for a range of applications are well ahead of their competition. The time to capitalize on this opportunity is now. Streamlining CAD model conversion allows manufacturers to realize the innovation and promise of AR, VR, plant layout and more.

Repurposing Engineering Models

Engineering departments build 3D models as part of the design and documentation cycle. Increasingly, other departments are recognizing how to reuse this incredibly detailed asset in new and innovative ways. The applications of reusing 3D models fall into four categories: sales, plant layout, service, and training.

AR/VR for Sales: Product Visualization and Configuration

Today, the uses for AR and VR in manufacturing are growing fast. New applications in field offices help salespeople close orders more quickly because they present their products in new, interactive ways. Potential customers see in three dimensions exactly how their products would look with the new configurations. This includes everything from the inner workings of products to external aesthetics. Furthermore, prospective customers can configure the products to their exact specifications and then observe, in real time, how those changes would look. Reusing 3D models is a fundamental enabler for this application of AR and VR.

Virtually interacting with and configuring products boosts the surety of form, function and fit in customers' minds. This leads to more sales at a faster clip. Additionally, it allows sales offices to present products that might not otherwise fit on the office floor.

Plant Layout: Discovering Slowdowns

The 3D models of equipment produced by engineers are a natural fit for plant layout. They enable engineering teams to mockup entire facilities, configure the shop floor, and simulate the flow of goods. This allows teams to identify, isolate, and address potential bottlenecks and slowdowns.

Reusing engineering models for plant layout accelerates and streamlines work. Exploring and visualizing different configurations of the plant or facility ensures the site is operating at capacity. This results in an increase in production efficiency and throughput and, of course, produces financial benefit.

