

Design of a Driver Gear System for Incessant Feeding of Fiber in Additive Manufacturing of Continuous Fiber Reinforced Composites

Andrew McGinnis

Faculty Mentor: Dr. M. Noor-A-Alam

Mechanical Engineering, Indiana University Purdue University Columbus

Introduction

Continuous Fiber 3-D Printing is a type of additive manufacturing of composites that allows using the unbroken fiber within the polymer matrix during the printing process. The fiber material used in this project is carbon fiber. This process of printing introduces an incessant feeding of fiber to the main plastic being used. With the fiber included in the composite, the overall strength of the material is greatly increased and can then have a wider range of applications.

Purpose

The purpose of this research project is to develop a driver gear system that will allow for a more consistent inclusion of the fibers into the polymer material. This will facilitate the improved print quality of continuous fiber reinforced composites.

Design

The design for this project consists of a few key components, a machined extruder nozzle, supports for an electric motor, roller wheels, and the spool on fiber being used. The nozzle had a 2 mm hole drilled in the side and had a small 0.8 mm tube laser-welded to ensure the fiber is introduced in the center of the nozzle. A small motor and gear system will continuously turn roller wheels that will help feed the fiber and prevent any loss of tension when making sharp direction changes.

Methodology

The process for this project started with identifying the key areas of concern with previous projects. Those being the loss of tension during sharp geometrical direction changes and the tendency for the fibers to be pushed against the inside wall of the nozzle. The nozzles being used were sent to a machining shop and had holes drilled and a small metal tube laser-welded inside. This tube will prevent the fiber from being pushed against the wall and ensure its centered in the nozzle. Next, CAD models of the supports are made to model the design and ensure dimensions are accurate. The supports will be 3D printed and have the motor and rollers affixed. A pulley system will connect the motor to the shaft of the rollers and when powered will drive the fiber and prevent loss of tension during printing.

