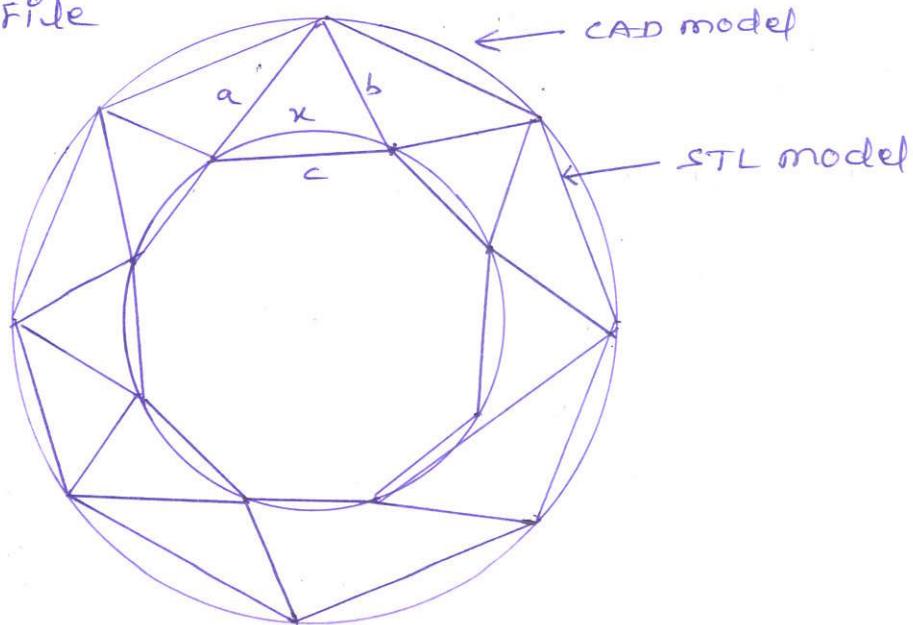


RAPID PROTOTYPING DATA FORMATSSTL FORMAT:-

- STL is a file format native to the stereolithography CAD software created by 3D systems.
- STL file describe only the surface geometry of a three-dimensional object without any representation of colour.
- STL format specifies both ASCII and binary representation.
- STL is a file format native to the stereolithography CAD software created by 3D systems.
- It is widely used for rapid prototyping, 3D printing and computer-aided manufacturing.
- The STL format specifies both ASCII and binary representation.
- Binary files are more common, since they are more compact.
- An STL file describes a raw, unstructured triangulated surface by the unit normal and vertices of the triangles using three dimensional cartesian coordinate system.

STL-File



Advantages:-

- ⇒ STL files are simple, light and very easy to handle by software and machines.
- ⇒ we can email it, download it and transfer it with remarkable ease because it only contains the basic shape of the generated surfaces and their coordinates understood by the 3D printer.

Disadvantages:-

- ⇒ Even if it the most widely used format;
- ⇒ the STL files format has limitations.
- ⇒ First of all, it only understand the external surfaces and shape of your Model.
- ⇒ Any information of internal structure, colour, texture or attributes that a normal CAD file contains is not included in the STL files.

Applications:-

- ⇒ This file format is supported by many other software package.
- ⇒ It is widely used for rapid prototyping, 3D printing and computer-aided manufacturing.
- ⇒ STL files describe only the surface geometry of a three-dimensional object without any representation of color, texture or other common CAD Model attributes

STL File problems:-

The top 5 STL file errors.

- ⇒ Holes or gaps in a mesh. One of the most common error leading to printing failure is missing triangles.
- ⇒ Flipped normals. Each triangle in the mesh has a normal vector, which points out to the outer side of triangle.
- ⇒ intersecting and overlapping triangles.
- ⇒ Bad edges
- ⇒ Noise shells

