ORALE 1

Descriva il processo, l'uso in sicurezza e le principali caratteristiche della tecnologia di taglio e marcatura laser.

There are many different materials which can be used with FDM. In the first place, they are divided between the industrial and the consumer categories. The most commonly used are ABS (Acrylonitrile Butadiene Styrene), PLA (Polyactic Acid) and Nylon (Polyamide), but other exotic varieties of materials can also be used, like a material blend of plastic and wood or carbon. [13]

Because this technology presents some very good pros, FDM is often used in the area of non-functional prototypes in order to produce concept parts, functional models, prototypes in general, manufacturing tooling and modeling, and end use parts. More specifically, FDM can be used for low-volume production and prototypes aimed at form, fit and function tests.

At the same time, it is most commonly used in the aerospace sector, for example, to produce wind turbines. Anatomical models for medical use are also very much suitable to be built with this technology. Finally, FDM has slowly been enabling the rapid prototyping of biomedical micro devices, the kind of devices that are used on a daily basis in hospitals, for example, therefore very much fundamental, as it is considered both cheap, but at the same very safe. [14]

Since 2004, FDM technology has been used in a particular sector to produce load-bearing scaffold, which, according to a study, "has the potential for osteochondral defect repair". [15]

2.1.2. Strengths and Weaknesses

When it comes to 3D printing technology, one of the very first concerns relate to its cost. While in general it is the long-term use of materials that can become a serious expense, those who want to engage with Fused Deposition Modeling have an advantage from the start; in fact, FDM printing machines are among the cheapest and most affordable especially for those who want to use it in a domestic environment. Many brands today are available pre-built like Maker Bot and Ultimaker, two of the most popular desktop 3D printers, or can be built using DIY kits or going from the grounds up and printing parts to create a 3D printer.

Always on a positive side, FDM is considered to be a very clean technology, usually simple-to-use and office-friendly. The technology can also produce complex geometries and cavities that would otherwise be quite problematic. [16]

As for accuracy, the 3D prints do not reach the same level of accuracy and quality of other items which are instead produced through the use of Stereolithograpy. That said, the result is considered to be fairly qualitative, depending on the sector where the technology is applied.

ORALE 2

Descriva il processo, l'uso in sicurezza e le principali caratteristiche delle tecnologie di stampa 3D a filamento e a resina.

microcontroller-based applications. Furthermore, the modern μC programming methods have managed to abstract the low-level tasks with the underlying hardware and, hence, have rendered this technology sensible for the inexperienced *makers*. Nowadays, microcontrollers constitute a low-cost and easily accessible technology that can be straightforwardly incorporated within any *makerspace*.

To understand the impact of microcontroller technology on the maker industry, it would be wise to follow the advancement of microcontroller programming and application development during the years of maturation. The advancement of this technology can be separated into two major eras, in consideration of the requisite time needed to learn, program, and develop a microcontroller-based application [48]. That is, the (i) *long-cycle* development era and (ii) *short-cycle* development era.

Hardware Advancement in μC Technology

A significant reduction of the requisite time needed to program and develop a microcontroller-based application can be reasonably supposed to have arisen from the advancement of the *nonvolatile* memory technology. The *nonvolatile* (contrary to the *volatile* type of) memory is the one that is used to hold the application code, as it retains the stored information when the power supply is removed. The previous generation of μCs where either of an early type of *electrically erasable programmable read-only memory* (*EEPROM*), or of *ultraviolet programmable read-only memory* (*UVPROM*).

Both types of memories required a separate board (regularly referred to as *programming board*) in order to upload new code in the μC. This demand arose from the fact that it was required a different circuit for reading and executing code from μC's memory, and a different circuit for writing new code to the μC's memory. The interface for uploading the updated code to the μC device was regularly based on the *recommended standard 232* (*RS-232*), while the programming board required an additional power supply unit to power the internal components of the *programming board* (Figure 1.6a). In addition, the UVPROM type of memory required an extra UVPROM eraser, where the quartz window on the top of the device allowed the μC's memory to be exposed to ultraviolet light in order to erase previous data before uploading the new code (Figure 1.6b). The common exposure time was approximately 20 minutes and, hence, the code developer could assess the functionality of an error-free code two to three times per hour. In most cases, the user should develop a custom-designed PCB that would hold the application circuit (like the example presented in Figure 1.7).

The aforementioned information reveals the considerable hardware involvement, time, and cost of the requisite occupation just to upload a firmware to the μC's memory (in the *long-cycle* development era). When the later-type of EEPROM memory made its appearance in μC market, it allowed the data to be erased and rewritten within the application circuit. This fact rendered unnecessary the extra *programming board* that was used for the firmware updates and promoted the, so-called, *in-system programming* (*ISP*) capability. In addition, the more recent *Flash* type of memory does not require the μC to be completely erased before rewritten (i.e. it can be read/written in blocks) and, hence, it promotes faster firmware updates that accelerate the debugging process.

The critical time during the μC programming and application development process reduced even more with the replacement of the RS-232 interface. The today's USB industry

Tema 1

Il candidato, nel contesto di un Laboratorio Prototipi a servizio dell'attività didattica di una Scuola di Design, descriva un'ipotesi di organizzazione dei servizi a supporto della didattica nell'ambito della prototipazione interattiva.

Tema 2

Il candidato, nel contesto di un Laboratorio Prototipi a servizio dell'attività didattica di una Scuola di Design, descriva la dotazione tecnologica digitale (hardware e software) che ritiene possa essere presente in Laboratorio.

Tema 3

Il candidato, nel contesto di un Laboratorio Prototipi a servizio dell'attività didattica di una Scuola di Design, descriva alcune applicazioni (base e avanzate) delle tecnologie digitali a supporto della didattica evidenziandone il carattere innovativo nei prototipi interattivi.