Additionally, modeling will become indispensable when digital twins become more mainstream. A digital twin mimics the robotic line in the virtual world and shows engineers where to adjust modeling profiles and operating parameters.
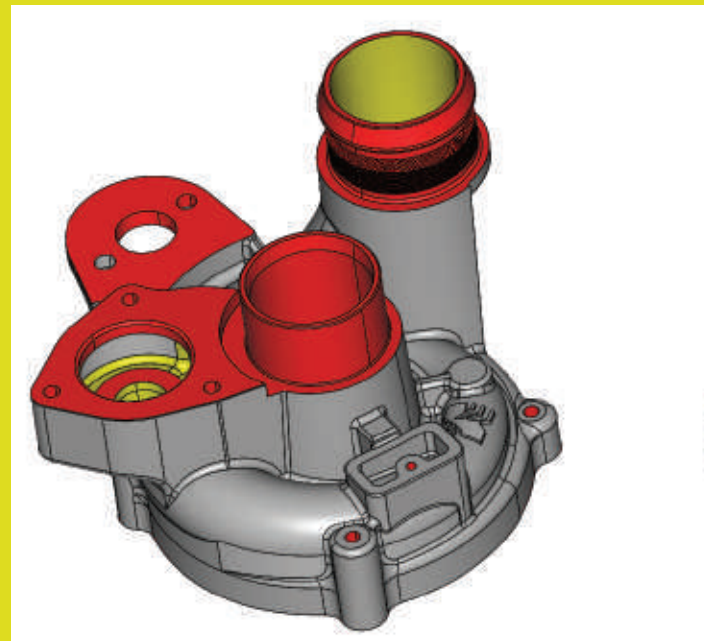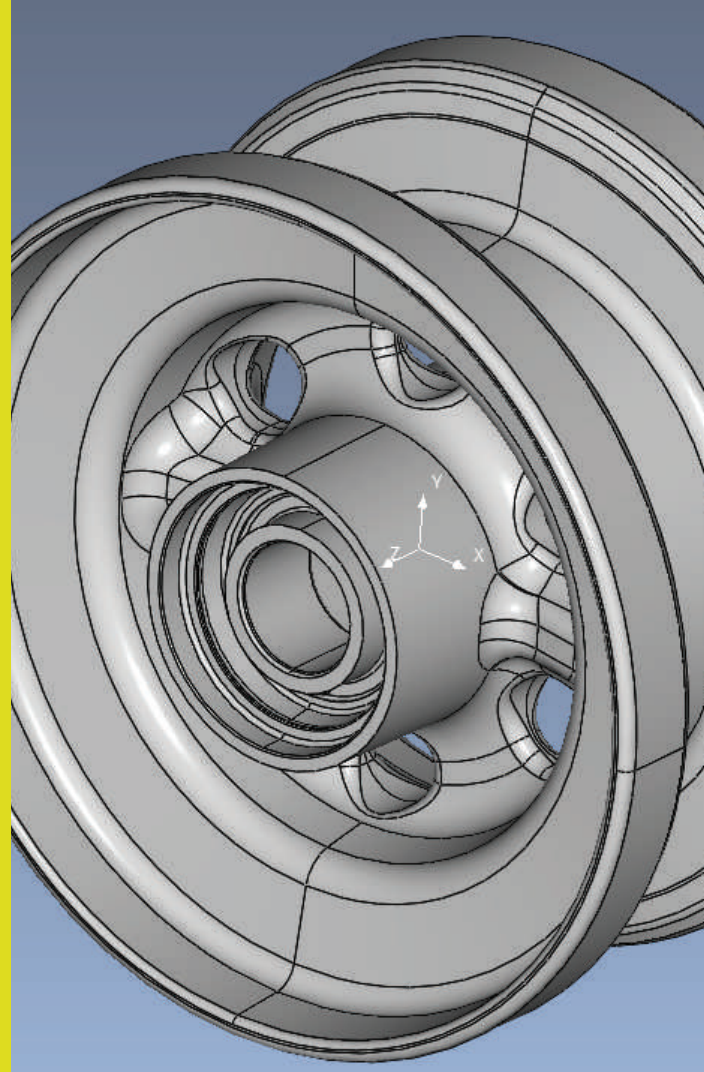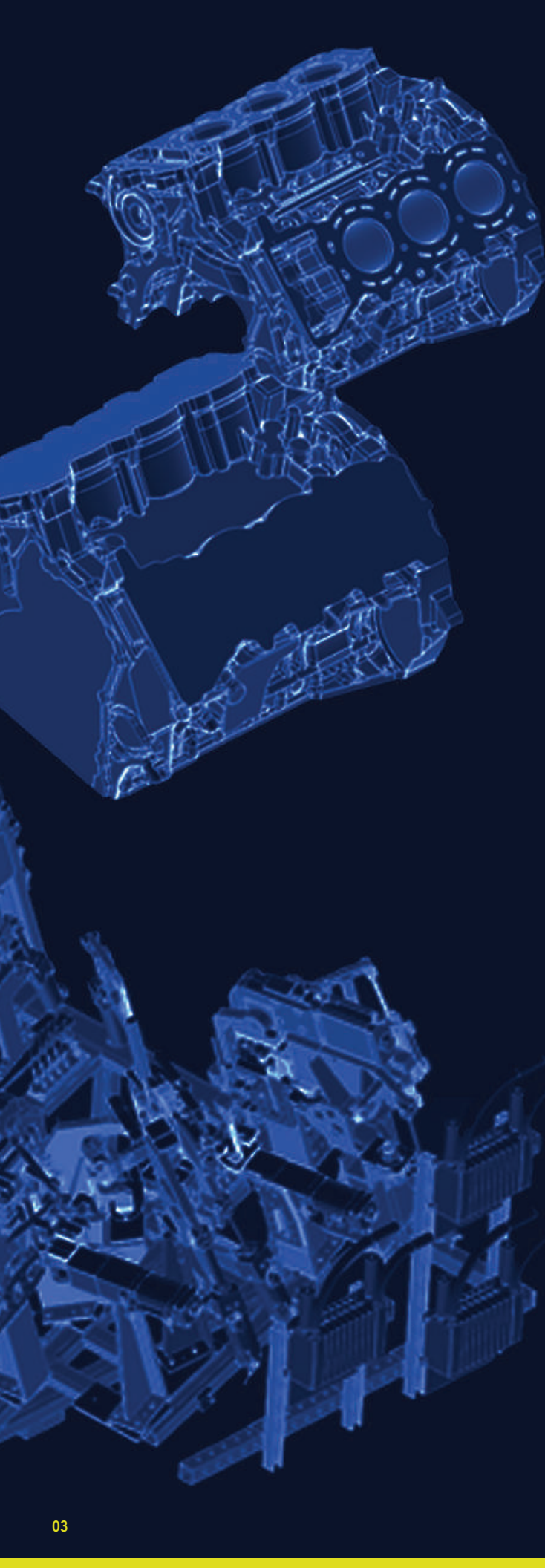
AR/VR for Service: Boosting First-Time Resolution

