Indian J.Sci.Res. 11 (1): 069-071, 2015
ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

INCORPORATION OF STEP IN THE OF MANUFACTURING ACTIVITIES

ASHOK G[1]

Department, Mechanical Engineering BKIT, Bhalki, India

ABSTRACT

Integration of Computer aided design, Computer aided process planning and Computer aided manufacturing seamlessly is one of the major issue in achieving the CIM. By tradition, CAD systems have tendency to be carefully on generating product design information more willingly than on readily and clearly facilitating the manufacturing of a product. Currently there is a apparent need in the marketplace for computer aided design & manufacturing systems that seamlessly integrate and facilitate design and manufacturing activities, allow for capably accepting tool and design changes on the fly, and allow the representation and exchange of digital part information using highly different machines and systems. The important issue in the integration is of part data exchange between Computer aided designs, Computer aided process planning and Computer aided manufacturing systems. In this research paper we are discussing the importance of the part data exchange standard in the integration, also how to relate standard for exchange of product data in the development of STEP based CAD/CAPP/CAM & CNC integrated system.

KEYWORDS: CAD**,** CAPP, CAM, STEP, Product Model Data, Exchange of Data

Automation of production systems for improvement in production efficiency and manufacturing flexibility has become one of the key issues in manufacturing industry and the only way to achieve this is through the application of computer integrated manufacturing environment in which computer aided systems work together with an integrated approach to support the life cycle of a product. In this regard, the integration of Computer Aided Design (CAD), Computer Aided Process Planning (CAPP), Computer Aided Manufacturing (CAM) and Computer Numerical Control (CNC) is considered as the key area of focus. In other words integration of CAD, CAM and CNC through CAPP is regarded as one of the key issues in the realization of CIM, which is expected to fulfil the need of current manufacturing industry in terms of total automation of its activities. In this integration process CAPP forms an important link between CAD and CAM which are usually developed independently and are considered as 'islands' of automation. Each system supports a separate phase of the whole product life cycle such as design and manufacturing and the integration issue is normally not focussed in their development [ISO CD10303-1, 1992].

Computer Aided Process Planning is the application of computers to assist the human process planner in the process planning function. Process planning is a task aimed at translating part design specifications and part description into manufacturing operation instructions by analysing the engineering drawing in respect of features, dimensions, tolerances, surface finish, material and production volume etc. and then examines the available processes, machine tools, cutting tools, fixtures, etc. in order to decide the following:

- Manufacturing processes
- Machine(s)
- Tool(s)
- Machining parameters
- Fixture(s)
- Sequence of operations.

Product Data Flow Issues in CAPP

Traditionally engineering drawings have been used to convey part specifications and descriptions, however it is found that an engineering drawing is not a suitable form of input for CAPP system and as an alternative CAD representation of part model is successfully employed as the input for CAPP system. Hence, it has become common practice to represent a designed part thorough its CAD model [Smith, B. M, 1989].

The product model data stored in the database of CAD systems, generated during the design and modelling process should directly flow to CAPP and from CAPP to CAM and CNC for seamless integration of CAD, CAPP, CAM and CNC. It means, in real life manufacturing environment there is always a need to manage data transfer between the CAD platform and other systems for various applications, which practically considered being difficult, because each

[1]Corresponding author

computer aided system has its own internal data model which is a proprietary data format. To resolve this, the data exchange issue should be addressed by means of adopting a common file format which the different computer aided system can read and process easily. By using direct translators between CAD and CAPP and between CAPP and CAM and from CAM to CNC, the data can be transferred, but the problem with this is, every different computer aided system requires a different translator, so there will be large number of translators required to handle all computer aided systems in the world. Another method is adopting neutral file format , a neutral file can defined as , the file with a format which is independent of any specific system standards and which acts as an 'agent' to connect dissimilar computer systems that cannot normally communicate with each other due to data format incompatibility.

It should be noted that neutral format is the 'acceptable' and consistent format within an organization or a group of organizations and the format may differ from other organizations which may set their own format standards. A review shows that companies are using neutral format files to achieve integration of manufacturing systems.