A Sample STL File

Solid point

facet normal $0.00000e+00$ $1.00000e+00$ $0.00000e+00$

outer loop

vertex $0.00000e+00$ $0.00000e+00$ $2.00000e+01$

vertex $0.00000e+00$ $0.00000e+00$ $0.00000e+00$

vertex $1.00000e+01$ $0.00000e+00$ $2.00000e+01$

end loop

end facet

facet normal $0.00000e+00$ $1.00000e+00$ $0.00000e+00$

outer loop

vertex $1.00000e+01$ $0.00000e+00$ $2.00000e+01$

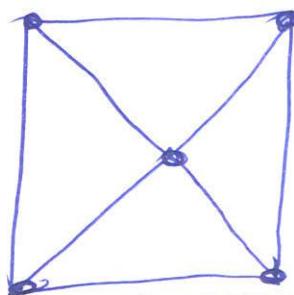
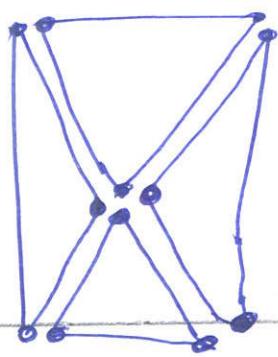
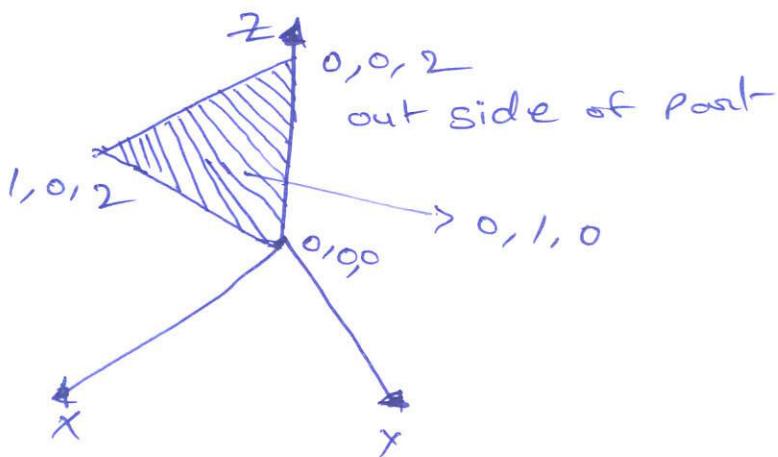
vertex $0.00000e+00$ $0.00000e+00$ $0.00000e+00$

vertex $1.00000e+01$ $0.00000e+00$ $0.00000e+00$

end loop

end facet

....



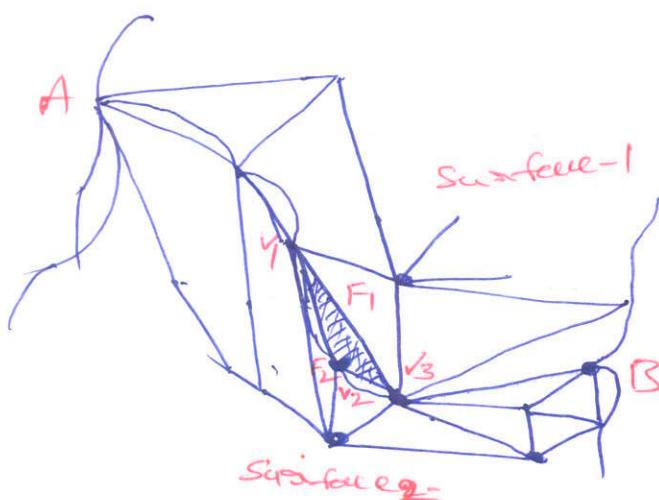
Edge and vertex
redundancy in
STL format

Unit-4, Pg-3/15

⑥ STL File Problems

- ① Gaps (cracks, holes, punctures) that is missing facets
- ② Degenerate facets (where all its edges are collinear)
- ③ Overlapping facets
- ④ Non manifold Topology conditions

missing facets (or, gaps)



Advantages:-

- ⇒ simple
- ⇒ sequential memory access.
- ⇒ portable
- ⇒ Does not require large amount of RAM, critical in 80's

Disadvantages:-

- ⇒ Geometry leaks
- ⇒ NO specified units.
- ⇒ unnecessary redundancy.
- ⇒ poor scalability.

CONSEQUENCES OF BUILDING A VALID AND INVALID Tesselated Model

- ⇒ A valid model. A tesselated model is said to be valid if there are no missing facets, degenerate facets, overlapping facets or any other abnormalities.
- ⇒ When a valid tesselated model
 - a) is used as an input, it will first be sliced into 2D layers.
 - b) Each layer would then be converted into unidirectional scan lines for the laser or other RP Techniques to commence building the model.

STL File repairs:

1. Auto-repair. The STL repairs software's wizard will attempt to fix all major errors, including holes, separate shells, and intersections.
2. Separating shells. A mesh consists of collection of connected triangles. It can contain multiple continuous surfaces that ideally are joined together while obsolete ones need removal.
3. Closing holes, bridging gaps. Some comprehensive STL repair programs allow different ways of hole filling

such as planar, tangent, ruled or breef from.

