

Research theme 3D Printing
Research title Developing a process for continuous fibres in Fused Deposition Modelling
Researcher Thomas de Bruijn
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Company University of Twente
Supervisor Tom Vaneker

Background

Over the past decades, 3D printing has become increasingly popular for the production of prototypes, small-volume production series and geometrically complex parts. A main advantage of this process is the automated transition from CAD to product. However polymers, the most used material for production of parts, lack the mechanical performance to be used for structurally demanding applications. Composite materials, traditionally used for strong, light and stiff products, can among others be processed by tape placement. This manufacturing method is gaining more popularity within the composite world and has striking similarities with Fused Deposition Modelling (FDM), one of the most used 3D printing technologies.

Assignment

The goal of this study is to combine these two manufacturing processes by implementing the use of continuous fibres into FDM. The process to be developed will bring the advantages of composites and FDM together, featuring highly automated production of complex shapes with a high specific stiffness and since no mould is needed, at low costs.

Results

A new process has been designed by combining the most important aspects of FDM and tape placement (Figure 1). Validation of the stiffness and bonding is performed by investigating the results of a three point bending test. Compared to a non-reinforced ABS sample, printed by conventional FDM, versions of continuous fibres show a nine times higher flexural modulus (Figure 2). The stiffness of reinforced printed samples is 70% of ones produced in controlled conditions, using a press. These results, combined with a microscopic study, indicate a successful bonding is accomplished. This study shows the implementation of continuous fibres in FDM, resulting in a higher stiffness and thereby a first step is taken into enabling a new area of applications.

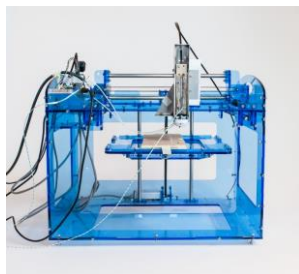


Figure 1 - The prototype system

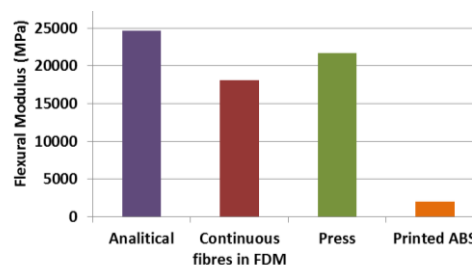


Figure 2 - Results

Personal experience

Working on a master subject by combining two interesting processes, one that is currently generating huge attention in popular media, making technology more popular and the other, pushing the boundaries of lightweight constructions was a nice experience.