Leading manufacturers build customer service into their plans. Service and maintenance are crucial to all businesses.

AR service manuals already exist. Technicians wearing AR headsets zoom in on a problem with an industrial machine, and an AR animation appears on the screen atop the real-life part. Service animations guide technicians step-by-step through maintenance procedures.

Virtual instructions are much easier, and less time consuming, than consulting a service manual in paper form. They also allow service and maintenance technicians to better understand procedures than they would by following directions and two-dimensional diagrams in a manual. Directions for repair and maintenance in 3D are easier and more intuitive to follow. Technicians progress through the steps quickly without making mistakes or trying other repair methods, such as calling in a manager.

These 3D service guides raise the rate of first-time resolution, a key metric that leads to higher customer satisfaction and recurring service revenues. Ensuring a large volume of service revenues is crucial to any industry transitioning to a product-as-a-service model.

AR/VR for Production: Accelerating Learning

Another application of AR and VR is in training, as these technologies are also suitable for use in instructing production workers. The applications deliver a new, more detailed, and less ambiguous method of instruction. As a result, production workers know exactly how to execute procedures. Just as with service, the 3D applications offer employees a virtual, detailed guide to each step of the production process. The workers even interact with and interrogate the model to gain more clarity on just how a certain aspect of the production process must be carried out.

When employees train using AR and VR, rather than sitting through seminars or receiving verbal or online instruction, they return to the production line faster. One other big benefit: They're better trained on manual tasks, reducing errors on the shop floor, and saving production costs.

The Challenge of Reusing Engineering Models

Manufacturers are realizing that reusing 3D models gives them new and innovative methods to work with, and communicate information about, their products. Companies achieve strong value from these methods. However, a number of challenges stand in the way.

Native models created in CAD applications contain an incredible amount of rich information and data, which makes files very large. The models, for example, contain highly accurate boundary representations of part geometry. They also include details of how the parts were built, as well as parametric controls for design changes. Some also have computer-aided manufacturing information pertaining to machining, such as feeds, speeds, and step-overs. This information allows manufacturers to use 3D models as a rich source of information—perhaps even as a model-based definition. All of this aids manufacturers, but it means file sizes are extremely large.

The problem is that manufacturers cannot use large files for AR or VR experiences or for plant layout. The use of fully detailed 3D models slows the responsiveness of applications. AR and VR applications become glitchy and unresponsive. To date, this has undermined the reuse of 3D models in these applications without the need for painful, time-consuming efforts. Repurposing 3D models for other applications requires simplification, known as the effort to reduce CAD file size and polygon count by removing geometric entities. The question is: How do manufacturers accomplish this?

The Traditional Way of Preparing 3D Models for Reuse

Manufacturers generally follow an established approach to the reuse of 3D models. Engineers prepare 3D models by manually modifying the geometry. They remove internal details, simplify external details, shrinkwrap portions of the geometry, create bounding shapes but, leave the solid geometry such as connection points intact. This process removes a great deal of information and data, simplifies the model, and makes it smaller.

However, manual efforts have a big drawback: they take a lot of time. It might take eight hours to simplify and prepare a single 3D model which can be completed with automation in less than an hour. From a financial perspective, manual efforts are costly in two ways:

Wasting engineer's time

This takes highly valued engineers away from the tasks they've been trained to do: designing, detailing, verifying, and testing products. Engineers' time is fractured, which delays new product development, cuts time spent exploring design options, and undermines innovation.

