Automated Geometry Simplification using 3D_Evolution™ for Multi-CAD application in a PLM system
Abstract

A large general machinery company wanted to develop an automated process to generate simplified 3D Computer Aided Design (CAD) model from existing master models and manage the results in the PLM application. The current manual process was time consuming with inconsistent results. A few of the requirements are Auto export data from database to be simplified, remove all internal parts and features of the models, remove all parts internal to an assembly. In addition, create JT, STEP copies of simplified models.

A persistent collaboration challenge in sharing data is how to reduce the size of a model being shared for visualization, along with the Computer Aided Design (CAD), Computer Aided Engineering (CAE) and Computer Aided Manufacturing (CAM) departments through process automation. CT Core Technologies introduces within this paper, Automated Geometry Simplification using 3D Evolution for Multi-CAD application in a PLM system. With the press of a button the Geometry Simplification (GS) module enables the automatic simplification of 3D models, creating a bounding geometry. This innovative application will allow its users to reduce the model’s overall size and complexity using a unique scripting language to allow for flexible implementation into PLM systems.

This sensitive data is exposed in the model history, and assembly. The 3D_Evolution architecture contains a scripting language to allow for process automation within the PLM application. Bodies can be simplified automatically by keeping removed details in ‘no-show’. Specific enhancements to the 3D_Evolution product have allowed users to filter to exclude or simplify; always removing parts list within the file, if required. Automation is achieved; data stored for quick access in companies' PLM system of choice and Intellectual Property is not compromised.
**Case Study**

A large general machinery company wanted to develop an automated process to generate simplified 3D Computer Aided Design (CAD) model from existing master models and manage the results in the PLM application. The current manual process was time consuming with inconsistent results. Moreover, it was difficult to keep in sync the master models to the simplify models due to the time checked out from the PLM application. In addition, the large general machinery company wanted to protect its Intellectual Property (IP) by removing the internal components, thus creating the envelop information, while reducing the size of the model by sixty-five percent.

**Requirements:**

- Auto detect changes in the database
- Auto export data from database to be simplified
- Remove all internal parts and features of the models
- Remove all parts internal to an assembly
- Flatten the assembly in to a single multi-body part
- Create native CAD files, and check back into the database
- Create JT, STEP copies of simplified models
- Send final results out to the enterprise for use.

**Methodology**

In order to have a competitive advantage in a global environment, companies must be able to collaborate while safeguarding their Intellectual Property (IP) of confidential information contained in its 3D CAD models. A persistent collaboration challenge in sharing data is how to reduce the size of a model being shared for visualization, along with the Computer Aided Design (CAD), Computer Aided Engineering (CAE) and Computer Aided Manufacturing (CAM) departments through process automation. Another major challenge is to create simplified representations without compromising the information business partners need to accomplish their tasks. CT Core Technologies introduces within this paper, Automated Geometry Simplification using 3D Evolution for Multi-CAD application in a PLM system. This module is based on the conversion 3D_Evolution software. With the press of a button the Geometry Simplification (GS) module enables the automatic simplification of 3D models, creating a bounding geometry. This innovative application will allow its users to reduce the model’s overall size and complexity using a unique scripting language to allow for flexible implementation into PLM systems.

The fact is that 3D models with comprehensive interior designs reveal details and design features about a new product before it reaches production. This sensitive data is exposed in the model history, and assembly. Because the data is sent too many different end-users for visualization layout, mock-up, and engineering, it is difficult to control who eventually accesses the data. The only effective solution is to provide geometry that
does not contain confidential design details for engineering use-cases that do not require it. 3D Evolution's GS module produces geometry which removes internal data sets without disturbing the consistency of the data needed for the end-user to complete his or her task.

Now that users' data has been simplified, 3D Evolution provides a solution suite for process automation. The 3D_Evolution architecture contains a scripting language to allow for process automation within the PLM application. GS module parameters can be customized for companies or furthermore, multiple business units, in specialized scripts that can be deployed within the PLM application. This customization can output the Simplified version of the original CAD assembly/model with their own nomenclature within your PLM system for easy access and identification.

Collaboration is still a critical component and hurdle with large datasets. Sending data across the globe is difficult when detailed models, such as engines, gearboxes or powertrains are shared due to bandwidth with size limitations. A massive reduction of the file size of up to 75%, can be achieved through the automatic process using 3D Evolution scripts. Assemblies can be simplified by filling holes before GS with the removal of internal and external objects; users can even take the voxel size of a model in a percentage of the assembly. Bodies can be simplified automatically by keeping removed details in ‘no-show’. Setup configurations allow making the choice to remove holes or bosses by saving time to remove the smallest of details on a 3D cast. Another interesting feature of the GS module is the fast and easy access to the casting cores. Users can take it to the next step by setting up the configuration by keeping exact representation of faces with areas greater than a specific volume in, __mm x^3. GS allows for selection of the type of plane, cylinder, cone, sphere or torus; remove the smallest bodies or details less than a specific volume in mm x^3. Specific enhancements to the 3D_Evolution product have allowed users to filter to exclude or simplify; always removing parts list within the file, if required. Oftentimes, users opt to flatten the assembly into a single multi-body part to protect their proprietary part numbers.

Finally, after protecting your Intellectual Property and collaborating with manageable file sizes accessible through your PLM system, your company can have a reliable output with a quality standard that targeted business units desire. The automatic simplification routine creates an outer shape bounding geometry which exceeds even the most stringent quality standards. For some applications especially the inner geometries are interesting; FEA (Finite Engineering Analysis) calculations the “wet surfaces” as an example an intake air duct can be extracted. These results are repeatable and quantifiable through our 3D Evolution solution set deployed within the scripts. Automation is achieved; data stored for quick access in companies' PLM system of choice and Intellectual Property is not compromised.
Conclusion

In an era that is witnessing technological discontinuities, managers should not focus on size as a goal; instead, they should focus on the development of new business models that help them have a competitive advantage to stay alive. It has been said, "if you are not [implementing automated process] in this era, you will not be in business" Companies like CT Core Technologies allow its customer to automated simplifications, reducing time-to-market while making its core business the engineering chore. The end result is displacing our competition while increasing its intellectual capital through resources, technology, and methodologies. It is important to note that the increased automation of routine scripts will not remove the human element in innovation. On the contrary, it will allow people to focus on areas where their value is greatest; generating novel ideas and concepts, learning from experiments, and ultimately making decisions that require judgment. Core Technologies welcome the time to understanding of our customers simplification needs.

About CT Core Technologies, Inc.

CT Core Technologies, Inc., a subsidiary of CT CoreTechnologie GmbH Group headquartered in Frankfurt, Germany; is the leading provider of 3D Computer Aided Design (CAD) translation software known as 3D_Kernel_IO, 3D_Evolution and 3D_Analyzer. The company’s purpose is to optimize the interoperability space and help organizations to effectively share engineering data in the product lifecycle management (PLM) process. 3D_Kernel_IO is the Software Development Kit (SDK) used in 3D Evolution suite. It is also embedded in many well-known CAD, CAE, CAM software solutions which are the first choice conversion tools for leading technology companies in the automotive, aerospace, general machinery and consumer goods industries. The 3D_Evolution™ product-line is module-based to include the reading of features, Simplification, Thickness Checker and Model Compare just to name a few. Its kernel comes with healing and stitching functions as well as scripts that are written for implementing automated processes for the engineering chore. The 3D Analyzer product allows for visualization of 3D embracing model based definition.

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