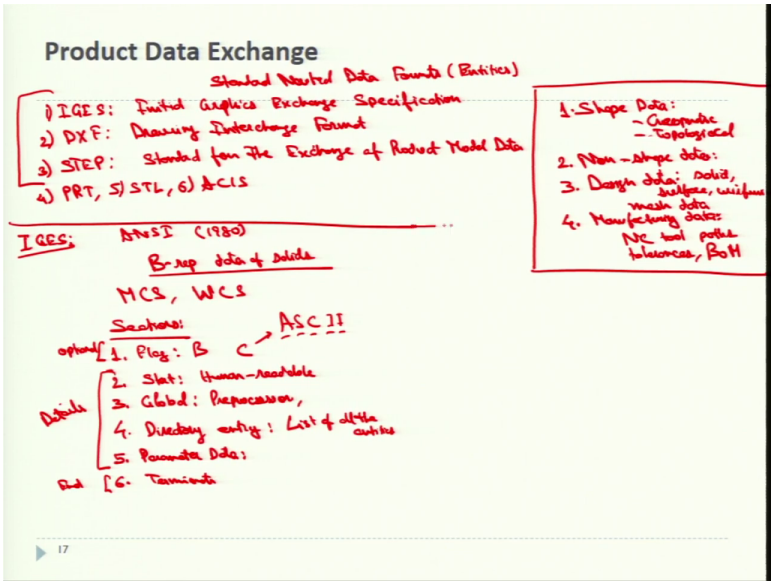
Computer Aided Decision Systems - Industrial Practices using Big Analytics
Professor Deepu Philip
Department of Industrial and Management Engineering
Professor Doctor Amandeep Singh
Imagineering Laboratory
Indian Institute of Technology, Kanpur
Lecture 36
Product Data Exchange (Part 2 of 2)

In the decision support systems for the computer aided design and computer aided manufacturing, we were discussing about the pre and post-processors in the last lecture. There are several file formats or we call it entity types, which are important to be discussed and what are these formats, how are they developed and where does this lead us to.

(Refer Slide Time: 00:35)



The product data exchange has certain or standard neutral data formats, we call it neutral data format or we call it the entities. Now, there are different kinds of the data requirements for the requirements for the exchange, the data is available in the form of a shape.

1) When I say Shape data, shape data means both geometric and topological information that parts or form features, the fonts, colors, everything that turns or comes into the shape data.

- Geometric data

- Topological data

2) Next data is the non-Shape data, for the non-shape data that means, the graphics data such as the shaded images and the model global data as may be measuring units of the database, the resolution of storing the database the numerical values. So, all these come under the known shape data which is not exactly the shape, but it is defining or it is the periphery of the shape that is also important.

3) Next kind of the data that we have is the Design data. By design data, I mean the information which is used by designers to generate different geometric models for analysis purposes. So, this is generally the three different formats that we discussed in the last lecture, solid surface and wireframe these are in these formats. So, mass property and maybe the filant element analysis filant element, mesh data that we have that also comes here in the Design data only, mesh data, mesh format.

4) Then we have the Manufacturing data. So, that is why we call it as an almost a big data system because lot of entities are there which are calculated to gather for each tool point whatever the NC tool paths are generated. So, different points have different coordinates and from each point to another point when the machine moves, it could be the absolute or it could be incremental a movement that we have. So different kinds of manufacturing data sets are there which contains information regarding the toolpaths regarding the tolerances, regarding the process planning, the tool design, bill of material also comes into this category only.

So, these different kinds of the data are there. The standard neutral data formats could be different types like:

1) IGES- Initial Graphics Exchange Specification.

2) DXF which was way back generated in 1980s or so by Autodesk wholly, which is, Drawing Interchange Format.

3) STEP: Standard for The Exchange of Product Model Data.

4) . PRT

5) . STL

6) ACIS and so on.

There are different formats different software's support and we can keep talking about them, let us only discuss about the basic formats which are there.

