REVERSE ENGINEERING

19MO502 Additive Manufacturing-I
Unit -2 /Introduction
III Year / V Semester

INTRODUCTION

Engineering is the process of designing, manufacturing, assembling, and maintaining products and systems.

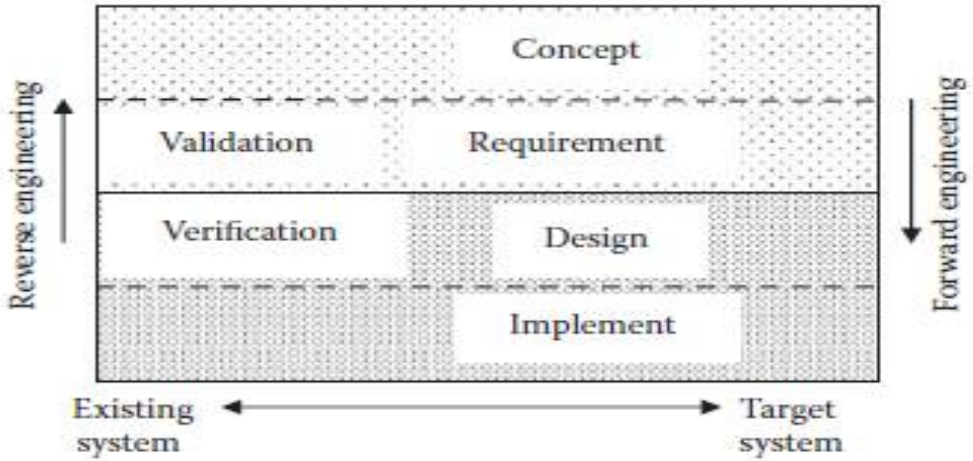
- Forward Engineering
- Reverse Engineering

Forward engineering is the traditional process of moving from high-level abstractions and logical designs to the physical implementation of a system.

Example: Crank shaft → design (Cad model) → Die making → Final product

INTRODUCTION

The **reverse engineering** process moves upward, analyzing the implementation of the existing system, extracting the design details, recapturing the requirements, and facilitating the original concept.



REVERSE ENGINEERING

Reverse engineering is the process of duplicating an existing part, sub-assembly, or product without drawings, documentation, or a computer model.

The Society of Manufacturing Engineers (SME) states as “starting with a finished product o process and working backward in logical fashion to discover the underlying new technology”

- **This chapter will define the concept of reverse engineering systems that are typically utilized in design and 3D printing manufacturing environments.**

REASON FOR REVERSE ENGINEERING

Example: 1

- In some situations, designers give a shape to their ideas by using clay, plaster wood, or foam rubber.

CAD model

- As products become more organic in shape, designing in CAD may be challenging o impossible.
- There is no guarantee that the CAD model will be acceptably close to the sculpte model.

REASON FOR REVERSE ENGINEERING

Examples: 2

- **When a new car is launched on the market, competing manufacturers want to mak**

a same car.

<u>CAD model</u> : Designing in CAD may be challenging or impossible.

<u>Solution:</u> (Reverse Engg)

- Analyzing the implementation of the existing system and extracting the design details.
- Competing manufacturers may buy one and disassemble it to learn how it was built and

to make it.