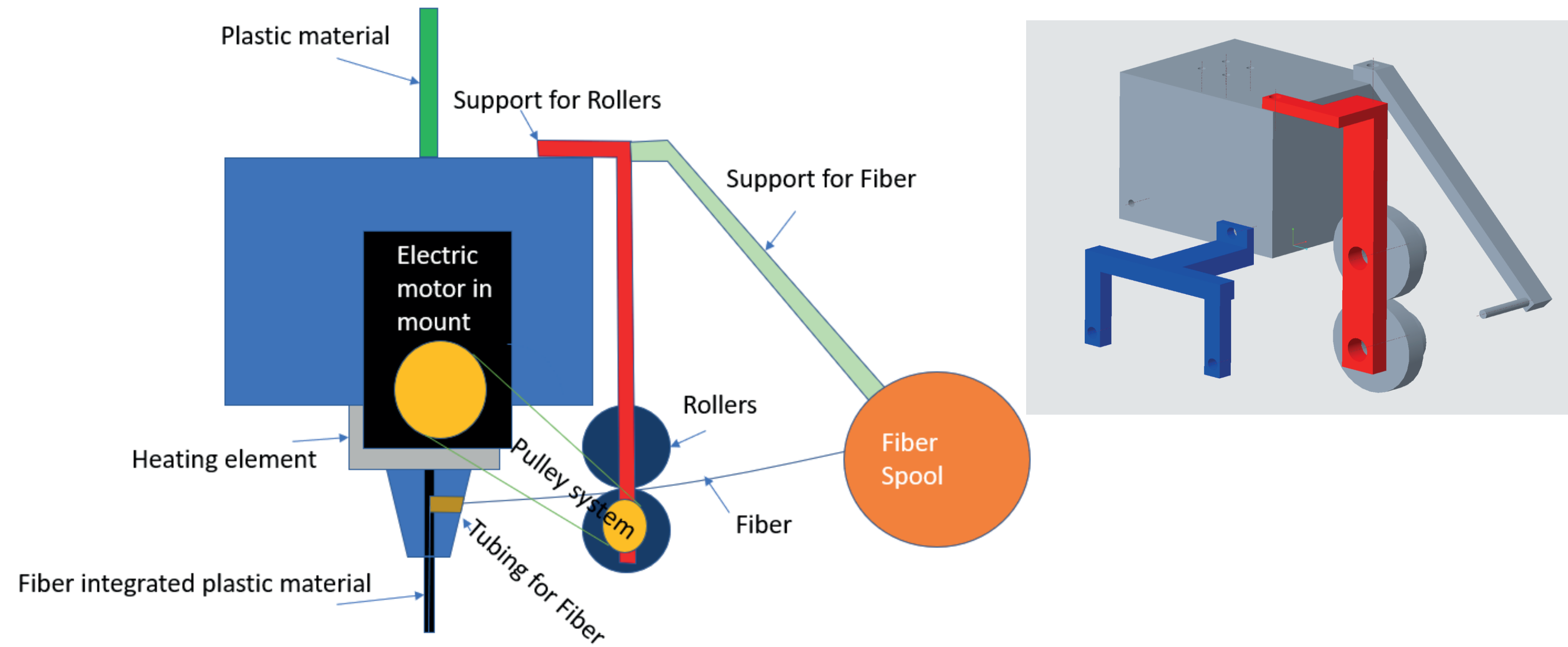


Fig. 1: Schematic of the printer and driver system

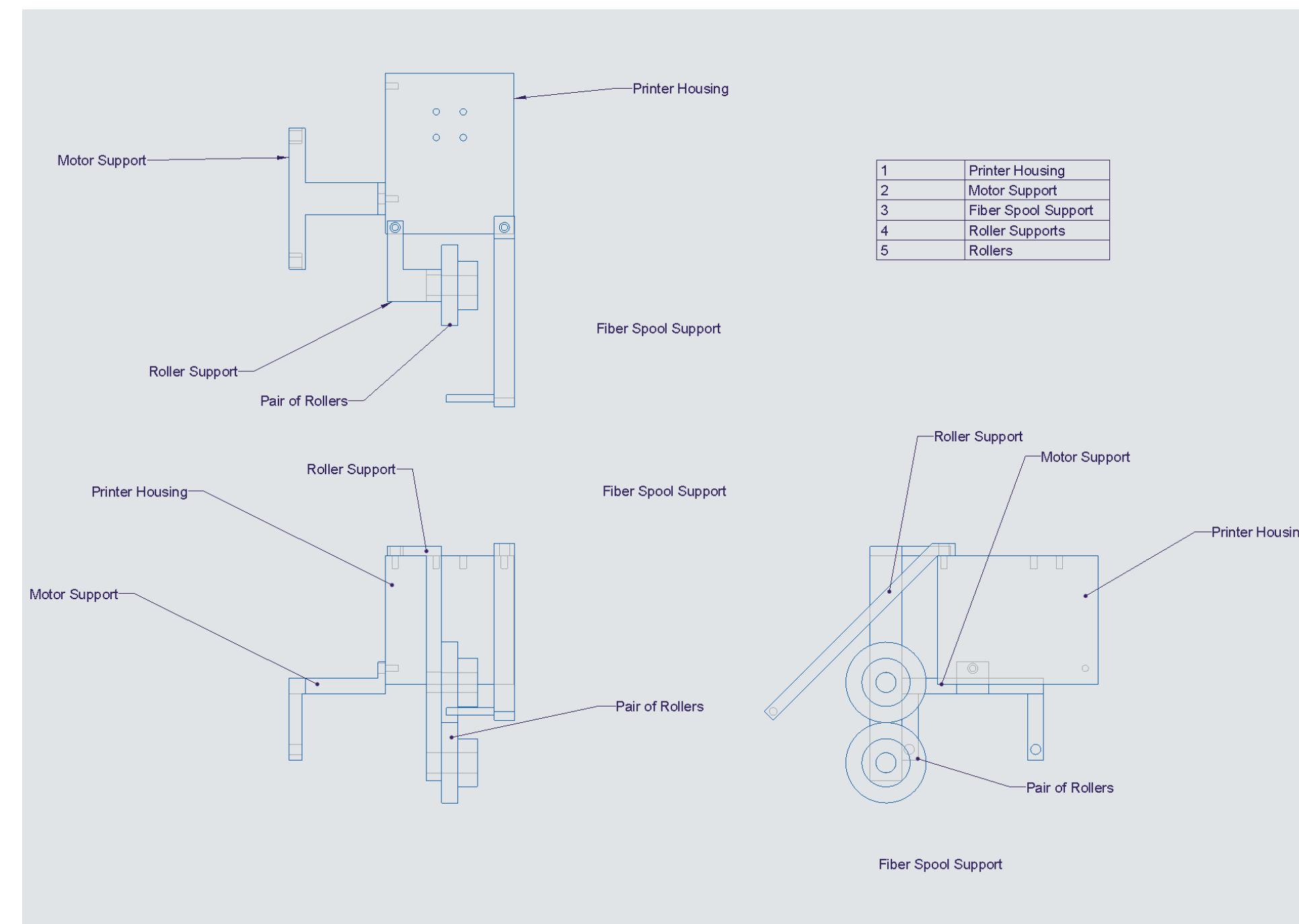


Fig. 2: Drawing Layout of Supports

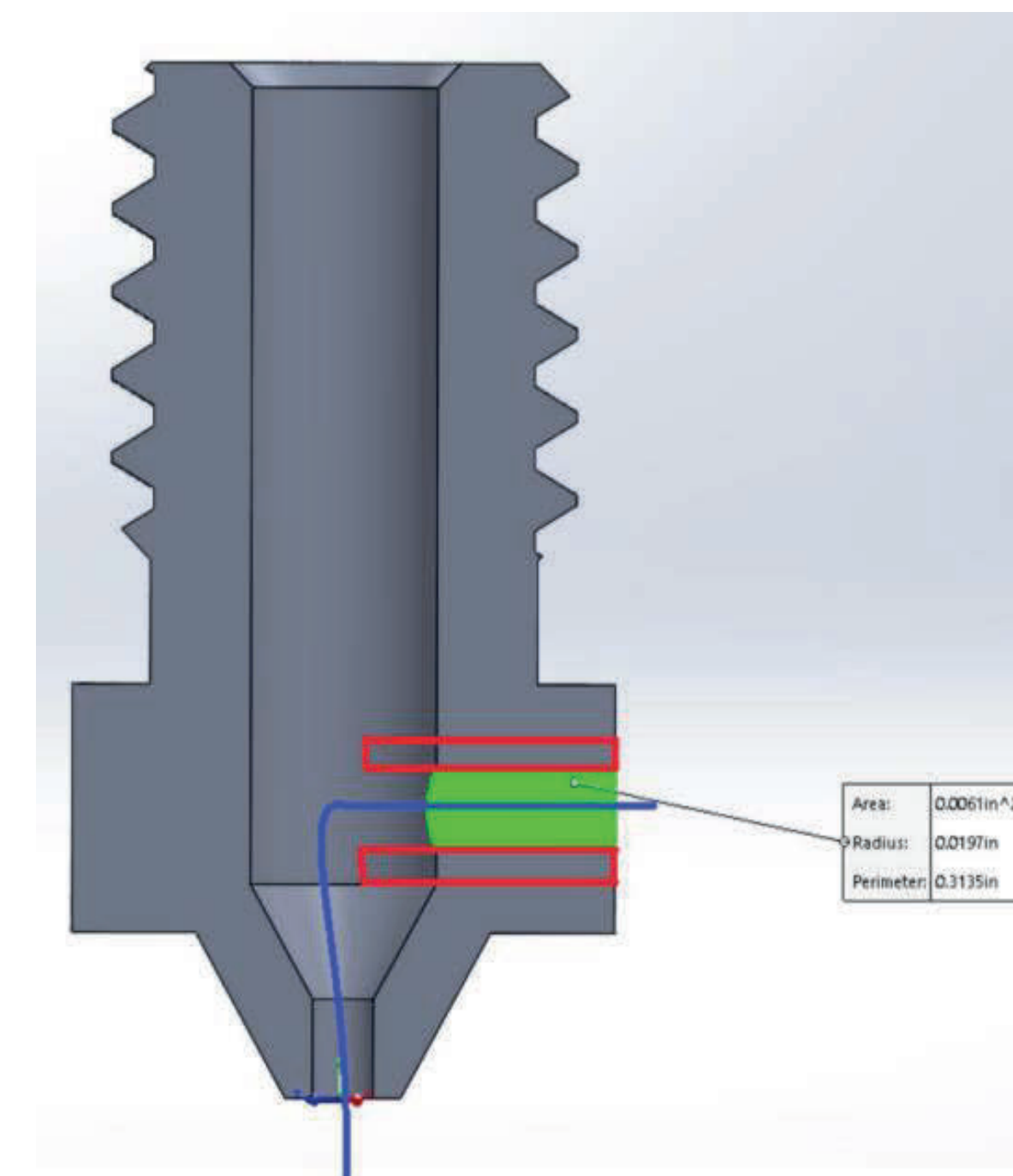


Fig.3: Interior of Nozzle with fiber feeding process



Fig.4: Machined Nozzle

Future Work

Improving quality of printing and more control of the printing parameters

References

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