IMPROVEMENT IN QUALITY OF DEGREE OF ACCURACY IN EXTRUSION PROCESS

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Аннотация – В данной статье проводится исследование факторов, влияющих на диаметр пластиковой нити, а также рассматривается задача повышения качества пластиковой нити в процессе экструзии.

Introduction

A rapid prototyping method makes it possible to produce complicated parts based on computer 3D model. Most of the rapid prototyping methods can assemble models from a variety of widespread and special materials. The modern additive technology for the most of 3D-printers requires ABS-filaments or PLA-filaments, respectively, from ABS (Acrylonitrile butadiene styrene) polymer or PLA (Polylactic acid) polymer, with a diameter 1.75 mm or 2.85 mm, which used as a consumable material in 3D printing technology.

Filament obtained from plastic granules, which in case of ABS, is the products of oil and gas industry. Accordingly, the price of granules is much cheaper than the price of the finished product, even taking into account the cost of electricity consumed in the transformation of the granulate in the filament.

In this article has been investigated factors affecting the diameter of the plastic filaments, as well as considered the problem of improving the quality of the filament plastic in the extrusion process.

Statement of the problem

A great deal of research has been conducted at universities and research institutions to expand the applications of FDM technology and to improve the FDM process. Work has also been in progress in some organizations to develop new metallic or ceramic materials for rapid fabrication of functional components by FDM with higher mechanical properties [2, 3].

In operations of the 3D-printer basic parameters affecting the quality of the finished product and fidelity digital models is diameter of the plastic filament. Therefore, to improve the production of plastic filaments, it is necessary to investigate and correct the control loop diameter plastic filament.

In order to stabilize the diameter of the plastic filament, we must consider the dependence on other parameters such as the temperature in the heating zone of the screw, the screw speed, the pressure in each zone of the screw and others. Changing any of these parameters leads to a change diameter of filament.

The most important parameters that have a permanent effect on the change in the diameter of the plastic filament is heating temperature and screw speed. On the base of this parameters experiment has been finished on the real object.

Fig. 1 shows a graph of an experiment conducted on an extrusion installation showing the temperature dependence of the diameter.

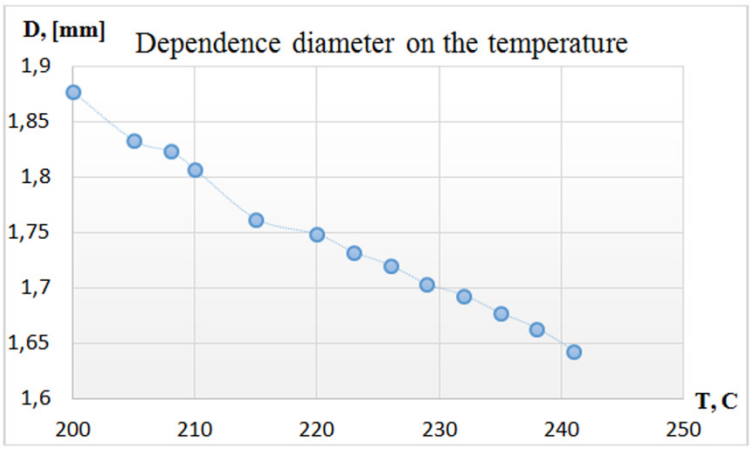

Fig. 1. Graph of the filament diameter of the temperature of the extruder

From the graph on the fig. 1 above it can be concluded that the higher the temperature, the smaller the diameter.

Analyzing the resulting graph fig. 2, we can conclude that by increasing the drive speed increases the diameter of the filament in the plastic extruder.

For a simple model of the extruder, changing control parameters as drive speed and the heating temperature is carried out manually. The influence of external factors not taken into account in the system, respectively, the system is not able to respond to external perturbations in the form of changes in ambient temperature, changes in the composition of raw materials, etc. thereby increasing the range of variation of the filament diameter.

The arguments above lead to the need for a system of automatic control of the diameter of a loop, which could provide the necessary accuracy and speed in the production process. Solve tasks can fully developed algorithm

of adaptive digital PID control. Fig. 3 shows a functional line diagram of an extruder feedback.