4. Resolving overlaps and intersection. This typically requires recalculating entire portions of the mesh.
5. Filtering out double faces, double vertices, inverted normals, and sharp, narrow triangles.
6. stitching open edges and remaining holes.
7. Manual repair by deleting and creating triangles.
8. Remeshing to optimize triangle count.
9. Exporting to the chosen mesh format.

Generic solutions

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- ⇒ the most commonly used input to a rapid prototyping (RP) system, is the factor stereolithography file (STL).
- ⇒ several problems plague these STL files owing to the very nature.
- ⇒ STL File and the non-robustness of commercial CAD system model tessellator.
- ⇒ the consequences of not correcting these error are detrimental to the creation of the intended prototype.
- ⇒ In part 1 of two papers, a description of all STL file-related error is given.
- ⇒ the paper also proposed a generic solution to solve one of the major problems in the proper creation of a prototype. That is, the problem of missing facets.
- ⇒ Part 2 deals with special cases of error associated with STL files
- ⇒ The performances evaluation of the proposed solution is also given

### Other Translator:-

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IGES FILE:-

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- IGES [Initial Graphics Exchange specifications] is a

routine to produce a plotter output file and then loop back to repeat the process.

→ The Advantage of the HP/GL format are that a lot of commercial CAD systems have the interface to output the HP/GL format and is a 2D geometry data format which does not need to be sliced.

→ However, there are two distinct disadvantage of the HP/GL format.

→ First, because HP/GL is a 2D data format, the files would not be appended, potentially leaving hundreds of small files needing to be given logical names and then transferred.

CT Data:-

→ CT [computerized Tomography] scan data is a particular approach for medical Imaging.

→ This is not standardized data.

→ Formats are proprietary and somewhat unique from one CT scan machine to another.

→ The scan generate data as a grid of three-dimensional points.

→ Where each points have a varying shade of gray indicating the density of the body tissue found at that particular point.

→ Data from CT scan have been used to build skull, femur, knee and other bone models on stereolithography systems.

→ Some of the reproductions were used to generate implants, which have been successfully installed in patients.

→ The CT data consists essentially of faster Image

of the physical objects being imaged.

- it is used to produce models of human temporal bones.
- there are three approaches to making models out of CT scan information.

1. CAD system

2. STL-interfacing

3. Direct interfacing.

Newly PROPOSED FORMATS:

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- As seen above, the STL - a collection of co-ordinate value of triangles - is not ideal and has inherent problems in this format.
- As a result, researchers including the inventor of STL
- 3D System Inc., USA have in recent years proposed several new formats and these are discussed in the following section.
- However, none of these has been accepted yet as replacement of STL
- STL files are still widely used today.

standard used to exchange graphics information b/w commercial CAD system.

- It was set up as an American National standard in 1981.
- The IGES file can precisely represents CAD models.
- It includes not only the geometry information but also topological information [Directory Entry section]
- In the IGES, surfaces Modeling, constructive solid geometry [CSG] and boundary representation [B-rep] are introduced.
- Especially, the ways of representing the regularized operation for union, intersection and difference have also been defined.
- Because IGES is the standard format to exchange data between CAD system.
- It also include much redundant information that is not needed for rapid prototyping systems.
- The algorithms for slicing needed in RP systems.
- Such as the SLA cannot be carried according to the IGES format.
- The support structure needed in RP systems such as to the IGES format.

HP/GL FILE:-

- HP/GL [Hewlett-Packard Graphics Language] is a standard data format for graphic plotters
- Data types are all two-dimensional, including lines, circles, splines, texts, etc.
- The approach as seen from a designer's point of view, would be to automate a slicing routine which generate a section slice, invoke the plotter

RAPID PROTOTYPING SOFTWARE'S

→ computer-aided design [CAD]:

Build a 3D model of the desired end-product using various parts and specifications.

→ simulation:

use topology optimization and lattice structure to discover a material layout that can be optimized within a given design space, using specific loads, boundary conditions and constraints.

→ Quoting:

provide a quote or estimate for a specific additive manufacturing order.

→ Manage orders:

view the manufacturing jobs currently on order and any pending shipments at varying for needed materials to complete the job such as Alloys, customers, plastics, composites.

→ Post-processing:

ensure orders are moved along in the supply chain and shipments are created and sent to the appropriate party for processing and distributions.

→ Job Management:

monitor which 3D printing jobs have been ordered, which are printing, which are ready to be shipped, or on-hold. view the cost of each job, the expected time, and the materials needed to produce.