Hiring new employees

Companies hire new staff to simplify the engineering models. It is possible that the company is able to justify the expense, depending on the profit of the business. On the other hand, the net-new costs to the manufacturer undermine margins for emerging product-as-a-service businesses.
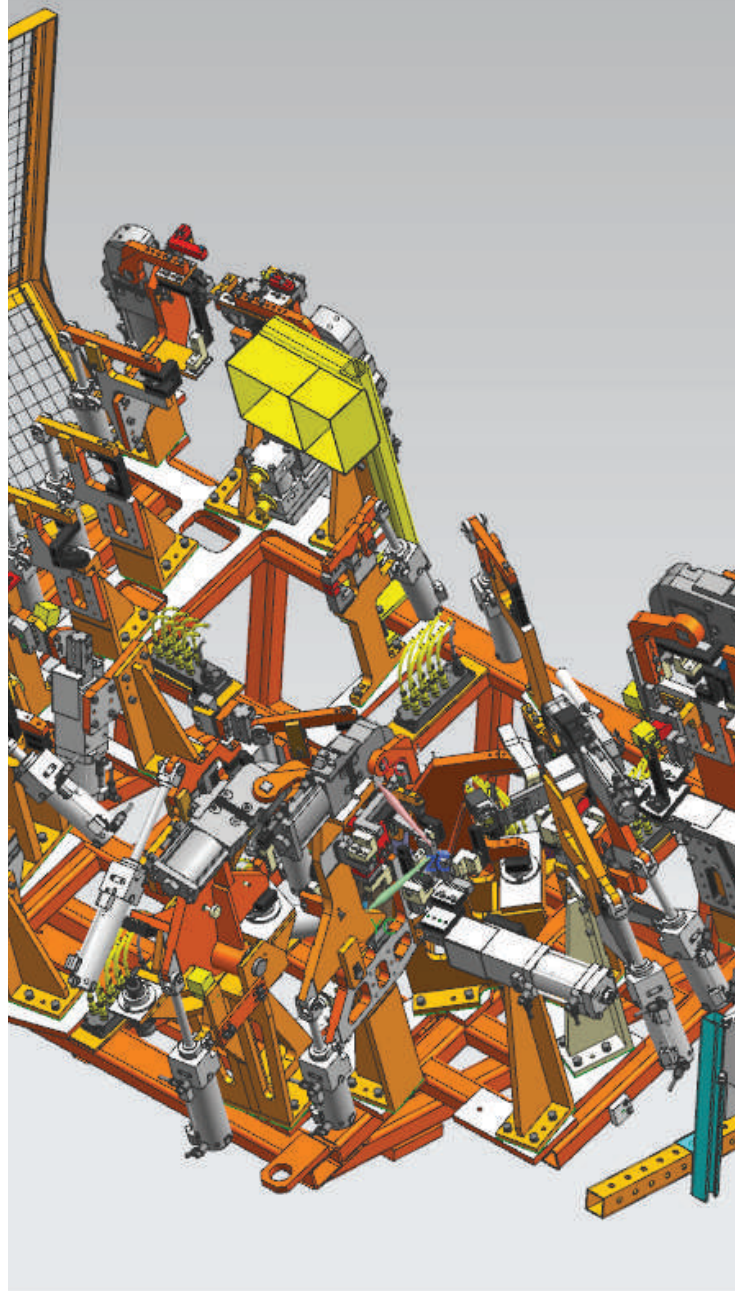
Giving engineers another job that doesn't put their skills to the best use, or calling on new, untrained staff that add expenses to the business are not ideal approaches. Neither action is financially neutral. The significant time and cost required hampers companies looking to leverage 3D models for reuse.

