262 3D Printing 2.3 Essay.

Pros and Cons of Additive Manufacturing

**15 Points**

Students will write a 1 page (~3 paragraph) essay on the pros and cons of additive manufacturing. Points are awarded on content, composition, writing skills, etc. Some example key points that should be present are as follows:

## Advantages

* **Complexity is free:** It actually costs less to print a complex part instead of a simple cube of the same size. The more complex (or, the less solid the object is), the faster and cheaper it can be made through additive manufacturing.
* **Variety is free:** If a part needs to be changed, the change can simply be made on the original CAD file, and the new product can be printed right away.
* **No assembly required:** Moving parts such as hinges and bicycle chains can be printed in metal directly into the product, which can significantly reduce the part numbers.
* **Little lead time:** Engineers can create a prototype with a 3-D printer immediately after finishing the part’s stereo lithography (STL) file. As soon as the part has printed, engineers may then begin testing its properties instead of waiting weeks or months for a prototype or part to come in.
* **Little-skill manufacturing:** While complicated parts with specific parameters and high-tech applications ought to be left to the professionals, even children in elementary school have created their own figures using 3-D printing processes.
* **Few constraints:** Anything you can dream up and design in the CAD software, you can create with additive manufacturing.
* **Less waste:** Because only the material that is needed is used, there is very little (if any) material wasted.
* **Infinite shades of materials:** Engineers can program parts to have specific colors in their CAD files, and printers can use materials of any color to print them.

## Disadvantages

* **Slow build rates:** Many printers lay down material at a speed of one to five cubic inches per hour. Depending on the part needed, other manufacturing processes may be significantly faster.
* **High production costs:** Sometimes, parts can be made faster using techniques other than additive manufacturing, so the extra time can lead to higher costs. Additionally, high-quality additive manufacturing machines can cost anywhere from $300,000 to $1.5 million, and materials can cost $100 to $150 per pound.
* **Considerable effort in application design and setting process parameters:** Extensive knowledge of material design and the additive manufacturing machine itself is required to make quality parts.
* **Requires post-processing:** The surface finish and dimensional accuracy may be lower quality than other manufacturing methods.
* **Discontinuous production process:** Parts can only be printed one at a time, preventing economics of scale.
* **Limited component size/small build volume:** In most cases, polymer products are about 1 cubic yard in size, while metal parts may only be one cubic foot. While larger machines are available, they will come at a cost.
* **Poor mechanical properties:** Layering and multiple interfaces can cause defects in the product.