CNC Machines

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Reverse Manufacturing

• Reverse engineering is also called backwards engineering allows a design to be modified to meet new requirements,
Reverse manufacturing process

Figure: cycle of the reverse manufacturing process
The steps of reverse manufacturing

• Implementation recovery
• Design recovery
• Analysis recovery
Steps of reverse manufacturing

1. Existing Object
2. Data Acquisition (Contact or Non-Contact Methods)
3. Pre-processing (Noise Filtering & Merging)
4. Point Cloud / STL Data
5. Feature Extraction
6. Segmentation & Surface Fitting
7. CAD Model
8. Applications of CAD/CAM/CAE Tool
9. Manufacturing Process
10. Finished Product
Reverse manufacturing process

- **Data acquisition**: is the process of sampling signals that measures real world physical conditions and converting the resulting samples into digital value that can be manipulated by computer.
- **Preprocessing** is preliminary processing of data. For example extracting data from larger step
- **Point cloud**: is a set of data points in space. The points represent 3D shape or object.
3D scanning

- 3D scanning: is the process of analyzing a real world object to collect data on its shape. The collected data can then be used to construct digital 3D model.

Figure: 3D scanner
How do 2D and 3D scanners work

- Scanners use the light to make digital copies of real objects. There are two types of the scanners:
  - 2D scanners use to make digital copies of documents or pictures, and also used to create a 2D image.
  - 3D scanners use the reflected laser light to build up a three dimensional model of an object.
Uses of reverse manufacturing

- Legacy Components
- Original Equipment Manufacturer (OEM) issues
- Design Development, Part Testing & Analysis
- Modern manufacturing
- Digital Archiving
Why do we use Computer Aided Design (CAD)?

- To create accurate data for manufacturing. To create two- or three-dimensional (2D or 3D) graphical representations of physical objects.
Video on Reverse manufacturing
Virtual manufacturing

• It is a new kind of manufacturing and it is a computer system which can generate the same information about manufacturing system’s structure, states and behaviors as we can observe in real manufacturing.

• Virtual manufacturing involves the simulation of a product and the processes involved in fabrication.
Virtual manufacturing is not true manufacturing, but in the manufacturing of computer and network system related with software.

Virtual manufacturing processing results are digital products, rather than the real material products.
What are the benefits of virtual manufacturing?

• Reduce development and manufacturing cost
• Reduce time to market
• Enhance communication
Figure: virtual manufacturing and real manufacturing
Simulation program for CNC machines
References

- https://www.youtube.com/watch?v=Yiiqj135OUk
- https://www.youtube.com/watch?v=ZMvWzYxTQGs