1) So, IGES that is Initial Graphics Extreme Specification. This is the most popular format for the neutral file. This is supported by different CAD CAE CAM systems and it is defined by the ISO systems different quality management systems as well. So, it was first developed in 1980. And it was adopted by American National Standard Institute by ANSI in 1980s only. IGES use different versions were there IGES version 1, 2 maybe IGES version 5, the recent versions now can also help us to have the B rep data of solids. So, IGES used to distinct Cartesian coordinate systems that is MCS it is Machine Coordinate Systems and WCS that is the World Coordinate System both are used by them. So, if an entity is directly described relative to an MCS, then no transformation is required. So, this is achieved in the IGES by setting the value of the metrics pointer to 0 to prevent unnecessary processing. So, IGES format if I try to talk about it has a line that is consisting of 80 characters, it was originally developed in the Fortran that is the formula translation data format. Now IGES has major I would say 6 sections,

a) Flag section- So as defined by ASCII, which is American Standard Code for Information Exchange. Flag section is the one that is used with compressed ASC double I and binary format it is a single record line that precedes the start section in IGES, this is optional sometimes. So, with the character C in the column, it identifies the file as compressed ASCII file. The compressed form is intended to simply be converted to form and regular ASCII form. In the binary format, the flag section is called binary information it is given the code B in the binary format and C for ASCII.

b) Start section- Start section is a human readable introduction to the file that means it is commonly described in a prologue to the IGES file. This section includes the user relevant information such as the name of the CAD CAM system that is generating these IGES file, and a brief description of the product being converted. The IGES does not specify how these sections could be used, but it is definitely user can tailor them to their own requirement.

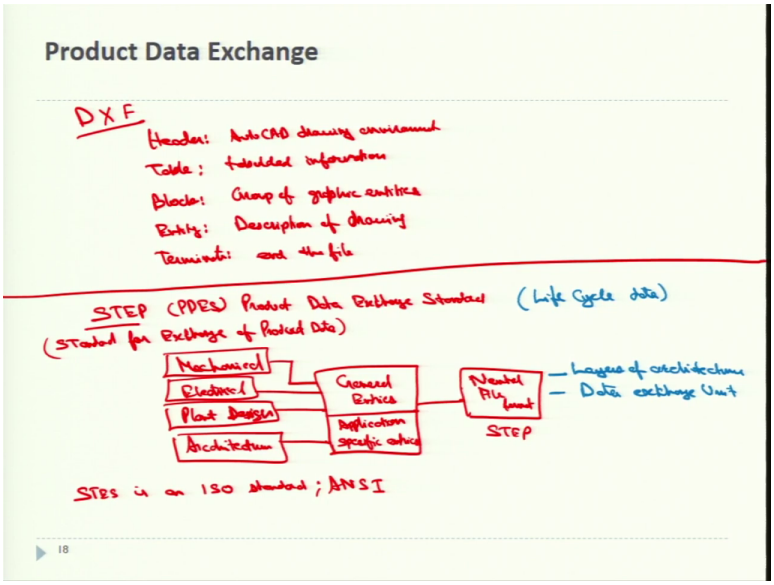
c) Global section- Global section includes the major information that is describing the pre-processor, and the information needed by the post-processor, because it is a neutral file. So, we have information about pre-processor here. Then, the information that is needed by the post-processor to be interpreted by the file it is also given here in the global section. Some of the parameters that are specified in this section are the characters, such as the delimiters between the individual entries and between the records, so the name of the IGES file, the vendor, the software version of sending CAD CAM system, all these things fall in the global section.

d) Directory entry section- When I say directory entry, it is the one that has the 80 characters that are talked about. So, directory entry is the list of all the entities which are defined in the IGES file together. So, here different entities are there, then entities are divided into different fields, then the field contains a pointer to the parameter of data entry for the entity in the parameter data section.

e) Parameter data- Parameter data means the actual data which defines each entity listed in the previous section that is in the directory entry section. For example, in the directory entry suppose, if you have given a straight line, straight line has 2 endpoints X1 Y1 Z1, X2 Y2 Z2, six points are there, these six points are the directory entry, parameter data will tell each value X1 X2 X3 as individual each parameter will talk about as an individual value. So, it will have the information regarding this the different characters which are also keeping a record of the parameter data.

f) Terminate section- In the terminate section it contains a single record we specify the number of records in each of the 4 preceding sections for the checking purposes. So, these 4 sections are major, flag this is optional. This is only end; these are the details.

