CMR

INSTITUTE OF TECHNOLOGY

Improvement Test – May – 2017

USN	

Subject:	**RAPID PROTOTYPING**					**Code:**	10ME837
Date:	25.05.17	**Duration:**	90mins	**Max Marks:**	50	**Sem:** VIII	**Section:** A & B

Note: Answer ALL questions (2 x 25 = 50)

		OBE	
		CO	RBT
1.	a) What are concept modellers? List out the various concept modellers. [10] b) Write short notes on (i).Thermal jet printer (ii) Sanders Model maker . Also List down the machine specifications. [15]	CO3	L2
2.	a) Briefly discuss the different types of errors generated while handling stl files with neat sketch . [20] b) List out the various commonly used RP softwares and their features. [05]	CO3	L2

IMPROVEMENT TEST

10ME837 – RAPID PROTOTYPING

Academic Year: 2016-17

Semester : 8

1.a) Concept Modellers. are a new range of RP systems addressing the specific needs of CAD offices. Although CAD systems have empowered designers with a number of tools to minimise errors and maximise design quality offering facilities such as photorealistic visualisation, interactive product simulation, assembly analysis, and kinematic and stress analysis, the design remains intangible until a physical model is built. Concept Modellers fill this gap by offering relatively quick and cost effective methods for building physical models at any design stage. They are marketed as new CAD peripheral solutions which enable designers to verify and iterate their designs without leaving the office. Typically, Concept Modellers build models more quickly but not so accurately as other RP systems and usually cost less than $50,000.

3D Systems ThermoJet printer (Multi-Jet Modeller);
- Sanders ModelMaker II (Inkjet Modelling Technology);
- Z-Corporation Z402 (3D printer);
- Stratasys Genisys XS printer;
- JP System 5;
- Objet Quadra system

1.b) Thermojet Printer

The Multi-Jet Modelling (MJM) process was developed by 3D Systems in 1995. This technology complements 3D Systems's established line of Stereo lithography products. Initially, the MJM machine was marketed as the Actua 2100 but since 1998 it has been known as the ThermoJet printer.

MJM parts are constructed from a thermoplastic material. The parts have a layer thickness of 40 /-lm, an X-Y resolution of 85 /-lm and a droplet placement accuracy of ± 100 /-lm [3D Systems, 1996].

Resolution	300 DPI
Maximum Model Size	250 x 190 x 200 mm (10 x 7.5 x 8 in)
Modeling Material	ThermoJet™ 88 and TJ2000 thermoplastic
Material Color Options	Neutral, grey, or black
Material Capacity	5.9 kg
Material Loading	2.3 kg cartridge
Interface	Ethernet 10/100 Base-TX, RJ-45 Cable, TCP/IP protocol
Platform Support	Silicon Graphics IRIX v6.5.2 Hewlett Packard HP-UX v10.2 ACE Sun Microsystems Solaris v2.6.0 IBM RS 6000 AIX v4.3.2 Windows NT v4.0
Power Consumption	230 VAC, 50/60 Hz, 6.3 Amps
Dimensions	1370 x 760 x 1120 mm
Weight	375 kg

1.c) Sander's Model Maker

The inkjet modelling process was developed by Sanders Prototype Inc (SPI) in 1994. This technology combines a proprietary thermoplastic ink jetting technology with high-precision milling to build models or patterns that have a dimensional accuracy of± 13 11m over 229 mm in the Z axis and up to ± 0.025 mm over 76 mm in the X-Y plane [Sanders, 2000]. The latest system developed by SPI is called PatternMaster. In terms of achievable accuracy, this system is superior to other Concept Modellers.

Build envelope	304.8 x 152.4 x 228.6 mm
Layer thickness	0.013 mm - 0.13 mm
Minimum feature size	0.25 mm
Dimensional accuracy	± 0.025 mm per 25 mm in X, Y and Z axes
Surface finish	32-63 micro-inches (RMS)
Wall thickness	1 mm
Size of micro-droplet	0.076 mm
Plotter carriage speed	Up to 500 mm per second
Footprint	889 (Width) x 660 (Depth) mm
Supported formats	.STL, .SLC, .DXF, .OBJ, .HPP (HPGL)
System controller	IBM-compatible PC running Microsoft Windows 95 or NT
Power requirements	115V 60Hz or 230V 50Hz AC

2.a) Errors in handling STL files

Several problems plague STL files and they are due to the very nature of STL files as they contain no topological data. Many commercial tessellation algorithms used by CAD vendors today are also not robust [4–6], and as a result they tend to create polygonal approximation models which exhibit the following types of errors:

