

Project title: Robot-assisted Composite Production
(RaCPro)

Partner: Institut für Unternehmenskybernetik e.V. (IFU)
Information Management in Mechanical Engineer-
ing (WZL-MQ/IMA)

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Univ.-Prof.
Prof. h.c. (Moscow State Univ.)
Dr.-Ing. Dipl.-Wirt. Ing.
Thomas Gries
Director

Santino Wist
Research Assistant

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Mission Statement

Worldwide, 40% of composite parts are currently manufactured manually. Small and medium-sized enterprises (SMEs) in particular benefit from the high proportion of manual work, as this allows them to operate highly flexibly and achieve a high component variance with small quantities. In doing so, they rely on the great expertise and experience of their workers.

However, due to weak recruitment of staff, there is a growing shortage of skilled workers in the industry. For this reason, composite producing SMEs have to rely on lateral entrants from various professions: from blacksmiths and furniture designers to machining mechanics and carpenters. What these lateral entrants have in common is that they have no experience or expertise in working with textile materials. In particular, the forming (draping) of the limp, sometimes sticky textile layers is time-consuming and error-prone. A sensitive understanding of the material is required to ensure that the fibers are not displaced and that wrinkles or other types of defects are avoided.

As a result, depending on the required component complexity and quality, new employees require 12 to 24 months of thorough training, which is necessary against the background of high penalties and reject rates as a result of component defects. In this context, a lack of and overworked skilled workers creates a gap in the production capacities of SMEs, so that orders cannot be accepted and potential profits are not realized.

Therefore, the goal of the research project is to increase production capacities for SMEs by 30%. The approach to achieve this goal is the development of a robot-assisted drawing workstation for the production of high-quality FRP components with different complexities (see figure 1).

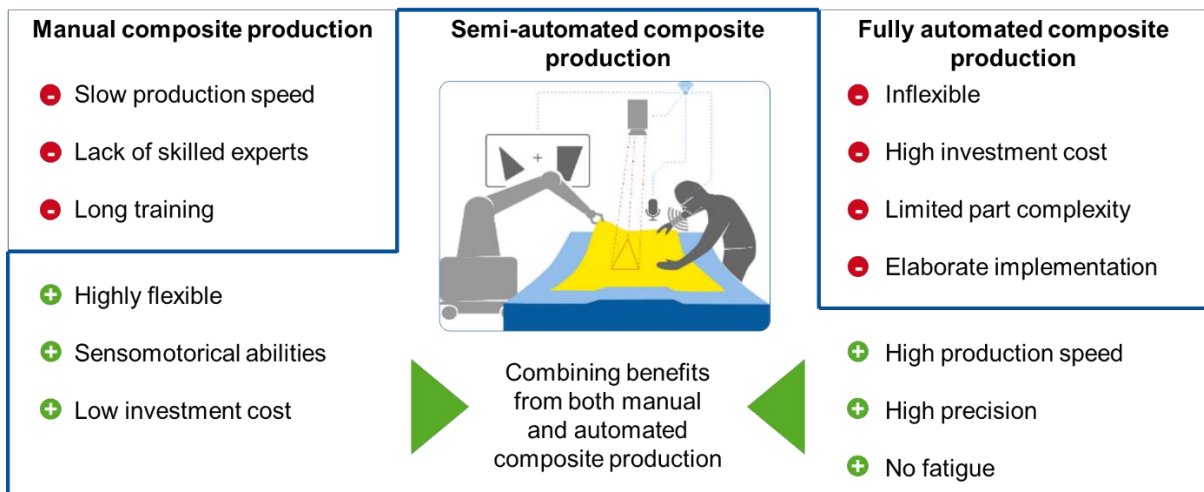


Figure 1: Project goal and benefits

Approach

For the implementation of HRC, low-cost collaborative robots (so-called cobots) are used, which are equipped with numerous sensors and thus enable a cooperation between humans and robots - without the safety limitations required for conventional industrial robots, such as fences or light barriers.

The focus of the research project is on teaching a cobot that imitates the movements of trained skilled workers during draping using imitation learning. Initially, components with simple geometries will be examined. In a further step, the component complexity is to be increased. In this way, it can be investigated up to which component complexity cobots can be used for draping and at which component complexity skilled workers achieve better qualities. The result of the project is therefore not only the development of a draping tool for cobots but also the creation of a decision-making basis for the effective division of tasks between humans and robots.

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Contact

Hannah Dammers, M.Sc.

hannah.dammers@ita.rwth-aachen.de