



Boris Gallarotti

Student	Boris Gallarotti
Examiner	Prof. Dr. Agathe Koller-Hodac
Subject Area	Automation & Robotik
Project Partner	ETH Zürich - Digital Fabrication , Zürich, ZH

# Automated concrete fiber reinforcement

## A feasibility study

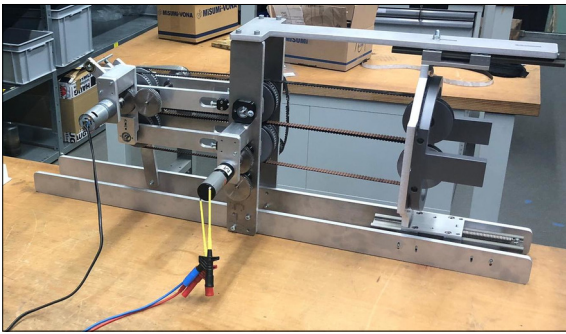


Figure 1: Functional Model  
Own presentment

**Initial Situation:** Recent research (Concrete Structures and Bridge Design, DBT) has shown that placing reinforcement like steel wire or steel fibers between the layers of 3D printed concrete gives better structural performance and ductility to the 3D printed parts.

However, most of the needed fiber types are only available as bundles, glued together with water-soluble glue. To be able to use these bundled fibers, they first need to be put into water to dissolve the glue. Then they need to be dried before they can be used.

The procedure itself of placing the fiber-reinforcement is done by hand in an elaborate way and thus not very efficient.

**Objective:** To improve the process of separating the fibers from the bundles and then placing them between the concrete layers, a feasibility study for automation needs to be carried out, so that little human interaction is needed and the efficiency is substantially increased.

The task can be divided into two subtasks:

1. Investigate and conceptualize an automatable and scalable method to separate the fibers from each other so they can be used for reinforcement.
2. Investigate and conceptualize an automatable and scalable method to transport the fibers at a controllable rate

**Result:** A functional model has been developed and assembled to test three functionalities for a possible solution:

1. The transportation of fiber bundles in between two conveyor belts.
2. The transfer of the fiber bundles over a pulley from one conveyor belt section to the next while the conveyor belt sections are rotated around a torsional axis (Figure 3) and a revolute axis (Figure 2).
3. The separation of fibers from the fiber bundles by having one conveyor belt section run at a faster rate and picking off fibers from the fiber bundle that is fed by the slower running conveyor belt section.

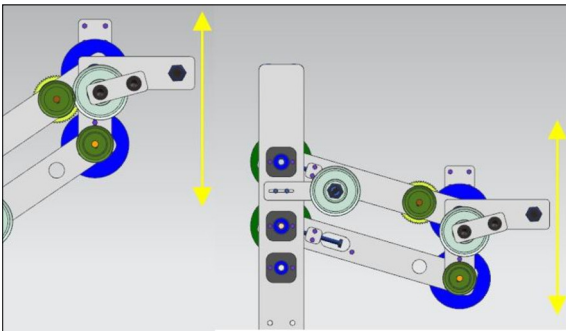


Figure 2: First conveyor belt section - upwards & downwards motion (conveyor belts not displayed)  
Own presentment

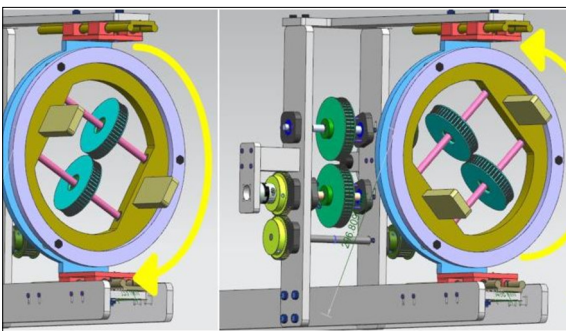


Figure 3: Second conveyor belt section - torsional motion (conveyor belts not displayed)  
Own presentment