

Granule in-Feed System of 3D Printing-Fused Deposition Modeling

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Abstract— Additive manufacturing is an advanced manufacturing process of making three dimensional solid object from a digital file.3D printing is one of the process in Additive manufacturing. The creation of a 3D printed objects is achieved using additive processes. In fused deposition modeling a filament in the form of wire will be extruded through the nozzle with the help of hot end. External force is provided to wire by rollers and bearings. In wire extrusion process back pressure is created and this will make wire to reduce its movement. With that external force the filament is extruded .The usual problem facing in 3D printing (Fused Deposition Modeling) is clogging of nozzle. Whenever the nozzle is clogged it has to be cleaned and then had to restart the print from beginning. There are some situations where the print is about to end but it will stop due to blocking of nozzle. If we observe that mainly blocking occurs due to not having enough and un-uniform pressure to push the filament into the extruder. By changing the feeding system that means instead of using wire extrusion here there is the use of granules and hopper. Based upon the principle of feed system of injection molding machine this feed system is designed. This is the basic info regarding the changing of feed system.

Key words: Fused Deposition Modeling, Granule in-Feed System

I. INTRODUCTION

3D printing is a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of material. It is also known as rapid prototyping, is a mechanized method whereby 3D objects are quickly made on a reasonably sized machine connected to a computer containing blueprints for the object. The 3D printing concept of custom manufacturing is exciting to nearly everyone. This revolutionary method for creating 3D models with the use of inkjet technology saves time and cost by eliminating the need to design; print and glue together separate model parts. Now, you can create a complete model in a single process using 3D printing. The basic principles include materials cartridges, flexibility of output, and translation of code into a visible pattern.

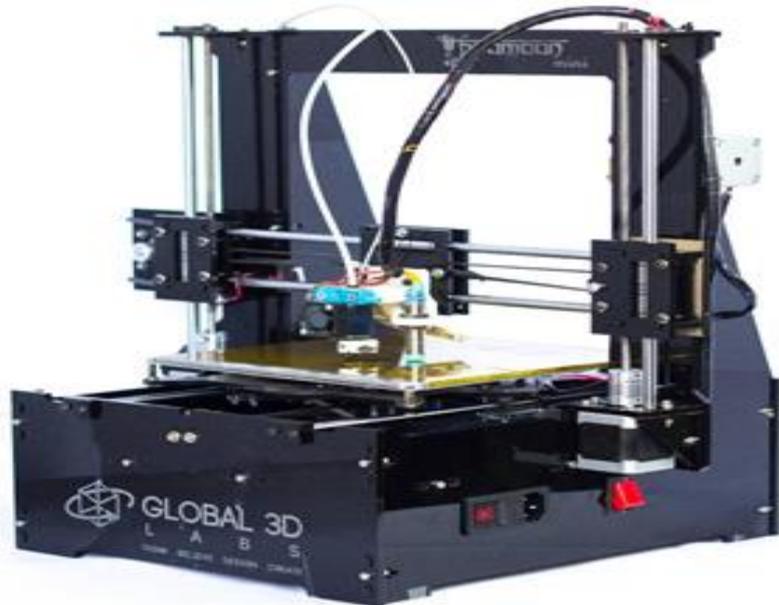


Fig. 1: Desktop 3D Printer

A. 3D Printer

3D Printers are machines that produce physical 3D models from digital data by printing layer by layer. It can make physical models of objects either designed with a CAD program or scanned with a 3D Scanner. It is used in a variety of industries including jewelry, footwear, industrial design, architecture, engineering and construction, automotive, aerospace, dental and medical industries, education and consumer products.

II. 3D MODELLING

3D model of Granule feed system is made in CATIA V5. The model is done according to the free flow of granules without any obstruction. Designed part can be seen in Fig.2.