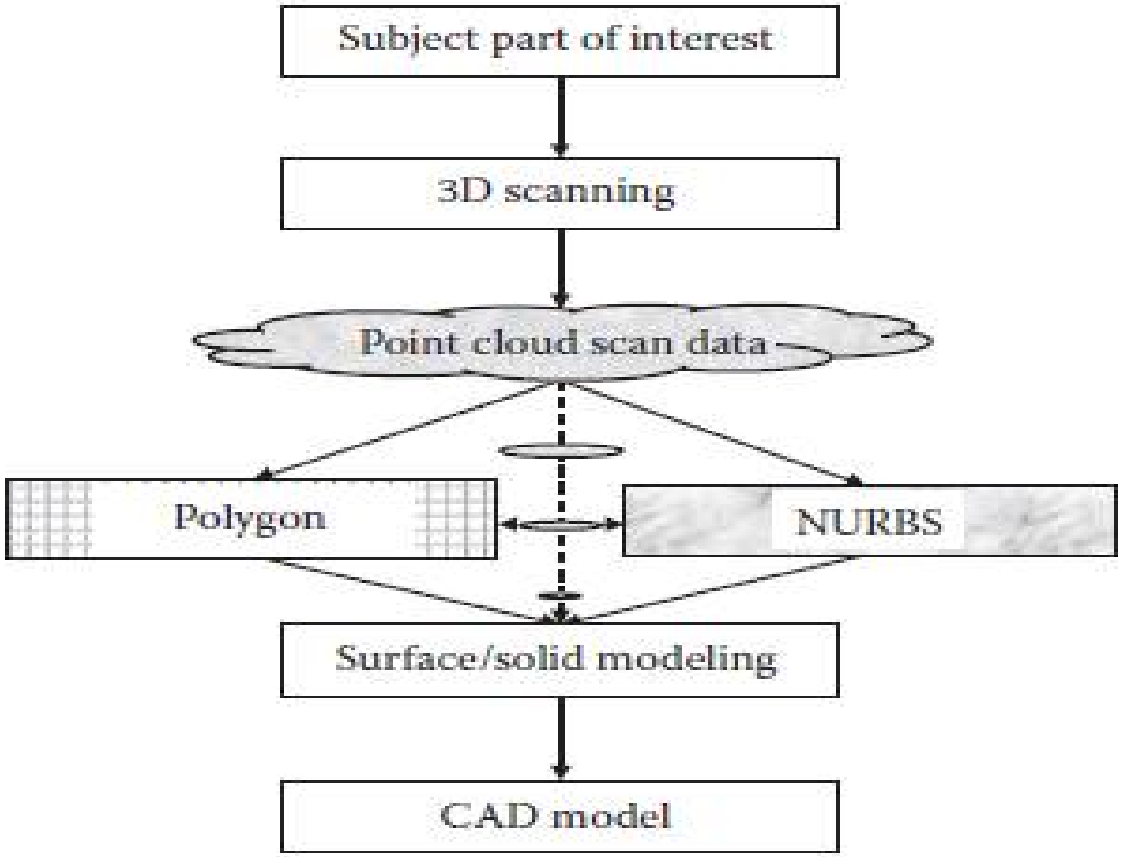
USE OF REVERSE ENGINEERING

- There is inadequate documentation of the original design.
- The original product design documentation has been lost or never existed.
- Analyzing the good and bad features of competitors' products.
- The original supplier is unable or unwilling to provide additional parts.
- The original manufacturer of a product no longer produces a product.

USE OF REVERSE ENGINEERING

- To compress product development cycle times. By using reverse engineering, a three dimensional physical product can be quickly captured in the digital form, remodeled and exported.
- Creating data to restore of manufacture a part for which there are no CAD data.
- Exploring new possibility to improve product performance and features.

