Solutions for special challenges in production

Within the framework of research and development projects, the Fraunhofer Institute for Large Structures in Production Engineering IGP realizes concepts for product and process innovations together with cooperation partners from industry. The research focus is on future-oriented industries such as shipbuilding and steel construction, energy and environmental technology, rail and commercial vehicle construction, and mechanical and plant engineering.

The scientists specialize above all in finding resource-saving alternatives that reduce the burden on the environment and workers. The aim of the research is to develop holistic solutions that enable more cost-effective and high-quality manufacturing.
Tasks from the production and manufacturing of large structures form the research focus of Fraunhofer IGP. In addition to the actual production and manufacture of the end products, their maintenance is also a focus of the research work.

- Forming technology joining and shaping
- Mechanical joining technology
- Thermal joining technology
- Adhesive bonding technology
- Fiber composite technology
- Coating, weathering and corrosion protection
- Factory and work organization
- Production planning and control
- Automation technology
- Measurement of large structures

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Production technologies of the future

Solutions for the maritime industry

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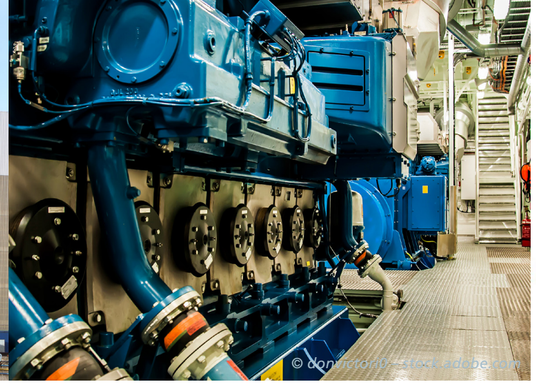

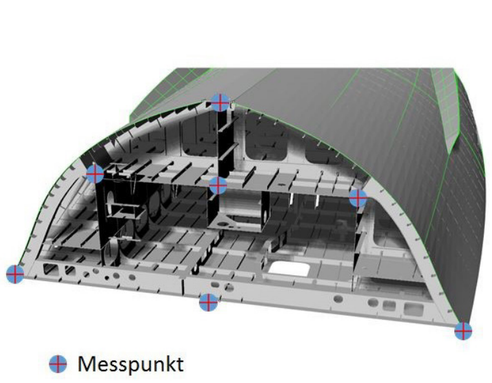

Goodbye measuring tape – mobile projection systems for shipbuilding production

Positioning and marking work in shipbuilding is time-consuming, highly manual and error-prone. Commercial projection systems are primarily fixed statically above production lines to project repetitive production steps. The researchers at Fraunhofer IGP are currently working on the development of a mobile laser projector. For this purpose, a mobile projection system is to be expanded into a multi-sensor system by means of additional sensors.

Automation of the work steps in the advanced manufacturing process is not readily possible. By using a mobile projection system, workers are provided with an aid that accelerates and subjectivizes manual positioning and marking work. The information flow between the executing and planning persons is improved thanks to a digital data flow.

- Improved quality and efficiency of manual stakeouts
- Faster, more precise results even for complex surveys
- Digital data flow between actors

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Sound sensor system „hears“ engine damage

Large units such as ship engines sometimes have a long service life. In this respect, sensors or other monitoring units for maintenance are only available in newer makes. Maintenance work, the detection of damage and the general assurance of the functionality of the aggregates therefore often depend on the experience of individual workers. Failures cause major financial losses.

In the AKKUT research project, Fraunhofer researchers:in are developing sound sensors for retrofitting these engines and intelligent evaluation mechanisms. The real-time analysis of the sound sensor data allows statements to be made about the system behavior of the ship's engines. Due to the limited data available and the lack of model behavior of old engines, the data is first evaluated via a human-technology interface. In this way, the system learns how the large unit sounds in the „standard case“ and when it „hears“ a deviation. The result is data-driven machine monitoring.

- Retrofitting von Großaggregaten mittels Schallsensoren
- Mensch-Maschinen-Schnittstelle zur Bewertung der Daten
- Supervised Learnings trotz defizitärer Datenausgangslage

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Digitalized quality assurance in shipbuilding

Due to the increasing competitive pressure of shipyards, the demand for productivity, speed and economic efficiency is rising in shipbuilding. The demand for digitization of processes is high. The research project DiGoCheck aims to break new ground in geometric quality assurance in the manufacturing and inspection process of large volume structures in shipbuilding. Based on new and effective measurement methods using 3D laser scanning, the analysis of existing tolerances and the visualization of manufacturing deviations using AR, the project reshapes conventional assembly processes into a closed digital process chain. As a result, consistent feedback of findings and the reduction of rework, not only planning benefits but also major economic advantages.

- Online process control with the aid of laser scanners
- Increase in productivity and economic efficiency
- Revision of the process chain to a digital process
- Valid, reliable quality specifications for volume structures
- Feedback of results to planning and
- production level with the aid of AR applications

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Bonding in shipbuilding and maritime production

Adhesive bonding technology offers great advantages as a joining method in shipbuilding and maritime production. Due to a lack of knowledge about the aging behavior of the joints, its use is only possible with enormous effort and is thus strongly inhibited. In the „Adhesive layer aging“ project, researchers at Fraunhofer IGP are investigating the parameters relevant to the aging of adhesive joints. Accelerated laboratory aging procedures are used to test the durability of bonded joints under maritime operating conditions. The findings and aging procedures obtained enable small and medium-sized companies in particular to use adhesive bonds simply and safely in maritime production.

- accelerated laboratory aging procedures
- reliable design and use of adhesive bonding solutions in shipbuilding production, equipment and repairs

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Aluminum – Non-contact Temperature Monitoring

Welding aluminum sometimes results in large amounts of welding-induced distortion of the assemblies. Straightening processes such as flame straightening are used to subsequently compensate for the distortion. For steel structures, annealing colors are used as a reference to estimate the temperatures required to achieve the desired straightening effect.

For aluminum, annealing colors do not form in the relevant temperature range. A non-contact temperature monitoring system is being developed at Fraunhofer IGP. This is to be implemented in conventional straightening systems. As a basic requirement for increasing the reproducibility, reliability and degree of mechanization in the flame straightening of aluminum, the system thus offers the possibility of qualifying the flame straightening process.

- mobile and autonomous device for torch systems
- Information for a correct and quickly executed straightening task
- Qualification of the flame straightening process for aluminum alloys

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