Hungarian University of Agriculture and Life Sciences

Szent István Campus

Stipendium Hungaricum

Mechanical Engineering Master's training education

Design of a Filament Extrusion System for a Sustainable and Cost-Effective FDM- 3D Printing

Insider consultant: Dr. László Zsidai

University professor

Insider consultant's Institute/department:Institue of Technology / Mechanical Engineering Department

Created by: **Rihem Jebali**

Gödöllő, Hungary

2024

ABSTRACT

Additive manufacturing has gained widespread adoption in recent years since it offers numerous benefits such as increased design flexibility and reduced material waste compared to traditional manufacturing methods. One of the most widely used additive manufacturing methods is fused deposition modeling (FDM), which builds three-dimensional things layer by layer by extruding thermoplastic filament via a heated nozzle.

The design and development of a small-scale filament extruder and winding system for the manufacture of feedstock for 3D printers is the main objective of this thesis. First, a survey of the literature on extrusion methods and additive manufacturing was done. In order to inform the design of extruder components, key parameters influencing the extrusion process were subsequently studied through theoretical calculations and numerical simulations. The extruder screw, barrel, heating elements, and other components were modeled in SolidWorks.

The suggested extruder design has a maximum power demand of 300W and was intended for desktop use. To extrude popular 3D printing polymers, parameters including screw shape, rotational rates, and suitable motorization were established. Furthermore, a filament winding mechanism was created to generate consistent filament spools for dependable 3D printing.

All things considered, this study shows how to construct a simple small-scale filament extruder methodically and offers guidance on how to set process parameters for reliable 3D printer filament production. Advances in extrusion technology could lead to better quality filaments, more compatible materials, and integrated quality control capabilities, all of which could promote additive manufacturing.