REVERSE ENGINEERING PROCESS FLOWCHART



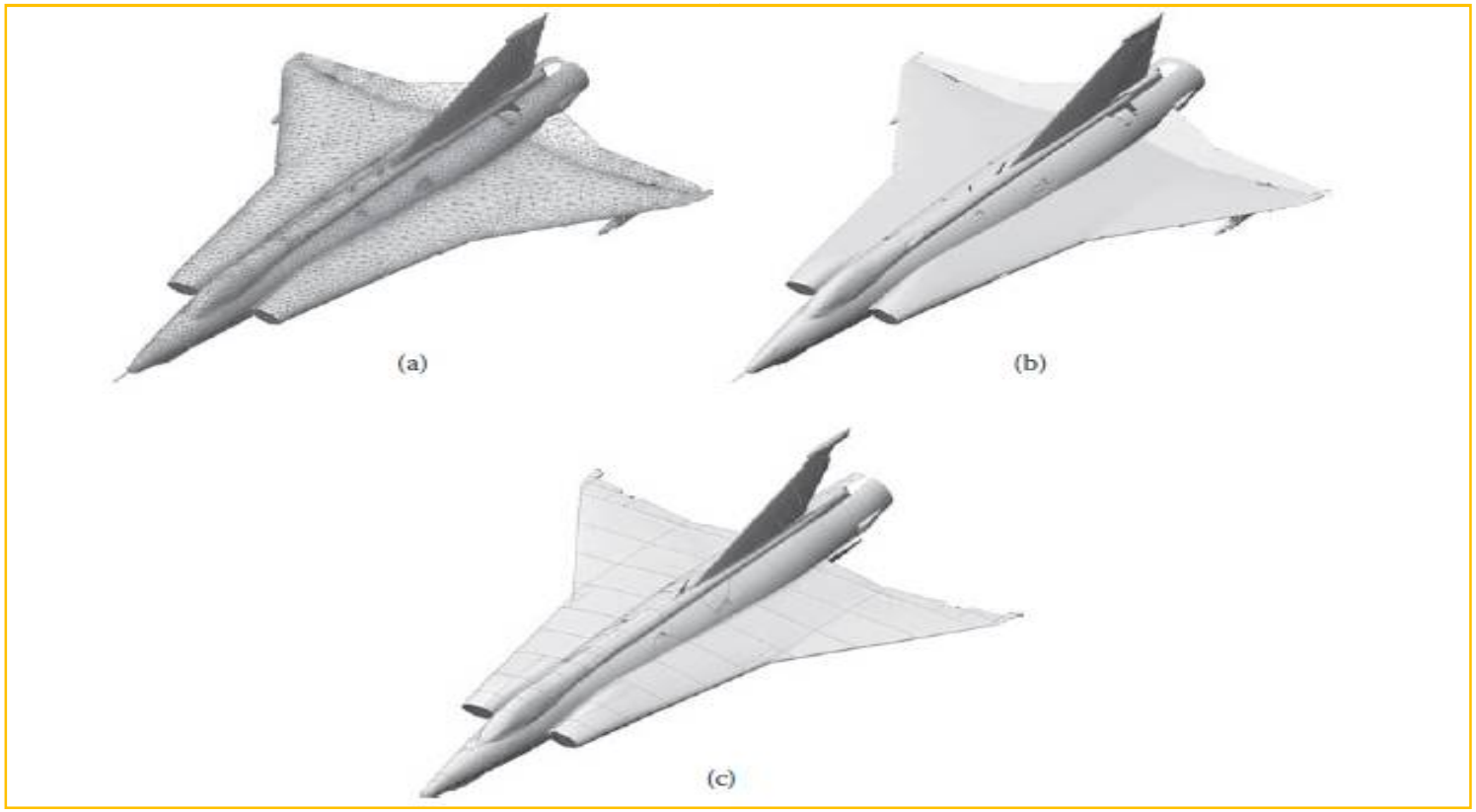
REVERSE ENGINEERING PROCESS FLOWCHART

- A typical reverse engineering process starts with the **selection of the part of interest.**
- Proper measurement devices for data acquisition are then used to generate raw data usually a **point cloud data file**.
- The point cloud is a set of 3D points or data coordinates that appear as a **cloud o cluster.**
- Point clouds **are not directly usable** in most engineering applications.

REVERSE ENGINEERING PROCESS FLOWCHART

- Point clouds are **converted to a proper format**, such as a polygon mesh, nonuniform rational B-spline (NURBS) surface models, or computer-aided design (CAD) models.
- Point clouds data is used as input for design, modeling, and measuring through a proces referred to as reverse engineering.

REVERSE ENGINEERING PROCESS FLOWCHART



(a) Wireframe polygonal model (b) Polygonal surface model

(c) NURBS model

REVERSE ENGINEERING TO 3D PRINTING

When the **tessellated STL** file is sent to the rapid prototype machine, the model is **sliced into multiple horizontal layers**.

- The pre-processing software slices the STL model into a number of layers from 0.01 mm to 0.7 mm thick, depending on the build technique.
- Once the final file formats are transferred to the RP device, the **build process occurs**.
- 3D printing machines build parts within a few hours, but can run unattended for several days for large parts.