PLTW Engineering

12/Reverse Engineering 4 of 4 – Additive Manufacturing

May 21, 2020

12/EDD

Lesson: **5/21/2020**

Objective/Learning Target: Students will be able to explain how the 3D printing process works as well as the various types of 3D printing that are currently used in the manufacturing industry.

Additive manufacturing and reverse engineering

Now that we have all of out components measured and any corrections or additions made in CAD, we can begin to make a prototype of the new product we have reverse engineered.

To do that the 2 most accurate methods are CNC machining and 3d printing.

3d printing relates to the field of Additive manufacturing.

What is additive manufacturing?

Additive manufacturing is a phrase used to describe using a computer-generated 3D model to create a solid object using a 3D printer. (Additive manufacturing used interchangeably with the phrase 3D printing.)

Using the specifications from the computer model, these special printers place layers of material— usually plastic, although technology is allowing the use of metal and other substances for 3D printing—over each other until the object is built.

Additive vs Subtractive manufacturing

Additive manufacturing is in contrast to subtractive manufacturing, where the user starts with a piece of material, such as metal or plastic, and molds the object using a series of machining processes such as milling, grinding, cutting, or shaping.

3d Printing

3D printers use coordinate points from a CAD model, convert those coordinate points into a computer program using G-code, and, using that data, move the tool head in the specified pattern that creates the solid object.

What materials can be 3d printed?

Large-scale and mass-market 3D printers can currently print using various types of plastics and metals.

However, engineers are experimenting with other materials such as concrete and even organic material.

What are advantages and disadvantages?

A few advantages that come with printing with plastic filament is that the process is less expensive and an engineer can print an object in a short amount of time.

The advantages of printing with metal are the object will be stronger and the design may include complex geometry that can be hard to create with traditional machining processes.

Disadvantages of plastic include the potential for warping and deformation of an object.

3d Printing limitations

Some printing processes have build plate constrictions.

Objects printed in plastic of a certain dimension may not fit on the plate where they are being built.

Materials may also have limiting factors based upon their molecular makeup.

3d Printing limitations

Unfortunately, CAD modeled parts and 3D printed parts cannot create fully rounded edges rounds or arcs because, by definition, they contain an infinite number of points.

Software engineers have explored this issue by turning the rounded edges and arcs on a CAD model into a polygonal.

Because the polygon contains points are so close together, the model gives the illusion of roundness.

Quiz yourself

1. Explain how a 3d printer works.
2. Explain how G-Code is used to re-create a solid model.
3. Have you ever used a 3D printer before? If so, what did you print?
4. What are some things that we use today that are made with a 3D printer?
5. Why do you think 3D printing continues to gain in popularity?

Helpful links

Modix 3d Printers

Markforged

Makerbot