Application of STEP in manufacturing

STEP, standing for STandard for the Exchange of Product model data, is officially titled ISO 10303 [Bloor, M. S, 1991]. The aim of STEP is to provide a representation of product information along with the necessary mechanisms and definitions to enable product data to be exchanged. The exchangeof data is intended between different computer systems and environments associated with the complete product lifecycle including design, manufacture, utilisation, maintenance and disposal. STEP represents an open standard to meet product data requirements over the entire life cycle of a product, including geometry, topology, tolerances, relationships, attributes, assemblies and configuration. To accomplish its ambitious goal, STEP has been constructed as a multipart ISO standard and is organised as a series of parts and each part is published separately. STEP uses a formal specification language, EXPRESS, to specify the product information to be represented. EXPRESS is a data specification language that can be used to define data structures and constraints. It provides comprehensive facilities for the definition of entities, attributes and relationships in context of modular (multi-schema) data models**.** The use of a formal language enables precision and consistency of representation and facilitates development of implementations. To transfer this information, STEP usually employs the neutral file approach. Transfer of data from one application to another is usually a two step process requiring an export and an import. The actual medium is an ASCII file. STEP covers a very wide range of products such as electronic, electro-mechanical, mechanical and sheet metal fabrications. STEP uses application protocols (APs) to specify the representation of product information for one or more applications. The APs define the scope, the information to be exchanged, the means of testing and a user guide for implementing the application. The nature of this description makes it suitable not only for neutral file exchange, but also forms a basis for implementing and sharing product databases and archiving. The ultimate goal is an integrated product information database that is accessible and useful for all the resources necessary to support a product. It is this characteristic which makes STEP computer sensible. It supports design reuse, data retention and provides access to data across a product's entire life cycle. Fowler [U.S. Product Data Association, 1994 (Part: 41)] and Pratt [U.S. Product Data Association (Part: 203)] provide a good introductory text on this subject.

The STEP standard is divided into many Application Protocols belonging to the ISO 10303 family of standards. Each protocol defines a data exchange standard for a defined family of products at a defined stage in its life cycle. The 'APs' utilize the lower-level information of integrated resources in well defined combinations and configurations to represent a particular data model of an engineering or technical application. The protocols list is shown below,

- Part 201 - Explicit draughting. Simple 2D drawing geometry related to a product. No association, no assembly hierarchy. Practically a subset of AP202 and 214.
- Part 202 - Associative draughting. 2D/3D drawing with association, but no product structure. Practically a subset of AP214.
- Part 203: Configuration controlled 3D designs of mechanical parts and assemblies. Mainly used for

3D design and product structure. A subset of AP214 but most widely used.

- Part 204 - Mechanical design using boundary representation
- Part 207 - Sheet metal die planning and design
- Part 209 - Composite and metallic structural analysis and related design
- Part 210 - Electronic assembly, interconnect and packaging design. The most complex and sophisticated STEP AP.
- Part 212 - Electrotechnical design and installation. Designed as a complement for AP214, but not fully harmonized with it.
- Part 214 - Core data for automotive mechanical design processes
- Part 215 - Ship arrangement
- Part 216 - Ship moulded forms
- Part 218 - Ship structures
- Part 219 - Dimensional inspection information exchange
- Part 221 - Functional data and their schematic representation for process plant
- Part 223 - Exchange of design and manufacturing product information for cast parts, currently on CD level
- Part 224 - Mechanical product definition for process plans using machining features
- Part 225 - Building elements using explicit shape representation
- Part 227 - Plant spatial configuration
- Part 232 - Technical data packaging core information and exchange
- Part 233 - Systems engineering
- Part 235 - Materials information for the design and verification of products
- Part 236 - Furniture catalog and interior design
- Part 237 - Fluid dynamics
- Part 238 - STEP-NC Application interpreted model for computerized numerical controllers**.**
- Part 239 - Product life cycle support
- Part 240 - Process plans for machined products

CONCLUSION

STEP is the most promising standard which provides a powerful support for CAD/CAPP/CAM & CNC integration. The integrated resources of STEP give a overall description of product data, which can bethe base of the global product data model for integration. The implementation methods of STEP have offered the mechanisms for data exchange and sharing for integration. For precise applications, various application protocols are demanded forstandard and consistent implementations. The formal description of STEP assurances the possibility of software tools which support to the implementation methods, soas to the system integration

REFERENCES

Bloor, M. S. and Owen, J, “CAD/CAM product-data exchange: the next step”, CAD,23(1991),237.

ISO CD10303-1, “STEP Part1: Overview and fundamental principles”, ISO TC184/SC4/PMAG, 1992.

Smith, B. M., “Product data exchange: the PDES project – status and objectives”, NISTIR 89-4165, 1989.

U.S. Product Data Association, “An American National Standard: Product Data Exchange using STEP (PDES) Part 41 – Integrated Generic Resources: Fundamental of Product Description and Support (ANS US PRO/IPO-200-041-1994,” Trident Research Center, Suite 204,5300 International Blvd.,N. Charleston, SC.

U.S. Product Data Association, “An American National Standard: Product Data Exchange using STEP (PDES) Part 203 – Application Protocol: Configuration Controlled Design (ANS US PRO/IPO-200-041-1994,” Trident Research Center, Suite 204,5300 International Blvd.,N. Charleston, SC.