

FRAUNHOFER INSTITUTE FOR NONDESTRUCTIVE TESTING IZFP

PRESS RELEASE

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Researchers want to make the inspection of threaded connections safer by using standardized ultrasound methods

Safety-critical threaded connections in the energy generation sector, e.g., for wind turbines, on drilling platforms, or in industrial plants pose the highest requirements for reliable and precise status monitoring. Scientists from the Fraunhofer IZFP and the Institut für Werkstoffkunde (IfW) are currently developing a standardized, cross-industry method whose use is expected to significantly improve the inspection of screws installed in the field.

Wind farms or drilling platforms at sea are exposed to extreme environmental conditions from storms, waves, the salty atmosphere and saltwater. As a consequence, threaded connections may loosen over time, or even break. This does not only affect heavy components such as rotor blades, but also more lightweight structures, e.g. ladders used regularly by maintenance personnel. Damaged screws can mean acute danger to life. To this very day, there is no standardized, universally applicable, nondestructive method that allows inspecting screws installed in the field for their operational reliability.



A test engineer is inspecting safety-critical threaded connections on a drilling platform. Scientists are to make threaded connections installed in the field safer by means of a standardized method.

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For safety reasons, so far, screws have either been replaced early, or re-tightened. In addition, the maintenance or replacement of screws in the maritime environment is associated with high expenditures of money and time. Expensive special vessels with the appropriate maintenance personnel must be deployed for several days. And if work below the water's surface is necessary, each dive also represents a risk for the industrial divers.

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Inspecting universally without time-consuming calibration and reference measurement

In the context of a project financed by the German Federal Ministry for Economic Affairs and Energy (BMWi), engineers and scientists from the Fraunhofer IZFP in Saarbrücken and the IfW in Darmstadt are developing a robust and versatile ultrasound method that can be used to inspect the preload force of screws installed, without requiring prior calibration. The correct preload force holds parts and components fastened with threaded connections together and is thus of essential significance in safety-critical areas. The presented method can be used to test said preload force directly and without knowing the original status of the threaded connection. "Based on the speed of two types of ultrasound waves, we plan to determine the exact tension status of the screw using an adapted method. The slower the two types of ultrasound waves move through the screws, the higher the preload force, i.e., changes in preload force can still be measured even years after the screw was installed," explained Michael Becker, project lead engineer at the Fraunhofer IZFP. After its successful development and testing, the ultrasound method is to be standardized and qualified for universal application. This, in combination with systems developed by the Fraunhofer IZFP earlier for ultrasound-based preload-force detection for industrial use, would allow seamless monitoring of the entire lifecycle of threaded connections.

Making research results usable for the economy

In this research project, in addition to the Fraunhofer IZFP (project lead) and the IfW, several smaller and medium-size enterprises (SME) that have great economic interest in standardized, cross-industry development of methods are also collaborating. In particular SME from the process technology, monitoring

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and maintenance, test equipment manufacturing, and screw design sectors will profit from this innovation.

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Project summary

- ☞ Research entities collaborating:
Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren IZFP,
Saarbrücken (project lead)
Institut für Werkstoffkunde (IfW) at the TU Darmstadt
- ☞ Project start: March 2018
- ☞ Term: 2.5 years
- ☞ Total financing: approx. 500,000 euros
- ☞ AiF Research project / Funding agency: BMWi
Under the umbrella of the AiF-Forschungsvereinigungen, new technologies are prepared in order to maintain and strengthen the competitiveness of SMEs.
- ☞ [IGF-Project: 19671](#)