SENSOR AND ACTUATOR INTEGRATION IN LIGHTWEIGHT SPORTS EQUIPMENT

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Lightweight applications made of fiber-reinforced plastics have been used for many years in top-class sport. With an innovative roller ski – developed in the joint project "SmartFrame +" funded by the Federal Ministry of Education and Research – different target groups are to be addressed. On the one hand, users are addressed who are looking for fun and physical exercise. On the other hand, there are winter sports enthusiasts who want to improve their skiing skills during the summer break. Especially in this case, there is the challenge to achieve a congruence in motion compared to the classic winter ski and thus to train the motor skills and muscle groups targeted.

Conventional roller skis are usually made from a simple straight aluminum profile – but the skiing experience is almost completely lost due to the stiffness. Furthermore, the freedom of design is highly limited. In the research project, computer-aided simulations were used to calculate a load-compatible structure made of glass and carbon fiber rovings and other semi-finished fiber products. This hybrid structure allows the absorption of all forces and reduces the mass significantly, but at the same time it also enables a resilience effect of the whole structure. This property is also supported by the use of the economical "radius pultrusion" process for the production of a curved basic body profile. Here, dry semi-finished fiber products passed through an impregnation line with resin then moved into a heated die and cured to the finished profile completely within seconds.

Due to the curved design, the roller ski achieves increased ground clearance, giving the user a much more realistic ski feeling. The innovative point of the roller ski is a piezo sensor, which can be integrated directly during the production process. The process allows to feed a carrier tape with applied sensors to the running process and thereby to integrate them safely into the profile. To analyze the training, the data of the sensor can be read out and evaluated wirelessly by app. The user receives a feedback about his training and can adjust it accordingly. Also complete training profiles can be created, recorded and analyzed subsequently.