

## **Collaborative robotics for draping**

**The 4-year EU project DrapeBot brings together human workers with robots to jointly perform draping of fiber-reinforced parts.**

STEYR. The Austrian research institute PROFACTOR leads a consortium of 9 partners in the EU-funded project DrapeBot. The goal is to realize human-robot collaboration for complex draping processes. This is needed to build up fiber-reinforced products layer by layer. Multiple industries nowadays rely on this type of process: aerospace, automotive, ship-building, wind-energy, and others.

### **Challenges in robotic handling of textiles**

Robots are nowadays commonly used in many industries. Over the last few decades they have been very successful in performing pre-defined repetitive tasks. Many scenarios involve rigid parts with fixed shape. These lend themselves very well to handling by a robot. In contrast to this, flexible and deformable materials pose multiple challenges for industrial robots. "Managing textiles is an easy everyday-task for us humans, but it is incredibly difficult for a robot", says Sebastian Zambal, project manager at PROFACTOR. The EU project DrapeBot pushes the frontiers for the use of robots in draping of textiles made of carbon or glass fibers. Fiber-reinforced materials enable efficient light-weight construction of many products. While completely automatic draping by a robot is still out of reach, collaboration with a human has the potential to boost efficiency. The idea is to let the robot do those parts of the work that is suited for it and have the human worker doing the rest.

### **Sensors for human-robot collaboration**

An important aspect of DrapeBot is the development and use of advanced sensor systems. These enable the robot to perceive its working environment and the human colleague. It requires the development of advanced algorithms for processing and fusing of sensor data. On the one hand, sensors are developed that assess more technical data such as boundaries of fabrics and orientations of fibers. On the other hand, sensors need to acquire data that contains information about the behavior and actions of the human worker. It is a special challenge for the robotic system to correctly observe human actions and correctly interpret what the human's intentions are. Instead of running a fixed program, the robot needs to constantly react and adapt its behaviour.

### **Trust in the robot as a colleague**

An interesting research question of the DrapeBot project relates to how much the human worker trusts in the robot. This trust is as important for a successful collaboration as it is among humans. For optimal collaboration, it is necessary that the human does not over-estimate the robot's capabilities or "over-trusts" the robot. At the same time, the human should not mistrust the robot. Both extremes lead to inefficiency in collaboration. DrapeBot aims at measuring trust to assess weaknesses and strengths of the collaborative robotic system.

## Consortium

The consortium of DrapeBot is as diverse as the projects' goals. PROFACTOR is coordinating the project and contributes with optical sensor systems. University of Padova, IT+Robotics, and CNR are working on sensors, robotic path planning and motion execution. Abele contributes with know-how in gripper design. DLR, BaltiCo, and Dallara provide use-cases from aerospace, ship-building, and automotive industries. Aalborg University deals with questions related to trust estimation. The project's website is accessible under <https://www.drapebot.eu>. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006732. This project is financed by research subsidies granted by the government of Upper Austria.



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