

Preface

The market's increasing demands on lightweight construction for a reduction of fuel consumption in transportation systems as well as reduced material resources is becoming of increasing importance. This aspect is even more underlined by the current discussion of reducing the green house gas emissions caused by production processes. In this context, considerate use of energy intensive materials such as aluminum plays a major role.

The Transregional Collaborative Research Center / TR10 "Integration of forming, cutting, and joining for the flexible production of lightweight space frame structures", set up by the German Research Foundation (DFG) at the Universities of Dortmund, Karlsruhe, and Munich, specially aims at research on small batch production systems for lightweight space frame structures. This research team focuses on the ambitious aim of creating a scientific basis for the development of innovative manufacturing processes and design methods for a flexible, integrated process chains. This chain should comprise production techniques like

- three-dimensional rounding during extrusion,
- extrusion of continuously reinforced profiles,
- cutting on the fly,
- five-axis machining,
- hybrid laser welding and friction stir welding, and
- joining by electromagnetic high speed forming or high pressure tube forming.

This work is accomplished in a coupled simulative and experimental way so that there is a complete virtual process chain parallel to the real one comprising the extrusion process, handling robots, and cutting and joining machines. Following the first funding period 2003-2006, the current funding period lasting until 2010, has already increased by 4 more projects covering the additional joining technique friction stir welding, an enhanced process chain simulation, numerical analysis of composite profiles, and the transfer from basic composite extrusion technology to the production of aircraft stringer profiles in industrial surroundings.

This content of technology development, simulation of production processes, and integrated consideration will be found in the organization of the following peer reviewed articles. It outlines certain aspects of theoretical and experimental projects while setting up the process chain.

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Klaus Weinert
Marco Schikorra