A Mini-Review of Using Additive Manufacturing in the Fashion & Textile Industry

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Abstract

In additive manufacturing (AM) techniques, 3D objects are built layer by layer. After the introduction of AM techniques, they found extensive applications in various industries such as medicine, dentistry, architecture, aerospace, textile, fashion, and so forth. This study presents a brief overview of the AM techniques used in the textile and fashion industries, the materials used, the companies that use this technology, and the printed products in this area.

Keywords: Additive manufacturing; 3D Printing; Textile industry; Fashion industry; Accessories

Introduction

Figure 1: relationship between the textile and fashion industry and AM processes.

By introducing additive manufacturing (AM) techniques in recent decades, researchers and craftsmen investigated the use of these techniques in various industries such as healthcare, dentistry, architectural, aerospace, textile, fashion and so forth [1,2]. In all of these techniques, initially, a 3D model must be created in computer-aided design (CAD) software or must be scanned from existing 3D objects by 3D scanning devices. Once the 3D model is prepared, by taking into account the type of technique to be used and setting the related parameters, the model is sliced in computer-aided manufacturing (CAM), and finally, the production sequence (G-codes/M-codes) is determined. As the state-of-the-art textile and fashion industries are also based on CAD/CAM, the use of AM techniques in these industries can be highly beneficial [3,4]. The use of AM techniques in the fashion industry was introduced in the fall of 2013 at the New York Fashion Week [5]. In this paper, the AM techniques used in these industries

are reviewed, and the advantages and limitations of each of these techniques are studied. Also, the materials used and the printed products are reviewed. Figure 1 shows the relationship between the textile and fashion industry and AM processes.

Fashion industry and rapid prototype

Since these industries are based on CAD/CAM, rapid prototyping can solve many design-related problems [6]. Therefore, one of the most critical applications of AM methods is producing prototypes in these industries. Prototyping can improve product design by providing customers with uniqueness and personalization. It also enables the production of lighter and more flexible products and the comparison between the prototype and the initial modeling [3,5].

AM process used in the fashion & textile industry

By using AM processes, it is possible to print complex geometries.

Among the AM methods in the fashion & textile industry, can be mentioned to fused deposition modeling (FDM), stereolithography (SLA), 3D printing (3DP-binder jetting), selective laser sintering (SLS), inkjet 3D printing, direct ink writing (DIW), and electro-hydrodynamic direct writing (EHDP) [5,7].

Companies that use AM processes in the fashion & textile industry

The most important companies include Iris van Herpen, Lady Gaga, Dr. Richard Hoptroff, Francis Bitonti, Timberland, Nike, etc. The most important products that are 3D printed in this industry are long dress detailed components, dresses, garment components, jewelry, watches, metal accessories, corsets, masks, helmets, bathing suits, shoes, high heel shoes, lumbar support garments, etc. An image of printed products in the fashion & textile industry is shown in Figure 2.
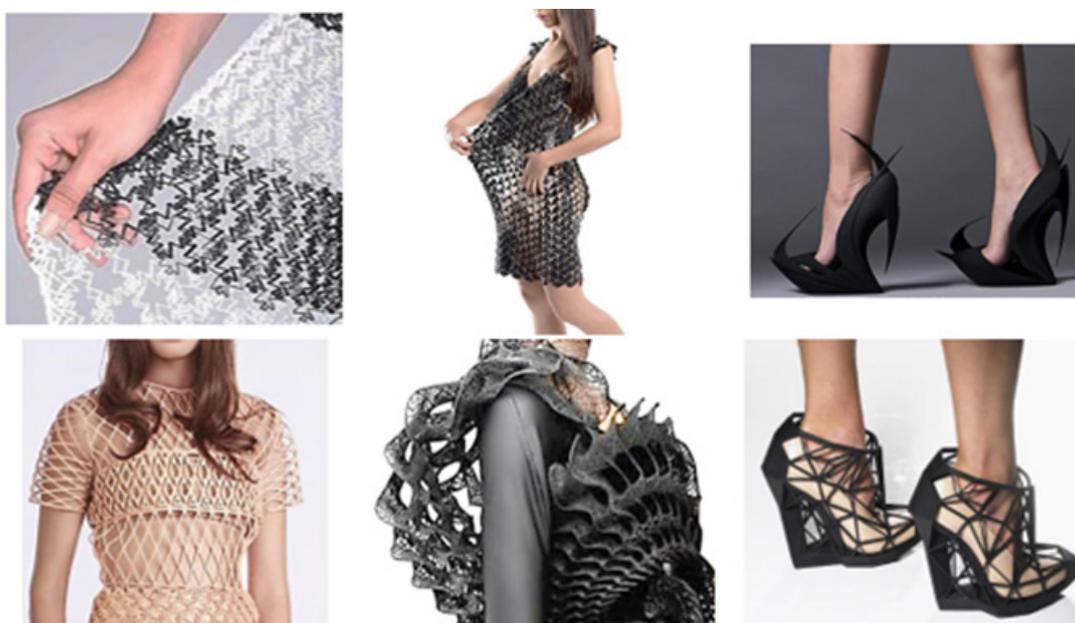

Figure 2: Some 3D printed products of the textile and fashion industry.

Materials used in AM in the fashion & textile industry

A wide range of materials is used in different AM methods. The most important materials used in the fashion & textile industry are thermoplastic polymers. If the goal is to produce a flexible product, thermoplastics such as thermoplastic polyurethane (TPU), thermoplastic elastomer (TPE), ethylene vinyl acetate (EVA) [6], and rubber materials are desirable. Nylon, polyamide, and polystyrene are generally used to produce non-flexible products.

Limitations of the use of AM methods in the fashion & textile industry

The main limitations of using AM methods in the fashion & textile industry are: the low speed of the process, the low surface quality in terms of thickness due to the step effect, the limited materials required in the fashion & textile industry, and the maximum

dimensions that can be printed by a 3D printer [8].

Conclusion

In this mini-review paper, a brief overview is presented of the use of AM techniques in the textile and fashion industries. In addition to the AM techniques used in these industries, the companies active in this area are introduced, and the materials used and some printed products are explained. Ultimately, the advantages and limitations of AM techniques in these industries are examined. The significant point is that the textile and fashion industries are based on CAD/CAM, and due to its position and the continuous progress of CAD/CAM, it can make enormous strides in these industries. Also, the principal advantage of using AM in these industries is the capability to manufacture complex designs and produce unique, personalized, and private products.

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