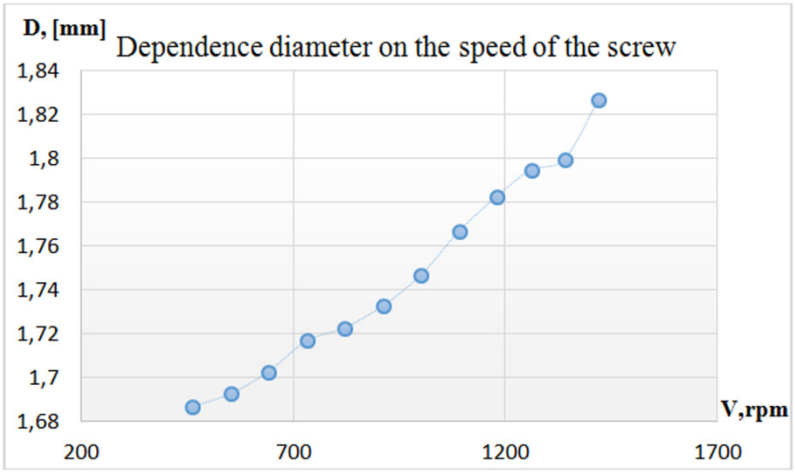

Fig. 2. It is showed the dependence of the diameter of the plastic filament on the rotational speed of the drive

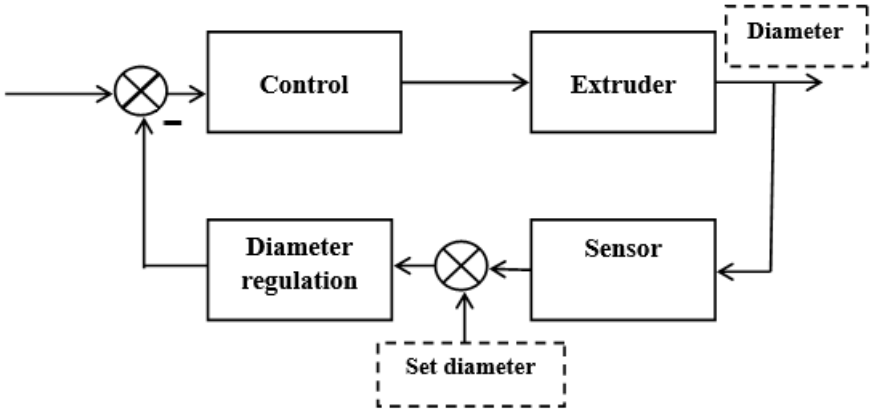

Fig. 3. Functional diagram of the extruder line with feedback

This diagram shows the connection of the probe diameter and electric installation, temperature sensor, and others. The controller is designed to form the control signal for diameter regulation when a signal comes from the sensor.

Conclusion

In this paper, conducted a study of factors affecting the diameter of the plastic threads, as well as consider the problem of improving the quality of the plastic thread in the extrusion process. The theoretical rationale for developing a feedback system for extrusion plant, which will improve the quality of the product, reduce the number of rejects, to ensure continuous operation for a long period.

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DESIGN OF THE TELEOPERATION ALGORITHM TO CONTROL THE HUMANOID ROBOT

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Abstract – This paper presents a concept design of work algorithm for teleoperation control system of humanoid robot. Humanoid robot control system needs to stabilize the robot in a vertical position in order to prevent the robot from falling. The process of design of the control system includes the design of position filter to detect the unstable positions. The application of such a control system enables to control the humanoid robot using motion capture technology.

Algorithm of the control system work

Humanoid robots are actively developed last years. There are many different designs of humanoid robot constructions but not all of them have control system that realizes adequate behavior of humanoid robot. That is why we propose to use the teleoperation [1], [2], [3], [4] to control such type of the robots. Further, we consider the algorithm of the teleoperation control system that allow control humanoid robots using the RGB-D sensor.

To form the control signals we need to collect the data about the human position. Let us create the operational block that process the data received from the RGB-D sensor. The objectives of this block are the forming of the packets with the human operator data and the initial data filtering, for example, forming of the packets only with the recognized position of the operator. When packet is filtered, system must inform the operator about it.