

# Using a 3D printer to innovate textile products

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**Abstract:** Today, 3D printing is available not only for industrial, semi-professional use, but also for hobbies and schools. Therefore, students TUL make full use of 3D printing within the subject Project Management. One of the topics they address is use of 3D printing for a textile product. They are looking for an answer to the question: How to 3d printing technology use for made a textile product?

**Keywords:** 3D PRINTING, TEXTILE PRODUCT, DIGITAL TEXTILES

## 1. Introduction

The 3D printing belongs to the rapidly emerging technologies which have the chance to revolutionize the way textile products are created. This is why it is necessary to acquaint students of textile specialization with news in this area also in the subject of project management too.

Teaching takes place in several steps:

- Students are looking for everything that has already been discovered or solved in the field of 3D textile printing.
- Students learn to create their own designs in the AutoCad program.
- Students are acquainted with the technology and possibilities of 3D printing.

Students create their own project of 3D printing.

- They design their own product
- They print the designed product
- They defend their work

There are several types of 3D printing, but the 3D printing of principle fused deposition modelling (FDM) is the most popular. It is conceptually simple and most of all the printing apparatus is cheap and of small size. We use the device Prusa i3 MK3S+ for teaching, as is shown in Figure 1.

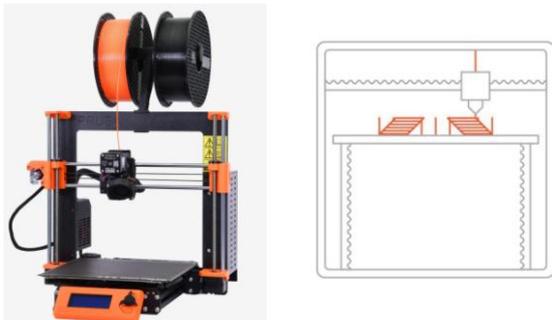


Fig. 1 3D printing Prusa i3 MK3S+ and principle of FDM [1]

3D printing is a form of additive manufacturing, i.e. creating objects by sequential layering, for pre-production or production. After creating a 3D model with a CAD program, a printable file is used to create a layer design which is printed afterwards. [2]

As can be seen from Figure 1, the thermoplastic fiber is continuously fed into a small heated chamber (extruder) where it melts and becomes a highly viscous liquid. The melt is then extruded through a die and then deposited in layers on a heated table according to a pattern calculated by the printer control software that will reproduce the desired geometry of the object. [1]

We use for printing different types of fibers (PLA, ABS, PET, PETG, TPU, Nylon, ASA, PC, HIPS, Carbon Fiber and many more.)

## 2. Areas of application of 3D printing for textile products

Several ways of using 3D printing technology in textile production are known. The purpose of this article is to summarize the possibilities that 3D printing provides for textile production. The aim is to present here various approaches to the use of 3D printing for the creation of a textile product.

For clarity, we identify four areas of use of 3D printing that can be applied in the textile industry:

- 3D printing of knitted or fabric
- Fashion of the Future to be 3D Printed
- 3D printing on textiles or as clothing accessory
- 3D printing of clamping device for ITC

### 3D printing of knitted or fabric

When 3D printing was created, it seemed that it would soon replace fabrics. Thousands of years of developing textile technology cannot be replaced that easily that is why every new project is a small step to figure out solutions to make the 3D printed textiles a reality one day.

Many issues need to be addressed in order for 3D printing to become a reality. The digital cloth should resemble the traditional textiles as much as possible, which means it should be thin, soft, airy, flexible. [3]

The 3D printing of textile of flexible structures of knitted is still in its infancy. Researchers approached the creation of 3D fabric in various ways. However, all of them to combine the main aspects of real textiles - to develop of 3D printing textile product which are of flexibility and strength. [4]

In order to print 3D structures, a 3D CAD drawing is required. Authors often use the software Autodesk to generate a 3D model of the weft knitted structure [5] as is shown in the Figure 2.

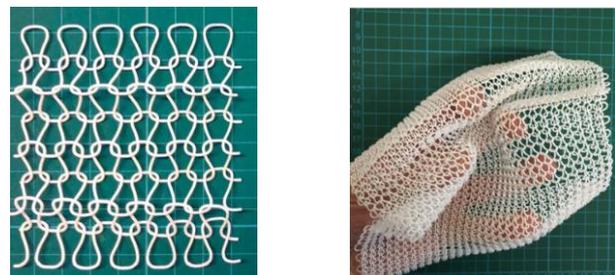


Fig. 2 Weft knitted structures printed form CAD [5]

In order to 3D print knit-based structures a 3D CAD drawing is required. This CAD drawing needs to consider the pipe wall thickness and distance between objects, particularly when creating inter-looping structures such as knitting. [6]

Fabrics are also created using 3D printing. The open source program Google SketchUp is used for this project to design fabrics

with canvas weave. Warp and weft yarns are created as separate components that are grouped into a single model that can be exported to a \*.stl file. [7]

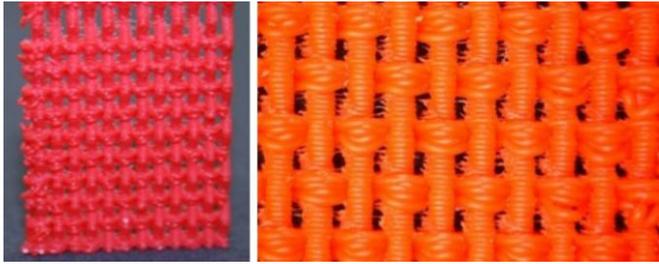


Fig. 3 The weave fabric samples 3D print

### ***Fashion of the Future to be 3D Printed***

The work [8] presented is part of a project to create garments using fused deposition modelling as 3D printing technology. Structures with various geometries are designed and tested with different materials starting from rigid to flexible. As a result, a fully 3D printed dress is created. Selecting this dress as a model, consumer acceptance for 3D printed garments is evaluated realizing an online survey containing 100 respondents. The data gathered show that respondents have knowledge of 3D printing, its advantages and the majority of them would accept wearing a 3D printed dress.

Recently, there have been many fashion designs printed on a 3D printer. Here are some photos of the products.



Fig. 4 The clothes from 3D printing [1]

### ***3D printing on textiles or as clothing accessory***

It is clear from the article authors [9], [10] work that the production of clothing accessories can also be an interesting area.



Fig. 5 The clothing accessories from 3D printing [9], [10]

### ***3D printing of clamping device for ITC***

The author [11] introduced the DefeXtiles technique, a fast and low-cost technique (FDM) that will make it possible to produce the tulle fabric used for made on the ironing pocket. The DefeXtiles thermal bonding ability allows users to extend existing clothing with a pocket. The pleated structure PLA pocket holds multiple items and is automatically retracted when these items are removed.



Fig. 6 The pleated DefeXtile pocket [11]

### ***3. Conclusion***

The topic of 3D printing is relevant for us in the Czech Republic also because the 3D printers we use in teaching are of Czech origin. The Company PRUSA, is celebrating its 10th anniversary this year. The establishment of a company can be compared to the American Dream. Let me mention part of the text from their website:

That was back in 2009 when Prusa built first 3D printer to make parts for my music controllers. He and his brother had a small workshop and they used to ship homemade 3D printer parts to enthusiasts all over the world, everything packed inside generic pizza boxes. Then, in May 2012, the Prusa Mendel i3 3D printer design came into existence. Prusa was flying around the world, giving talks at conferences about 3D printing but back home, in Prague, pretty much no one knew what 3D printing was.

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