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RAPID PROTOTYPING OF AED TRAINING DEVICE COVER

WYKORZYSTANIE METODY SZYBKIEGO PROTOTYPOWANIA NA PRZYKŁADZIE OBUDOWY DEFIBRYLATORA TRENINGOWEGO

Abstract

This paper presents the utilization of Rapid Prototype technology in industrial design. On example of cover for AED training device there was presented in what way the prototype is made. Cad model created in PTC/Creo is ready to be printed using any of available RP technology.

Keywords: *Rapid Prototyping*, *CAD*

Streszczenie

W artykule przedstawiono podstawowe rodzaje technologii szybkiego prototypowania oraz ich zastosowania w przemyśle. Na przykładzie obudowy urządzenia treningowego automatycznego defibrylatora pokazano sposób budowy modelu CAD oraz jego wykorzystanie w procesie przygotowania prototypu wykonanego w technologii FDM.

Słowa kluczowe: *szybkie prototypowanie*, *CAD*

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1. Introduction

In the late 70's the first 3D printing devices where made to produce prototypes. 3D printing started with a desire to print 3D-modelles, in the same way as text and picture printers work. The first printers that were produced were large and extremely expensive. Today you can get 3D printers for different costs. This depends on the quality of the printer and the material it produces. 3D printing is currently used for making various prototypes, this can be anything from new part of a car or material savings for soda bottles. It is estimated that there are approximately 120 printing devices in Norway with a cost of more than 200 000 NOK. The main buyers are often architects, engineering firms and designers. Although most of the printers are used to produce prototypes, there is a roughly 25% usage of making retail products. This will increase as the technologies are getting better and prices on 3D printers decrease. Benefits with 3D printing is that you have almost unlimited possibilities of making whatever you want and for a low cost. All you need is 3D drawing program, a printer and materials. Figure 1 displays were 3D printing is used in different industries. Figure 1 displays were 3D printing is used in different industries.

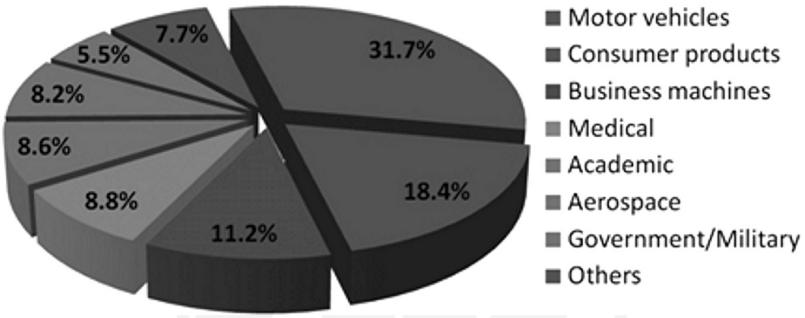

Fig. 1. Marked shares for 3D printing [1]

Rys. 1. Wykorzystanie technologii szybkiego prototypowania [1]

2. RP Technologies

3D printing, also known as rapid prototyping or rapid production is a technology based on text and picture printers. Text printers use only two axes, *X* and *Y* in a coordinate system. 3D printers use the same principles as a text printer, but it can also print in several layers in Z-axe direction. Today rapid prototyping machines have a limited size of the final product, the height extends to about 50 cm at the maximum height for the average printer. This will increase with evolving technology. Printers used today can create devices in different materials and colors. Everything from cheap printers that prints in plastic to expensive machines that prints in diverse metal alloys. Common for all the printers are that the printing is slow, normal operation speed is 20–28 mm per hour. This will vary, and it depends on quality of the product.

Table 1

Some types of technologies for 3D printing [2]

Type	Technologies	Materials
Extrusion	Fused deposition modeling (FDM)	Thermoplastics (e.g. PLA, ABS), eutectic metals, edible materials
Granular	Direct metal laser sintering (DMLS)	Almost any metal alloy
	Electron beam melting (EBM)	Titanium alloys
	Selective heat sintering (SHS)	Thermoplastic powder
	Selective laser sintering (SLS)	Thermoplastics, metal powders, ceramic powders
	Powder bed and inkjet head 3d printing, Plaster-based 3D printing (PP)	Plaster
Laminated	Laminated object manufacturing (LOM)	Paper, metal foil, plastic film
Light polymerised	Stereolithography (SLA)	photopolymer
	Digital Light Processing (DLP)	liquid resin

3D printing technology commonly used today are:

1. Monomer liquid
   The simplest of the professional models can make plastic models within a cube of 17×23×20 cm. The principle is that you pull the model up from a bath with a monomer liquid which flows on to a slim layer on top of a glass plate. It is affected by UV-light making the liquid polymerized. When a layer is completed, the bottom plate will move 1 mm in the Z-direction and the next layer can be produced.
2. Polymer powder
   This technology using polymer powder gives porous products. This type of printing allows for multiple color combinations when you add dye. In order to harden the polymer, it can be brushed or immersed in a binder. The binding liquid is epoxy or cyanoacrylate.
3. Selective Laser Melting (SLM)
   These types of printing machine use almost the same principle as the Monomer liquid technology. For each layer that is printed, metal powder is melted with a laser. This procedure will repeat itself, until it is finished [3].