# Automating AR and VR Experiences with CoreTechnologie

There is another choice. Manufacturers now have access to a new technique to automate the simplification and reduction of 3D models for reuse. This approach, -with 3D_Evolution from CoreTechnologie—accelerates the reuse of 3D engineering models and cuts the costs of preparing those models. The idea is to use 3D_Evolution to automate the simplification and reduction of 3D models while maintaining a high-quality output. The technology provides two sets of key capabilities:

- **3D_Evolution** automates the simplification and reduction of 3D models from their native formats. It decreases sizes by more than 90 percent through the use of algorithms that optimize the decimation of polygons for maximum file-size reduction. This capability automatically removes small, unneeded details, shrinkwraps geometry, and removes internal geometry.

- **3D_Evolution** works on batches of models, using automated scripts. This capability integrates with a range of product data management (PDM) and product lifecycle management (PLM) systems to automate the entire preparation process using the developed script for different results. It runs as a background process, kicked off by activities in the PDM or PLM solution, or in directories. This works for 90 percent of all models, vastly reducing the manual effort of 3D model preparation.
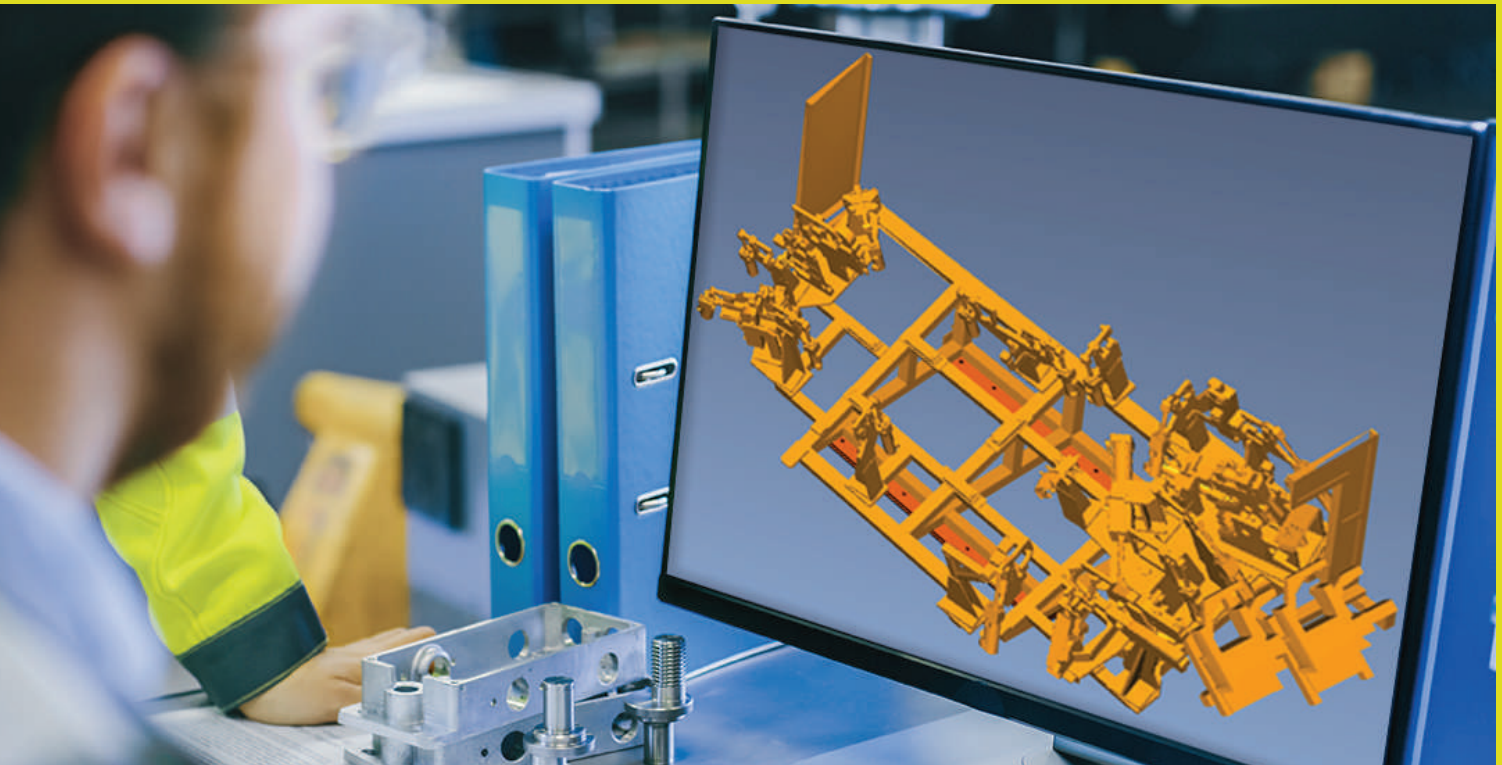
Leveraging 3D_Evolution from CoreTechnologie permits companies to reuse 3D models without engaging in the drawbacks of manual modification. Engineers stay focused on design. There is no need to invest in finding, hiring, and bringing new engineers on board to prepare 3D models.
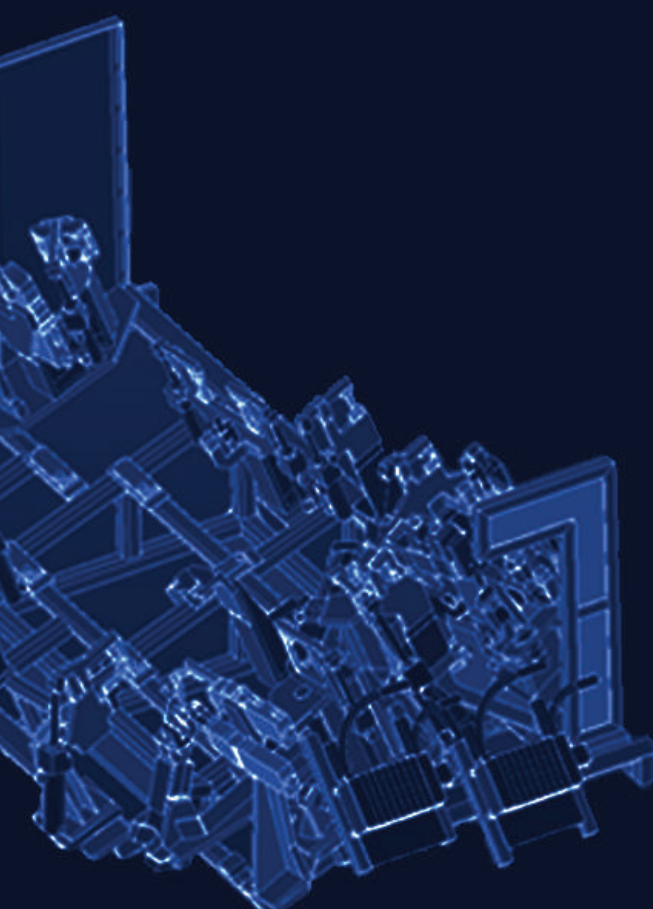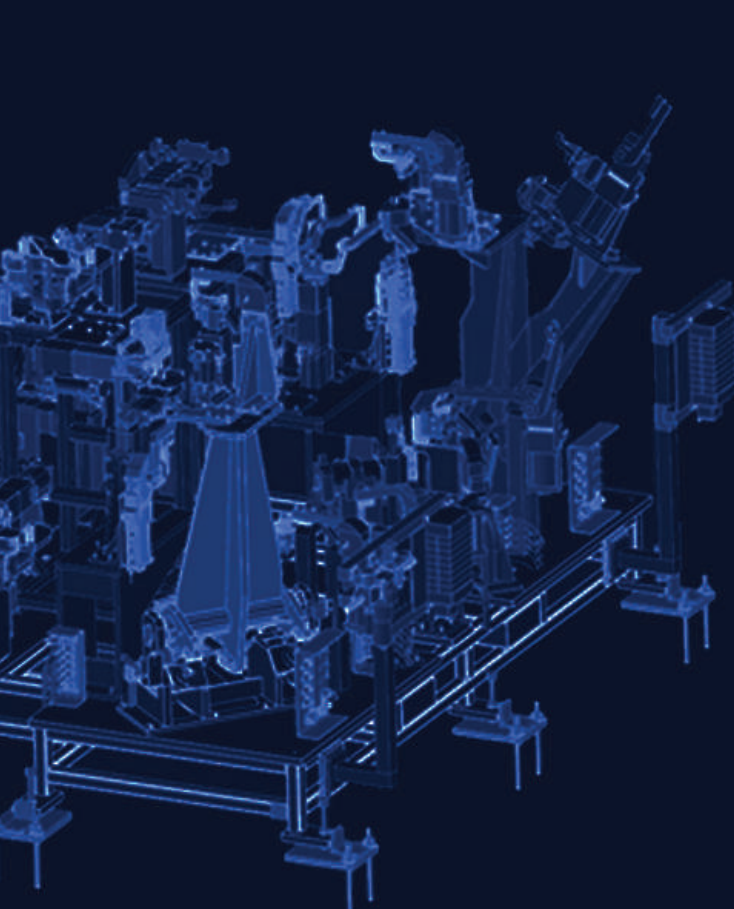
Generating Envelopes, Simplifying Models