(Refer Slide Time: 12:09)



2) Next, let us talk about the DXF format, DXF that is the drawing interchange format. So, these DXF formats were originally developed to give users some flexibility in managing the data and translating the very basic AutoCAD files into the format's that could be read and used by other CAD-CAM systems. So, because of the popularity of the AutoCAD, this became very common, it is such as like still we have the 3-letter extension file because, MS DOS systems were very common and it still uses 3-dimension extension. Like we have DOC file dot PDF file, we have EXL file. So, in the similar fashion, AutoCAD became so famous and the DXF file became one of the most prominently used files. So almost every newly introduced software whether it has CAD CAM or CAE they tend to provide translators to and from the DXF file.

a) So DXF file is again an American Standard Code for Information Exchange text file and consists of 5 sections, it has a header. Header describes the AutoCAD drawing environment that existed when DXF was created. AutoCAD drawing environment.

b) Then we have a table, when I say table, it contains the information about the line types, layers, the tabulated information is everything here. The textiles, the views, it is a tabulated information.

c) It has a block, the block contains a list of graphic entities which are defined as a group, group of.

d) Entity means it immediately follows the block section and serves the main part of the DXF file. So, this says all the entities in the drawing description is there.

e) Then we terminate, that we try to end the file.

So, there are certain limitations of IGES and the DXF formats. Both of them were developed to exchange product definition data instead of product data. So, product Data is also required that means the design, the manufacturing, the quality assurance, the testing, support throughout the entire lifecycle of the product, this information is also required to be kept as in the record in an archive data. So, even though the specification of IGES and DXF files have broadened to cover some of these product data, the data carry out by these files are still insufficient to give us a complete support for the product data throughout the lifecycle of it.

3) So, that is why there is a need or a call to have another format that is STEP, which is also known as 'PDES', that is Product Data Exchange Standard. Now, this is there to support any industrial application such as mechanical, electrical, plant design, architecture, engineering construction, so, all of these could be support which means in the architecture of the step which is standard for exchange of product data. When you try to draw a sockeye structure, it supports,

- Mechanical,
- Electrical,
- Plant design,
- Architecture and so on, all of these are supported by the STEP file.

So, we go for the General entries through them and also, we have Application Specific entries, then we have this neutral file format which is our STEP. So, in this case the neutral file format has different layers of the architecture. And the data exchange units as well so, this neutral file has within itself,

- The layers of architecture, layers mean it could be electrical, mechanical, if I am talking about a product that we will talk about the product of this interactive pen itself, this pen is having a plastic body over it, it has a tip that is maybe a soft or rubber tip, it has a button here, it has a button at the back, it has a software interaction. So, there are different electronics, mechanical links or different layers of architecture which are there they are all connected here.

- And this neutral file format also has the data exchange unit.

So majorly step is for the lifecycle management data, if those is required throughout the service life is it is to be worked upon. That is why we call the product data exchange standard now is our step. For instance, the software's like the Ansys Workbench uses step or it is working.

Now, STEP is an ISO data, an ISO data standard, that is it is the accepted by the ANSI and many international bodies which helped to support the industrial automation, step files are fully interpretable by computer. For instance, if the tolerance information is required, that can be directly taken from the computer that did not rather from the computer a text which requires human intervention to interpret.

So, the information given in the step format is associated with those entities which are required in different kinds of the application, in different kinds of the use of the features of the system for instance tolerances, the electrical information that all could be extracted from the STEP files. So, these are the major 3 files that I have discussed. So, with this, I will stop for this week. And we will discuss about the part programming and also, we will see a additive helpful systems which are helpful to have the smart or digital manufacturing coming into place. Thank you.