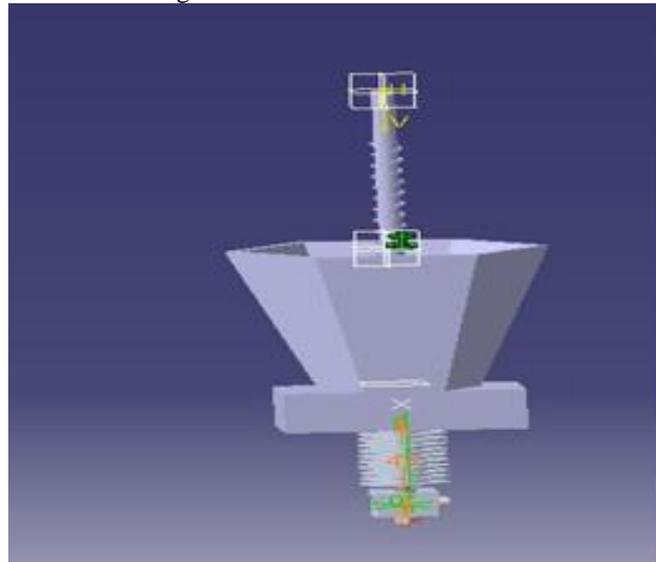


Fig. 2: 3D Model Of Granule Feed System

III. WORKING MECHANISM

Based upon the principle of feed system of injection molding machine this feed system is designed. This is the basic info regarding the changing of feed system. There should be some pressure to push the filament for the extrusion, in this feed system pressure is developed by two methods one is creating a turbulent flow of granules by rotating the hopper and the other is by using a lead screw same as injection molding. In the hopper there are some obstacles which reduce the kinetic energy and according to the Bernoulli's principle pressure increases by decrease in velocity. So based upon the above principle pressure is generated and the filament is extruded. By making these type of changes in traditional extrusion process there is a chance to avoid clogging of nozzle due to un-uniform pressures. And the extrusion will be continuous.

Whenever nozzle is blocked it requires some extra pressure to push the molten material out of the nozzle. So by this granule in-feed process there is no chance of un-uniform pressure as the lead screw rotates continuously granules will move into liquefier and in that zone the solid state is converted into molten and finally it is fired from the nozzle. The main intention of granule extrusion is to produce an un-interrupted print in Fused Deposition Modeling process, this is possible only if there is continuous pressure to push the molten material. Though there is a high temperature at the liquefier the flow will not be continuous this is because of having not enough pressure to push the flow out of the nozzle. So there should be enough pressure at blockage to clear that and that is possible by this granule extrusion process. Prototype of Granule In-feed system is shown in Fig.3.

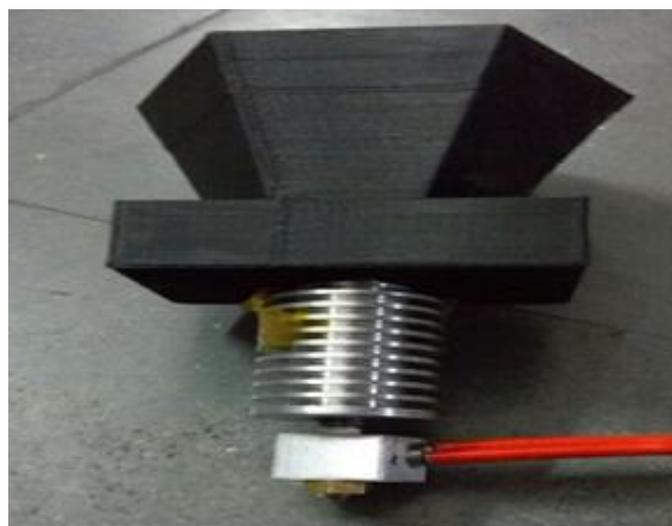


Fig. 3: Prototype Of Granule In-Feed

IV. CONCLUSION AND RESULT

Granule in-feed system is an attempt to create an alternative of roller and wire in-feed system and to avoid un-uniform pressures which are usual in wire in-feed system. The idea of granule feed is originated from injection molding process. So to get continuous fire of print granules are replaced from wire. By using granules the cost of the material will also change. By doing deeper research in material properties and hot end better results can be achieved in layer resolution. In future lead screw can be replaced by rotating hopper to create movement in the granules and also to increase pushing force of the granules.

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