Legal information

Johannes Wild
Lohmaierstr. 7
94405 Landau
Germany

E-Mail: 3dtechworkshop@gmail.com
Phone: +4915257887206

Thank you!

Thank you so much for choosing this book! With this book you can develop a solid knowledge about 3D printing and you will learn everything you need to know in terms of FDM 3D printing.

This guide will show you in particular how to prepare (Slicing) and print objects by using a 3D printer.

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1 Motivation

I'm sure you've already heard some fantastic stories about 3D printing and seen some fascinating photos of 3D printed objects that have sparked your enthusiasm for this subject. If not, then let´s get in touch with this ingenious technology. I´m sure that you'll be amazed what's possible in the world of 3D printing. In this book you will be guided step by step and you will learn how to use an FDM 3D printer and its software by means of the expertise of an engineer and experienced 3D printer user.

Everything you need to know to get started in 3D printing is explained in detail. You will learn how to print objects (downloadable for free) and how to materialize your own projects, ideas or prototypes. This book is made for all technically open-minded people who are interested in 3D printing.

Ideally, you should buy your own 3D printer. But don't worry, you don't have to pay a large amount of money for it. High quality 3D printers using the FDM technology are available for less than € 500.

If you don't want to buy your own 3D printer, you will still benefit from this book. On the one hand, through knowledge of the most important processes and principles of 3D printing technology. On the other hand by means of the possibilitiy to use a so-called makerspace or an external 3D printing service provider.

A makerspace is a place where several and different technical devices such as 3D printers, laser scanners or laser cutters are available to members for free use. These rooms, which are equipped like a workshop, offer the necessary space and the right equipment for the realization of your own projects. You can easily find out online where the next makerspace is located.

And before we start with the basics of 3D printing, we want to take a look at a selection of 3D printed objects first (Fig. 1.).

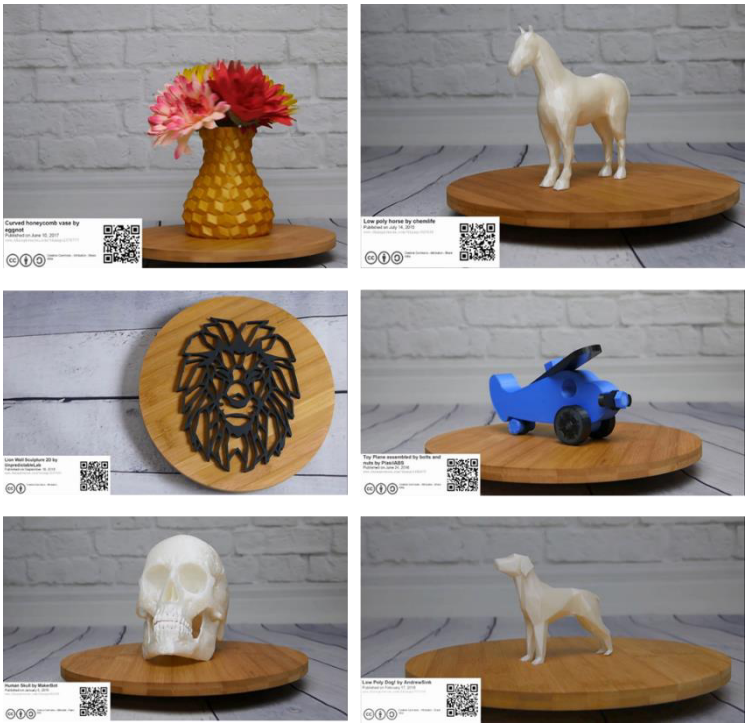

Figure 1: 3D printed objects: vase, sculptures and toys

With the help of this book you will be able to print many more great objects in the future. But you have surely been able to pick up some inspiration. And that's why we're now taking a closer look at the basic principles of 3D printing in order to get started with printing as soon as possible.

2 Introduction to 3D Printing

2.1 3D Printing Technologies and Procedures

The mainly presented and discussed 3D printing technology in this workshop is called FDM or FFF. FDM is the short form of "Fused Deposition Modeling". The heart of a FDM 3D printer is a nozzle equipped with a heating element, the so-called "Hot-End" (see Fig. 2). This part melts filament - the printing material - and deposits it layer by

layer on the printing bed or the previously printed layer. In this way, the print object gains height layer by layer.

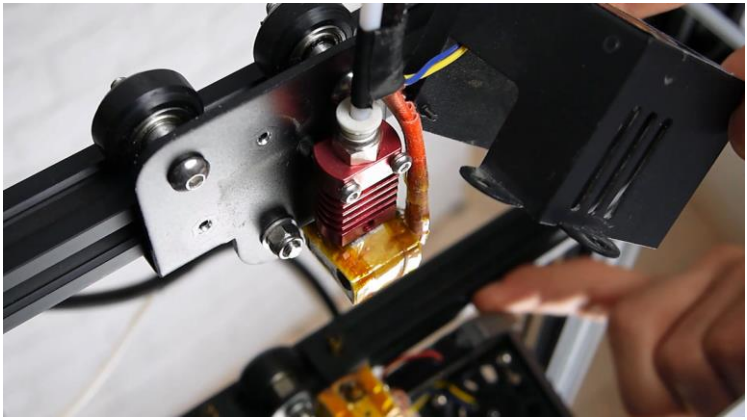

Figure 2: Hot-End of a 3D printer (Creality CR-10)

A plastic filament is usually used as a printing material. PLA is perhaps one of the easiest and common materials when it comes to 3D printing.

PLA is a plastic that is obtained from regenerative sources such as corn starch and is therefore biocompatible and food safe. Other plastics such as ABS are more difficult to print, but have better mechanical properties. The layer thickness is usually chosen in the range between 0.1 mm and 0.4 mm, whereby the print quality increases with a smaller layer thickness. However, the smaller the layer thickness, the longer the printing time.

To ensure that the print adheres well to the printing bed and does not come loose during printing, a heated printing bed in the range of approx. 60° Celsius is recommended. Some 3D printing enthusiasts use all kinds of additional equipment such as adhesive tapes, glue sticks, hairspray or permanent printing plates in order to achieve good printing bed adhesion. However, with well coordinated settings and a calibrated printing bed it normally works without those stuff. But there is an insider tip regarding the printing bed: