Chapter II
CAD Data Exchange and CAD Standards

ABSTRACT

Today, more companies than ever before are involved in manufacturing various parts of their end products using different subcontractors, many of whom are often geographically diverse. The rise of such global efforts has created the need for sharing information among vendors involved in multi-disciplinary projects. Transfer of data is necessary so that, for example, one organization can be developing a CAD model, while another performs analysis work on the same model; at the same time a third organization is responsible for manufacturing the product. Data transfer fills the need to satisfy each of these functions in a specific way. Accurate transmission is of paramount importance. Thus, a mechanism for good data transfer is needed.

The CAD interoperability issue - using one CAD system in-house, yet needing to deliver designs to, or receive designs from, another system, poses a challenge to industries such as automotive, aerospace, shipbuilding, heavy equipment, and high-tech original equipment manufacturers and their suppliers. It is worth studying the issue and determining how engineering model data is delivered today to manufacturers and suppliers, how CAD conversion, geometric translation, and/or feature-based CAD interoperability are handled, at what expense, and under whose authority.

This chapter explores the various ways to make this vital transfer possible. The attention will be directed towards data exchange and standards for 3-D CAD systems. Since CAD data formats have a lot to do with CAD kernels that govern the data structure and therefore the data formats, some popular CAD kernels are discussed. The data interoperability section covers different types of data translations and conversions. The use of neutral or standardized data exchange protocols is one of the natural methods for data exchange and sharing. This topic is covered at the end of this chapter.
ISSUES AT HAND

Computers and information technology have been introduced into industry in an ad hoc manner to initially relieve particular bottlenecks in industrial processes. There is no need to think of the effect on the overall enterprise and the issue of integration. Any attempts to deal with data exchanges were also in an ad hoc manner (Bloor & Owen, 2003). As computers are used more and more in all walks of an organization, in particular the product development process, data exchange and sharing has now risen to the top of the agenda for many businesses. These days, industrial cases related to CAD data conversion are not hard to come by. Consider large automobile manufacturer such as General Motor (GM®). The factory has facilities in 30 states of the U.S. and 33 countries. Parts for a car may come from within as well as outside the US. These parts are designed and manufactured according to the specifications prescribed by GM®. The companies that design these parts may not use the same CAD system, hence the necessity of data conversion. There is also a need for data sharing among the different parties of the design team. Pushing for a single CAD system across the supply chain will not sell. This is because any company may have other businesses which may lead to the choice of a different CAD system that suits a variety of applications. Companies that have more diverse businesses may end up maintaining two or more than two CAD or CAD/CAM systems. In this case, data incompatibility even exists in the company itself.

When it comes to working with other organizations, the format of design data that is exchanged tends to depend on its origin. Design data from customers and partners is more likely to be delivered in native CAD formats. Design data from suppliers is most likely to be received in neutral formats. This partially shows an increased level of awareness of data exchangeability among the suppliers. Design data from other internal engineering groups is largely delivered in native CAD formats as opposed to neutral formats.

It is worth noting that transferring data between various CAD systems must embrace the complete product description stored in its database. This includes the geometric data, metadata (non-graphic data), design intent data, and application data. Both geometric data and design intent data have been addressed in Chapter I. Metadata is the information (e.g. time stamps and the owner of the data) about a particular data (e.g. geometric data). This data is used to facilitate the understanding, use and management of core CAD data. Application data consists of any information related to the final manufacture and application of the design, e.g. tooling, NC tool paths, tolerancing, process planning, and bill of material. The types of data also depend on different stages of the product lifecycle during which the data is used. At some instances, data can be used in part or fully whereas in others it can be used with combination of different types. For example, while at the design stage more importance is given to the requirements of the customer, therefore geometric and design data are more relevant. Less emphasis is given to the metadata. Metadata can be critical when interacting with different systems and multiple users.

CAD KERNELS

CAD data formats are governed by the (solid) modelling kernels that the CAD systems were built upon. This is true with both history-based and history-free CAD systems as discussed in Chapter I. A modelling kernel is a collection of classes and components comprised of
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