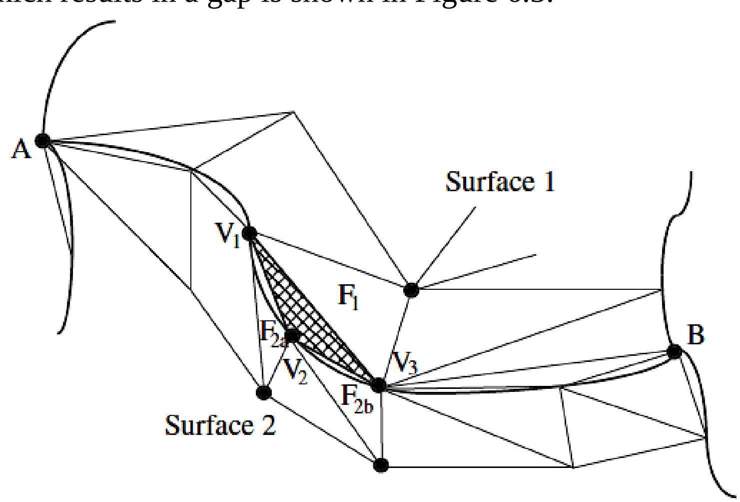
(1) Gaps (cracks, holes, punctures) that is, missing facets.

(2) Degenerate facets (where all its edges are collinear).

(3) Overlapping facets.

(4) Non-manifold topology conditions.

Tessellation of surfaces with large curvature can result in errors at the intersections between such surfaces, leaving gaps or holes along edges of the part model [8]. A surface intersection anomaly which results in a gap is shown in Figure 6.3.



Degenerate Facets

A geometrical degeneracy of a facet occurs when all of the facets' edges are collinear even though all its vertices are distinct. This might be caused by stitching algorithms that attempt to avoid shell punctures as shown

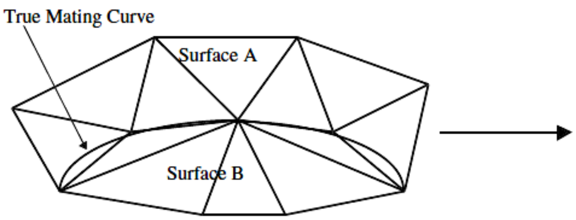


Figure 6.4(a): Shell punctures created by unequal tessellation of two adjacent surface patches along their common mating curve

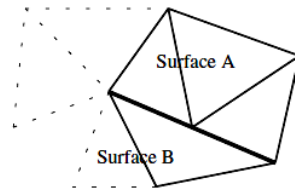


Figure 6.4(b): Shell punctures eliminated at the expense of adding degenerate facet

Overlapping Facets

Overlapping facets may be generated due to numerical round-off errors occurring during tessellation. The vertices are represented in 3D space as floating point numbers instead of integers. Thus the numerical roundoff can cause facets to overlap if tolerances are set too liberally.

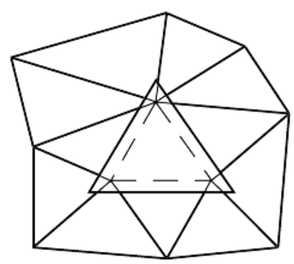


Figure 6.5: Overlapping facets

Non Manifold Conditions

There are three types of non-manifold conditions, namely:

(1) A non-manifold edge.
(2) A non-manifold point.
(3) A non-manifold face.

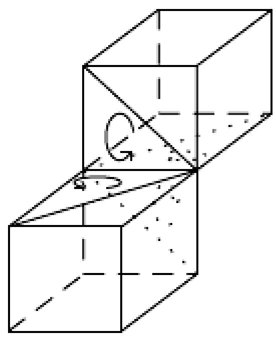


Figure 6.6(a): A non-manifold edge whereby two imaginary minute cubes share a common edge

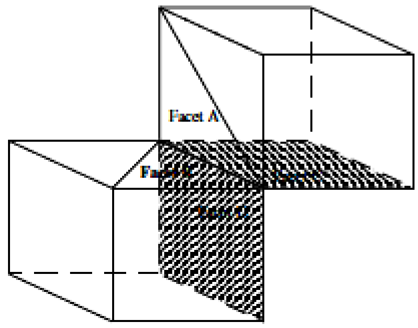


Figure 6.6(b): A non-manifold edge whereby four facets share a common edge after tessellation

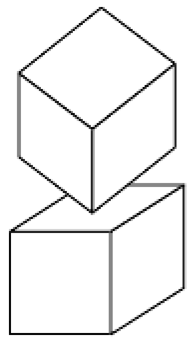


Figure 6.6(c): Non-manifold point

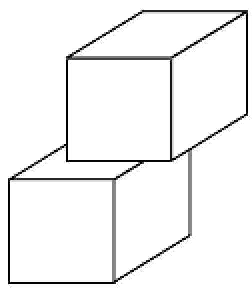


Figure 6.6(d): Non-manifold face