3D printing technology is today on the way forward. Future researchers believe that people no longer will buy finished products in stores, but rather create/print products themselves. Researcher Dave Evans believes rapid production machines will revolutionize the current production technology. “A few years into the future, humans will be able to create everything from artificial organs to foods”, he believes.

He also believes that there may be an industrial revolution in terms of how 3D printers produce units. There is another type of production preparation for building up layer by layer. This is very different compared to the production we have today, where we have to remove materials with the help of milling and drilling machines.

3. CAD model of AED training device

A practical using of Rapid Prototyping method was presented on example of AED training device cover. Before the prototype was prepared a CAD model was created. It was prepared in PTC/Creo software. Below figure presents the main dimensions of the cover, while complete model of the cover is presented in Fig. 3.

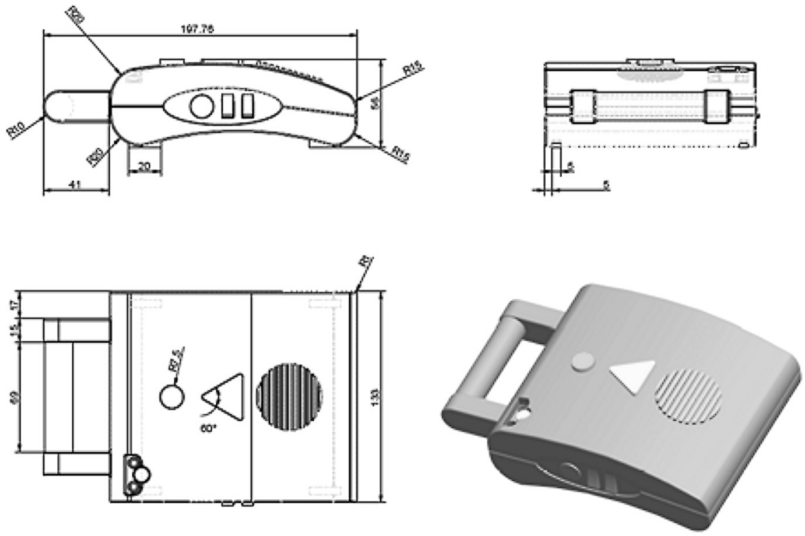

Fig. 2. Main dimensions of AED cover

Rys. 2. Główne wymiary obudowy defibrylatora

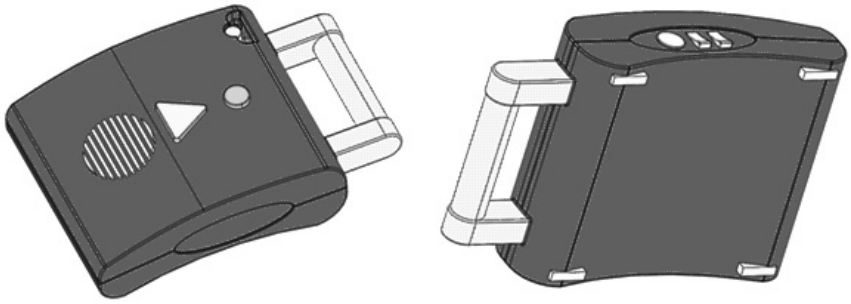

Fig. 3. Complete CAD model of AED cover

Rys. 3. Model obudowy defibrylatora

Presented CAD model was later used for preparing model in .stl format file and creating input data in appropriate software to Rapid Prototyping machine. Prepared prototype by the use of FDM technology is shown on below picture.

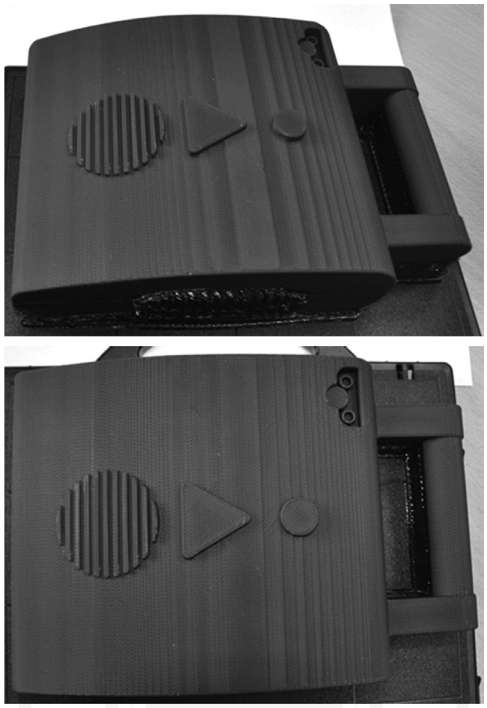

Fig. 4. FDM prototype of AED cover

Rys. 4. Prototyp obudowy defibrylatora wykonany w technologi FDM

4. Conclusions

Combining CAD systems and Rapid Prototyping technology allows to prepare prototype in reasonable time and cost. It also allows for testing various solution before product goes to final production and eliminate potential errors. Rapid Prototyping methods are still developing and allows to achieve better and better quality, but even now, allows to conducting test which were not available yet few years ago.

References

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