→ Build preparation and Machine planning:

plan out the use of all available machine at varying times throughout the day to maximize throughput. Improve machine planning by ensuring the workers, machines and needed materials are available during

Solid View:-

- solid view/lite is a free for others, within your network, to view 3D files in STL, SVF and solidworks formats.
- they can view, rotate, and print 3D image from these formats including those you and others have made using solid view/pro.
- solid views un programa de visualización de diseños CAD 3D, que se presenta en cuatro opciones: SOLIDVIEW LITE, que es gratis y con la que puedes ver STL, solidworks, Vrml y obj, ademas esta la version SOLIDVIEW, que trae lo anterior mas función de marcado o mark up, la opción mas completa es, SOLIDVIEW/PRO, con las funciones anterior mas herramientas de colaboración, manipulación, lectura de proE, catia, NX, STEP, IGES, solid edge etc. y SOLIDVIEW PRO RP para funciones avanzadas de análisis de archivos STL que incluye su reparación.

Solid view Advantage:

- Efficient 3D design. SOLIDWORKS is an easy to use parametric design modular, meaning you can easily edit the design at any stage in the design process..
- customer/supplier compatibility. choosing a CAD system that is widely recognised is very important.
- Built-in Applications. - -
- short learning curve. - -
- After sales support.

Disadvantage:

- low efficiency. while hammers are frequently used to process materials, they do so inefficiently.. - - .
- screen plugging. when screening multiple particle sizes or when material begins to backup, hammers also

also have the disadvantage of plugging. . . .
 → screen blinding. . . .

→ Drum Damage--

→ AEI solutions. - -

VIEW EXPERT:

www www

→ the DESKARTES free View Expert allows you to work with faceted data, like STL, VRML and ZMF.

→ Free viewing, repair and STL files output will provide you with Entry level functions for successful 3D printing and AM without any cost.

→ optionally, you can purchase more advanced production documentation and reporting functions for AM Applications reporting and quality control.

→ Also, different 3D CAD import translators to triangulate and auto-repair standard and native 3D CAD model for 3D color printing, Additive manufacturing and simulation Applications.

→ Import translators include STEP, CATIA 4/5/6, CATIA CGR, NX unigraphics, solidworks, solid edges inventor, JT and creo/proe input format.

View Expert for STL Files!:-

www www www www

→ Faster display list generation and texture handling.

→ Improved topology generation for architectural models.

→ 64 bit implementation improvements to handle millions of triangles.

→ Production screenshots and generate report for build monitoring, PDM and quality control.

3D View:-

- ⇒ 3D means three dimensional, i.e. something that has width, height and depth (length) . . .
- As we look around, the retina in each eye forms a two-dimensional image of our surrounding and our brain process these two images into a 3D visual.
- When you click on the 3D view button, the page goes into 3D view mode; in this mode, you can see your page presented in a 3D view in which nested blocks of HTML are increasingly "tall", projecting outward from the bottom of the page.
- This view makes it easy to visualize the nesting of your content.

Advantage:-

- Enhances & Improve visual communications. . .
- Cost Effective
- Easily show concept and options for a project.
- Precise and accurate Renderings.
- Easy to Distribute . . .
- Virtual Reality . . .
- Virtual Centers . . .
- Easily marketable and shareable.

Disadvantage:-

- Interaction might be required.
- Occlusion might be a problem.
- Distortion of information and wrong interpretation.

Velocity Software:-

- Velocity is a metric for work done, which is often used in agile software development measuring velocity is

sometimes called velocity tracking.

→ The velocity metric is used for planning sprints and measuring team performance.

→ There is no scientific evidence that measuring velocity improves effectiveness or team performance.

→ Furthermore, the metric can be misleading.

→ The main idea behind velocity is to help teams estimate how much work they can complete in a given time periods based on how quickly similar work was previously completed.

→ Velocity is relative measure. In other words, the raw numbers mean little; it is the trend that matters.

Rhino! -
www

3Data Expert:-

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- 3Data Experts is a professional tool for preparing 3D-model for additive manufacturing and 3D printing applications.
- 3Data Experts includes commands for manipulations of BOTH 3D surface models and 3D faceted models.
- These commands include surface triangulation, STL verifications and repairs, STL offsetting, splitting, connecting, decimation, smoothing, shrink wrap, 3D nesting and Boolean as well as STL coloring and texturing.
- Optimal supports can be generated for both stereolithography, DLP and metal process automatically.
- Sand supports can be generated for delicate sand parts.
- Finally, build documentations can be generated for production monitoring, PDM and quality control.
- 3 Data Expert is the 3D data processing tool you need to get your AM business running.
- 3Data Expert support structure generator allows you to generate advanced supports for metals, DLP and stereolithography process.

