

PRESS RELEASE

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Towards a digitally supported production environment

- BMBF-funded project DIREKT started in 2020
- Research on adaptive tooling and sensor integration in a flexible draping process for fiber reinforced composites
- Collaboration with Swinburne University of Technology further expanded

The ARENA2036 focus project DIREKT (Digital reconfigurable manufacturing of fibre composite components in a resilient production environment) has successfully been running since the beginning of 2020 as part of the Germany's Federal Ministry of Education and Research (BMBF) funding scheme "Internationalisation of leading-edge clusters, forward-looking projects and comparable networks" (InterSpiN).

DIREKT aims to develop a reconfigurable, self-monitoring and sensor-supported production environment for components made of high-performance fibre composites. The basis is formed by low-consumption lay-up processes for carbon fibre-based semi-finished products as well as shape-adaptive tools, which make the time-consuming and cost-intensive production of component-specific moulding tools unnecessary. For continuous monitoring of the process, various sensors are integrated into the production environment at the Institute of Aircraft Design (IFB) in Stuttgart, Germany. This ensures an early intervention possibility, which is supported by instant data analysis in close proximity to production (edge computing).

The combination of digital production technology, shape-adaptive and automated manufacturing processes is expected to deliver a substantial reduction in product costs for small and medium volumes. As a result, customer-specific component geometries and the lightweight construction material like carbon fiber reinforced plastic (CFRP) can be realised in a wide range of applications.

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The initial project phase has been successfully completed despite the applicable COVID-19 restrictions and the project partners are now intensifying their work in the individual areas. In order to enable resilient production, the pilot-production environment set up in DIREKT will be digitised and linked to the virtual environment via the sensor technology it contains by the InterSpiN partner project I4Produktion (Implementation of a cognitive digital twin on the way to resilient production). This partner project is another ARENA2036 focus project, which started in October 2020 and deals with the real-time monitoring of production performance in order to be able to react robustly to disturbances in quality and always work in an optimal range. Therefore, digital twins of the production areas of DIREKT and GIL-project (Global Innovation Linkage) of Swinburne University of Technology in Melbourne, Australia will be established.

In addition to the cooperation of the two projects, which are funded by the BMBF each with two million euros over three years, there is an additional focus within the scope of InterSpiN on the scientific exchange with the GIL project and the Australian partners. This project has a total budget of 3.6 million Australian dollars at its disposal to address the topic of automated industrial 4.0 manufacturing of high volume of fibre composite components. As part of the project, the new I4.0 Testlab will be established by the end of the year in collaboration with CSIRO (Australia's National Science Agency, Commonwealth Scientific and Industrial Research Organisation) – a facility for innovative research in the field of composite additive manufacturing. Next to the mutual exchange of information and results of the projects, the existing international cooperation will be further intensified by the joint supervision of five PhD students within the GIL-project by Professor Fox (Swinburne University of Technology) and Prof. Dr.-Ing. Middendorf (IFB, University of Stuttgart). "In addition to communication, the joint use of existing equipment is also of outstanding importance for successful cooperation", says IFB Director Peter Middendorf: "Therefore, it goes without saying that the PhD students of the GIL-project can also make use of the capabilities at the IFB".

Besides the IFB, the Stuttgart Media University (HdM), Balluff GmbH and CIKONI GmbH, a specialist for innovative fibre composite solutions, are directly involved in the project. CIKONI's form adaptive DYNAPIXEL technology is utilized and further improved for customer-specific and one-off production of composite parts. The research group IAD (Innovative Applications of Printing Technology) at HdM deals with screen printing technology, which is used for the cost-effective and reproducible manufacturing of high elongation strain sensors in DIREKT. The associated frontend electronics, data transfer and analysis of the complete process related sensor technology is enabled by Balluff GmbH, a

leading sensor and automation specialist. “We will use IO-Link as an industrial communications networking standard (IEC 61131-9) for connecting digital sensors and actuators to an industrial fieldbus or Ethernet“, explains Albert Dorneich, Project Manager at Balluff.

The international cooperation and information exchange of these projects was successfully established by using the online meeting tools that are now commonplace. A personal visit of representatives of the GIL-project in Europe had to be cancelled. Instead, a live-online meeting of all project partners of the three cooperation projects was organised, which was followed by over 60 participants from three time zones. The increasing, bilateral communication will continue to take place mainly virtually, although the personal contact "will hopefully be established in the near future, because the planned, mutual visits of the facilities in Australia as well as in Europe can further strengthen the growing basis of our cooperation", says Michael Liebl, PhD student and DIREKT project manager at IFB.



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ARENA2036 stands for „Active Research Environment for the Next generation of Automobiles“ and is the innovation platform for mobility and production of the future. The research campus is part of the funding initiative „Research Campus – Public-Private Partnership for Innovations“ in Germany. ARENA2036 is supported by the Federal Ministry of Education and Research (BMBF) and is run as a registered association with members from science and industry. Currently, ARENA2036 is in the second funding phase and has over 45 partners. The innovation platform based in Stuttgart, stands for cooperation under one roof between science and industry. ARENA2036 wants to make its contribution to the active shaping of work, mobility and production of the future in the context of digitalization. The partners are active in various disciplines – from the automotive industry, aerospace technology, textile and materials research to industrial science.