WHITE PAPER

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FEATURE and HISTORY TRANSLATION

As CAD data translation has developed over the years, it has faced many challenges. Some of these were of a technical nature, such as the effective translation of surfaces and later, solids. Some have business implications, such as the translation and exchange of product data associated with the CAD model. Over time they either have been resolved, or are in the process of being resolved.

The most recent challenge in the world of CAD data translations, the need to translate feature and history information, combines both technical obstacles and business implications. Here at Theorem we already have our first generation of "features based" translators in production and we know that the technical challenges can be overcome.

However, the business implications are unlike anything that has ever gone before in CAD data translation. As the technical issues diminish a real business issue arises.

Giving away your knowledge base?

If the CAD data exchange process encompasses the features, the history tree, the parameterisation data and constraints, then anybody receiving the translated model will be able to automatically and rapidly generate the same fully functional and parameterised model. They will then learn what you alone know, the features you use and the intelligence you employ to design the product(s) you sell. This is not just a simple scaling of a model, it is the transfer of a significant amount of intellectual capital and proprietary data.

For those who work in supplier chains the implications are significant. Your customer now knows a lot of your added value, he may more readily assess your strengths and weaknesses. He will have competitive bids for similar work, he can now make comparisons about how you design your products. Unless you contractually restrict him he can now quickly modify or redesign your products himself, by changing parameters or features.

On the other hand

For the OEM, large supplier, or for the CAD design house, who have several different design systems in house, here is the opportunity to share higher value data between in-house systems. When a feature on one system becomes a feature in another, and all the parameterisation works after the translation, then significant benefit may be gained from bridging across more than one CAD system. These parts or assemblies may then be finally brought together into the optimum system, for final assembly. If you work in a collaborative design environment you will want your customer or supplier to use the

parametric model. This will significantly reduce the effort required to design "in-processes" shapes needed for manufacturing. For these users, there will be real gain.

Implications

As we move to the deployment of feature and history based translations the effect of exchanging this type of data needs to be considered. That is the business implications are becoming a significant part of the decision process for companies choosing to collaborate on design. Previously it has mainly been a technology issue. Suppliers and O.E.M.'s therefore need to analyse their requirements and put the appropriate business practices in place.

The Solution

Fortunately the way Theorem's products are operated means you can turn feature and history translation on or off by just changing one setting. If it's set off then the translation will just pass the explicit geometry, attribute and assembly data so hiding your design knowledge from your business partner. In many cases this form of data is all that is required in a collaboration. If the data is to be used for Manufacturing, Analysis, Packaging or Digital Mock Up, this form of data will be adequate. If your business partner has design authority, and so will modify your design data, features should be turned on.

Whilst in the near term the translation of feature and history data will be achieved by direct (native to native) translators, longer term the use of STEP as a method will be a preferred route for some users. Today STEP provides Application Protocols for exchanging a rich set of data but not features. Theorem offers STEP AP203 and AP214 products today to enable the exchange of data by STEP. As an active member of the STEP community Theorem are working to define the STEP Construction and History Module which will result in the ability of various STEP Application Protocols to support the exchange of feature and history data.

Since mechanical CAD systems each employ proprietary representations of their data, neutral system independent standard formats such as STEP can be helpful when data must be moved from one CAD system to another or to a manufacturing system that works with CAD geometry. Using neutral standards requires a two-step process. The originating system must translate its proprietary format to the standard and write it to a file. The receiving system must then read the file and transform it to its internal format.

A new STEP module the Construction and History Module will in the future add feature and history definitions to the geometry and topology of AP203 and AP214.

Benefits of Feature and History Translation

Translation of an intelligent model, instead of just explicit geometry, gives the recipient of the design a more useful CAD model. The latest developments of Theorem's

CADverter products support features, histories, dimensions, parameters, attributes, and assembly structures between multiple CAD systems, into the company's Generic Collaboration Object (GCO). From there it translates this data into logical equivalents of the target systems.

At the core of feature translation is the Generic Collaboration Object (GCO). GCO is a system-neutral representation of design knowledge. Feature translation enables the communication of engineering-related information between and among OEM's and suppliers throughout the supply chain.

Adding feature support both extracts design knowledge and creates knowledge from/to proprietary CAD systems including Unigraphics, CATIA, Pro/ENGINEER, and I-DEAS, into GCO where it can be used in a variety of ways. For example, it can be passed along to other systems recreating models while maintaining the integrity of the design. Also, two or more engineers can share models between themselves, and continue to work with features, history, constraints, etc., without any operational knowledge of the other system.

In all industries, the pressure is on both manufacturers and suppliers to shorten product design cycles and reduce development costs. Complex products are made up of many parts, an automobile is made up of thousands of parts, and an aircraft is made up of hundreds of thousands of parts. These are sourced from hundreds of suppliers, so a closer, more collaborative work environment is essential if the need is to exchange and modify design data.

In supporting feature translation Theorem have yet again increased the scope and so raised the efficiency of data translation. OEM's will benefit with shortened design cycles, faster time to market, lower infrastructure and parts cost, and improved relationships with suppliers. Suppliers will reap the benefits of expanding business opportunities, better balancing of workloads. Suppliers can collaborate with OEM's at lower costs by utilising multiple CAD environments.

The knowledge of design, the creative element of design is captured in the modelling process. Exchanging, design knowledge, as defined by – features, history, constraints, assemblies, – has been a requirement for some years.

The Generic Collaboration Object (GCO) is a unique technology developed over 10 years by Theorem to enable design information to be readily shared between extended product teams regardless of their internal design systems. For the first time, true collaboration between disparate design systems is possible.

Collaboration is the key for all participants in the extended design chain. For both manufacturers and supplier, the opportunities brought about by Theorem's collaboration solution represent the opportunity to save time and money. Collaboration between organisations reduces the time to communicate change and make decisions, thereby shortening the design cycle.

Business opportunities are expanded now that suppliers can design in any system, yet meet any OEM's specific format requirements, they can bid on more projects at more competitive prices.

Collaboration allows suppliers to reduce the number of CAD/CAM systems they operate, and allows their workforces to use the design system most suited to their skills, without the necessity of re-mastering designs. The cost of ownership, higher skill retention and reductions in system support result in lower infrastructure expense, and higher margins.

Feature and history file conversion is one in which all of the original geometry and geometric features of the model in a source CAD system file are re-created by the CAD application in a specified target software application. For example, if the source is CATIA and the target application is I-DEAS, all of the geometry and geometric features are re-created directly by the I-DEAS application automatically. An operator does not drive the application, it is driven as part of the translation process.

This means that translated data is ready to use, fully modifiable and accurate. It will look and function as though it was created by the target CAD system, in this case I-DEAS.

Data Translation which does not support features and history will reduce a designers ability to manipulate the file. Usually it is possible to add protrusions or cuts but it is very difficult to define, move, resize, or modify the shapes.

Now with feature translation users will have a file translated which allows them to manipulate the geometry with all of the functions and capabilities of their specific CAD application.

The advantages of feature and history file translations include (but are not limited to):

- Fully modifiable features and entities are easier to work with.
- Smaller and more efficient files.
- The ability to share CAD files across an organisation or across an industry, regardless of the types of CAD systems being used by the parties sharing the files.
- The realisation of interoperability and collaborative engineering because feature and history file translations pull all of the design features over to the target file rather than just creating a "dumb solid".