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ScienceDirect

Procedia Manufacturing 22 (2018) 141–146

Procedia MANUFACTURING

www.elsevier.com/locate/procedia

11th International Conference Interdisciplinarity in Engineering, INTER-ENG 2017, 5-6 October 2017, Tirgu-Mures, Romania

Development on the production of a new type of extruder used in additive manufacturing, FDM technology

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Abstract

In this paper is studied the possibility of executing a new type of extruder used in 3D FDM technology printers. By using this new extruder, it is intended to considerably lower manufacturing costs compared to 3D printers using the raw ABS or PLA thread. The raw material used for the printers made with the new extruder will be ABS, PLA or other materials later developed. As a result, the training of the material needed for 3D printing will be done by means of a casting screw made in the form of a conveyor screw developed using the 3D printer. The design of the 3D model of the screw required for the extruder is done in AutoCAD by moving a cone trunk whose dimensions are variable after a conical worm wound on a cone whose axis of symmetry coincides with the axis of symmetry of the worm. The axis of symmetry of the cone torso will be perpendicular to the axis of the cylinder from which the worm will result. For calculating the points needed to define the axis of the trunk cone, vector calculation elements will be used. The program used for the point calculation belonging to the propeller is Auto-Lisp and the representations are made in AutoCAD. Once the transport worm is represented in AutoCAD, it will be imported into Inventor, where the final shape of the snail will be modeled, and it will be exported in format ".stl" and printed on the 3D printer, after which a casting mold will be executed and then poured.

Peer-review under responsibility of the scientific committee of the 11th International Conference Interdisciplinarity in Engineering.

*Keywords:*3D printer; extruder; FDM; rapid prototyping; conveyor worm.

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2351-9789
Peer-review under responsibility of the scientific committee of the 11th International Conference Interdisciplinarity in Engineering.
10.1016/j.promfg.2018.03.022

1. Introduction

There are several ways in which a product becomes reality. But in the case of prototype execution by conventional technologies (casting in molds executed by milling, followed by machining), they reach high manufacturing costs and a long time. This is why the 3D printing industry has developed.

Being the most common technologies in the 3D printing industry, methods such as FDM and SLS technology melt or soften the materials to produce layers. Fast FDM (Fused Deposition Modeling) technology is the most used manufacturing technology for its simplicity and affordability. It is used in modeling, prototyping as well as in production applications. The way a prototype is born is relatively simple (Fig. 1) and the stages we are going through in this manufacturing technology are the following:

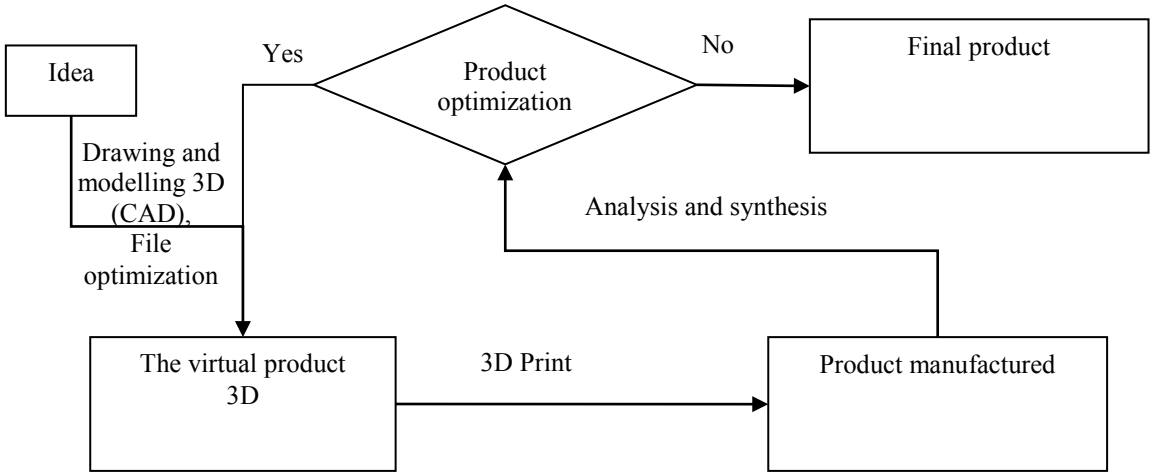

Fig. 1. Steps to a prototype fabrication in FDM technology.

In the first stage, the product is represented by 3D CAD modeling software such as Inventor, Solidworks, Catia. Having the 3D-modeled product and using dedicated software such as Cura the product is prepared for 3D printing. The desired 3D model is initially sliced into cross sections called layers. The printing technology consists in passing a plastic filament through an extruder that heats it to the melting point, then applying it uniformly (extrusion) layer upon layer with great accuracy to physically print the 3D model according to the CAD file.

The extruder is heated to melt the plastic filament, moving horizontally in two directions, under the coordination of a numerical control, directly controlled by the CAM application of the printer. The printer table executes the vertical movement. On the move, the head puts a thin strip of extruded plastic that cools sticking to the previous layer to form the desired 3D model.

Following a step of analyzing and synthesizing the resultant product, if the product has to undergo some modifications, the CAD file is changed and then the same steps are followed until the modified product is obtained. The purpose of this paper is to model the conveyor worm in 3D, thus opening the way to:

- removing the plastic filament by designing an extruder to work with PLA or ABS pellets to reduce the cost of printing;
- creating the possibility of using recycled plastic material as raw material for 3D printing.

The design of the 3D model of the screw required for the extruder is done in AutoCAD, moving a cone trunk whose dimensions are variable after a conical propeller wound on a cone whose axis of symmetry coincides with the axis of symmetry of the worm. The axis of symmetry of the trunk cone will be perpendicular to the axis of the cylinder from which the worm will occur, and the calculation of the required points will use vector computation elements.