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Project title:	Oszilla - Selective introduction of oscillation in yarn systems to prevent filament breakage
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Mission Statement

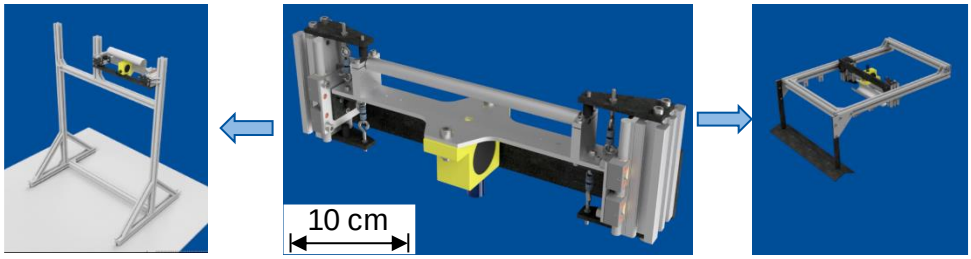
When processing brittle fibre materials such as glass and carbon, the damage to the filaments caused by friction leads to serious process problems and reduced product quality. Fiber damage leads to reduced mechanical properties of the fabric and thus directly to up to 10% reduced strength of the resulting fibre reinforced plastic. However, measures currently in use to reduce filament damage, such as varying the size of the fibre surface, modifying the guiding elements and adjusting the yarn flow, are not sufficient to enable SMEs to start processing brittle yarns.

The aim of this research project is to develop a modular device that will make the yarn system vibrate before it enters the shedding system. The additional device is intended to reduce filament damage by 10 - 20 % compared to the initial process.

Approach:

In the AiF project Oszilla the influence of vibration excitation of technical yarns on the friction behaviour and filament damage was investigated. The focus was on carbon fibers, whereby glass, ceramic and aramid fibers were also examined.

The weaving process was examined in tribological detail and the ceramic eyelet in the front reed was identified as the yarn contact with the highest damage influence on the carbon fibre. A vibration module was then developed to reduce filament damage. During the development of the vibration module, various oscillators, frequencies and other parameters were tested and their influence on filament damage and friction reduction was investigated on a tribological test bench. The module was then validated in laboratory and field weaving trials.



Frame for ribbon loom | vibration module | Frame for wide loom

Results:

Within the scope of the project, for the first time an attempt was made to introduce oscillations into a warp yarn set in the weaving process and to use these oscillations to reduce filament damage in the weaving process. On a laboratory scale, this principle could be proven with the help of the tests carried out. On the other hand, the effect could not be verified when applied to industrial conditions. However, it was proven that vibration excitation can significantly reduce friction on thread guiding elements. In addition, a method was developed with which the main frequency of a vibration can be determined via a simple acceleration sensor. The project results thus make an important, scientific contribution to process understanding when weaving reinforcing fibers.

The field tests carried out in this project with industrial partners show first steps in the attempt to transfer the effect of vibration excitation for filament damage reduction from laboratory scale to industrial suitability. Here, however, the hoped-for results could not be fully achieved. Instead of using an additional thread guide plate to introduce vibrations, as was implemented in the project, a machine-specific solution over existing thread guide elements is favoured for future projects.

With the help of the knowledge gained, however, the effect of friction reduction through vibration excitation can be verified and implemented in other textile processes. Currently, an oscillation module for vibration excitation of the warp threads in the warp knitting process is being implemented in order to counter streakiness in the fabric appearance.

Acknowledgement

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