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Technische Universität München

News Release

Munich, October 25, 2010

Enhancing wind power generation by monitoring stresses on blades

Young scientists win support for renewable energy startup

Four young researchers from the Technische Universitaet Muenchen (TUM) have won support to commercialize their approach to monitoring stresses on wind turbine rotor blades. When turbine operators expect high winds, which have the potential to break rotor blades and cause other kinds of damage to the system, they swivel the blades to face the wind edge-on. This reduces stress, but it also means down-time for power generation. Precise, real-time measurement of mechanical loads on rotor blades -- using a fiber-optic sensor system invented by the Munich scientists -- could help both to protect turbine components and to optimize energy generation. An EXIST research transfer grant awarded by the German federal government will help the team start their own business.

There are more than 21,000 wind power stations in Germany, and the trend is toward continuing expansion of renewable energy facilities. Four young researchers here at TUM see an opportunity to improve the generating capacity of all such power stations: Glass fiber sensors could measure the mechanical loads on and in the rotor blades; the precise and continuous measurements could be used to optimize each wind turbine's performance. The fibers, hardly thicker than a human hair, can determine how and where the material of the rotor blades vibrates, stretches or incurs slight damage.

For this purpose the scientists use optical fibers as they are also used in telecommunications – with one difference: The glass fibers are processed with lasers to create wavelength-selective reflectors called Bragg gratings. Infrared light sent through the fiber will be reflected by the grating. When the fiber is stretched or compressed, the wavelength of the reflected light changes. Since each grating only reflects a certain wavelength and lets the other wavelengths pass through without obstruction, the scientists are able to measure elongation and compression in many parts of the fiber simultaneously. Such sensors could potentially be attached to the surface of existing wind turbine rotors or built into the skin of new ones.

The greatest challenge was to be able to measure higher-frequency vibrations precisely, explains Dr. Mathias Mueller, one of the four future founders of the company. "We have been advancing the development of this sensor technology through various projects. But when we had optimized our technique to the point where we could measure the kinds of vibrations produced by an Ariane rocket during take-off, that was the breakthrough."

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Together with physicist Thorbjoern Buck, Mueller worked a total of two and a half years on the technology; software engineer Rolf Wojtech and industrial engineer Dr. Lars Hoffmann joined them to found the company. The federal EXIST grant will provide support during the first critical year and a half of the startup's development.

In addition to wind turbines, Hoffmann sees even more areas of application for the new sensor. For example, airplane and car parts, like wind turbine rotors, are manufactured from fiber-reinforced plastics. The industrial engineer explained: "Modern metal processing is able to look back on 200 years of experience. Fiber-reinforced plastics, in contrast, have only been used to a greater extent for 20 years. Our measurement technique will contribute considerably to extending the application potential of these new materials."

EXIST Transfer of Research (www.exist.de) is a support program awarded by the German Federal Ministry of Economics and Technology. EXIST supports excellent research-based plans to set up a business, which are associated with costly and risky development work. In the first funding phase, research results that have the potential of being the basis for founding a new business are developed further, to the extent that the feasibility of the principal technical product ideas is ensured and the business can be founded. In the second funding phase, the focus is on starting up business activities as well as securing external follow-up financing of the company.

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