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Mein Zeichen: VR
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Title: Development of a system for the optical measurement of the braiding angle close to the braiding point for the purpose of controlling an over-braiding processes

(German: Entwicklung eines Systems zur flechtpunktnahen optischen Messung des Flechtwinkels zwecks Regelung von Umflechtprozessen – BraidControl)

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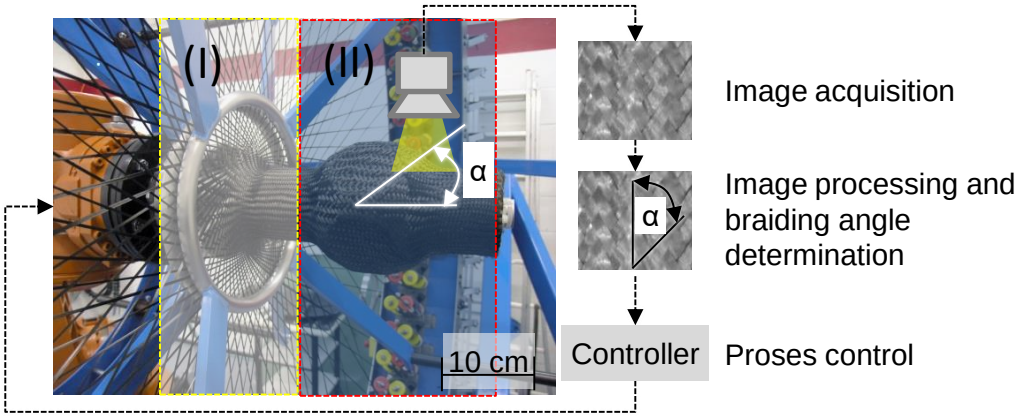
Over-braiding is a braiding process in which a preform made of reinforcement fibers for a fiber composite plastic (FRP) is produced in one process step. In this process, a near-net-shape mandrel (e.g. made of foam) is braided several times with fibers (e.g. made of carbon). This manufacturing process is used in various areas such as medical technology, aerospace, sports and leisure (< 50,000 pcs./year) as well as the automotive industry (> 50,000 pcs./year). Depending on the area of application, the product has to meet different requirements in terms of load carrying capacity and energy absorption. These properties depend highly on the fiber orientation of the preform. The fiber orientation, called the braiding angle in braiding processes, is formed during the braiding process at the braiding point. The braiding angle is still manually adjusted by the haul-off speed of the braiding machine. With the manual setting, long setting times and high deviations from the target value occur.



(I): Braiding area : α is being formed – reaction still possible
(II): Finished preform: α is formed – reaction not possible

Figure 1: Measurement of the braiding angle behind the braiding point as already implemented in research (II)

In principle, these disadvantages can be countered by controlling the haul-off speed as a function of the observed braiding angle. But reliable control is made more difficult by long delay times. Especially for components with small tolerances and components with variable cross-sections, short delay times are essential for reliable control. For example, the system developed at ITA, which in addition to quality control in principle also allows control of the haul-off speed, measures the braiding angle only about 10-15 cm behind the braiding ring (Figure 1).

The aim of the research project is to develop an innovative system, which, in addition to continuous quality control, permits reliable control and thus fast adjustment of the industrial braiding process regarding the braiding angle. The approach to be investigated is based on the acquisition of the braiding point by means of a multi-camera system (Figure 2). The braiding angle is then determined at the braiding point.

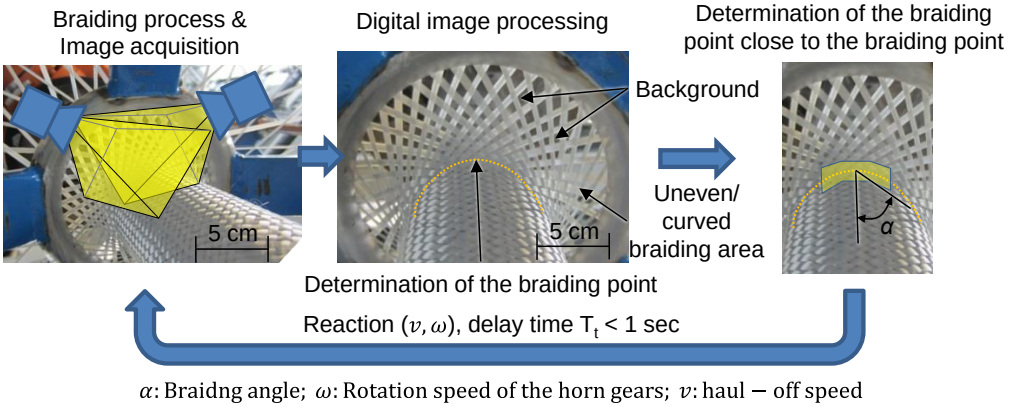


Figure 2: Minimisation of delay time T_t by determining the braiding angle near the braiding point

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