Detailed CAD model files are so large that some downstream applications can't work with them. The 3D_Evolution Simplifier function automatically generates envelope geometry for all major digital-factory planning and AR/VR tools. Envelopes replace details such as energy chains, conveyance systems, robot cells, and special section tubes. After simplification, the models are a fraction of the size of the original model. Because of the massive reduction in the number of elements, the Simplifier module enables accurate and fast processing of large CAD models.

The module uses a multi-thread processing tool that simplifies gigabytes of data in hours. It reduces the elements of typical assemblies with a decline in polygon count of up to 95 percent.

Working with CAD, PDM, and PLM Solutions

3D_Evolution's planning process software reads 3D formats like CATIA, JT, Creo, NX, SolidWorks, and STEP. It also recently added DGN interfaces. A CAD license is not required, reading from the binary code. 3D_Evolution automatically creates envelope geometries based on the exact, original model. The unique technology extracts the inner geometry of the models. Then it creates an outer shell as a closed, solid volume for conversion into CADx or a factory planning system such as MicroStation, Process Simulate, or PDMS.

In addition to removing the internal geometry, fonts, radii, and other unnecessary details, the software also removes holes and replaces them with embossed placeholders. It identifies and automatically deletes the internal bodies, leaving only the bodies that are visible from the outside and relevant for the planning process. In all stages of reducing file size and conversion, the healing functions ensure that geometry errors in the CAD model are checked and cleaned up.

Converting to Functional Structures

The software converts CAD assembly structures into the functional product structure necessary for space planning and simulation. With just a few clicks, the user disassembles, or "flattens," the original assembly structure. This merges parts of the simplified model in a manner that restricts the subassemblies and bodies that belong together in a new and now-functional oriented assembly structure, protecting the IP.

Recap and Next Steps

To define the requirements and the use case. CoreTechnologie has seen some of its customers that have developed multiple scripts for internal use - heaviest model, and external use; lighter weight model.

Reusing 3D models across an enterprise leads to shorter ramp-up times, fewer errors, less scrap, and faster time-to-resolution. Although 3D models drive the visualizations behind these applications, they are too big, intricately modeled, and cannot be used directly in other software tools.

Reducing these models consumes too much of engineers' time, keeping them from focusing on other projects. By automating this task, manufacturers can reuse 3D models broadly and reap their benefits, while enabling engineers to concentrate on design and innovation.

The 3D_Evolution program from CoreTechnologie converts CAD data into high-quality, readily usable AR and VR depictions. The program automates the simplification and reduction of 3D models from their native formats by more than 90 percent. It also works on batches of 3D models using automated scripts. This capability integrates with PDM and PLM systems to automate the entire preparation process in a batch activity.

By automating the preparation of the large 3D engineering models for sales, service, training, and plant layout, manufacturers can realize the value of reuse quickly.

To find out more about how Core Technologie can help you, contact us at :

info@us.coretechnologie.com

www.coretechnologie.com

248-563-8817