***Topic 2:* Open to outsiders: translating neighboring industry knowledge and innovations to FOW development.**

Title: Fiber Bragg Grating strain sensors for monitoring both wind turbine blades and offshore platforms.

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Abstract

The use of Fiber Bragg Grating (FBG) sensors is widespread due to its small diameter, light weight, high strength, high sensitivity, being non-electrical and their corrosive resistance. A broadband light is emitted from a source and the FBG reflects one narrow wavelength. Measuring the wavelength shift, it is possible to determine the deformation the fiber has undergone. This system is suitable for long-term monitoring as it does not need any extra maintenance.

For offshore wind turbines, it is important to get knowledge of the strain state of its components: by monitoring wind turbine blades, it is possible to adjust the pitch angle to optimize their performance, minimizing the stress fields at the blades and increasing their life expectancy. By monitoring the offshore platform, it is possible to get knowledge of the stress fields, capturing events of storm, thus improving future designs. These two scenarios require two different approaches described below.

On the one hand, a FBG sensor is being designed to measure strains in wind turbine blades. Therefore, the sensor matrix is made of fiberglass, embedding the FBG between fiberglass fabrics. It also includes a temperature compensation sensor which is encapsulated to isolate it from deformations. This fiberglass sensor is glued to the internal part of the blade.

On the other hand, a metallic strain sensor is designed to measure strain in offshore platforms. A low stiffness steel geometry has been designed to ensure that the strains are transmitted from the structure where it is bonded to the sensor. The optical fiber is guided through the sensor and fixed, ensuring that the FBG is in the central part of the sensor where, due to its geometry, the strains will be concentrated. Also, some work is done in achieving a sensed bolt to measure the preload applied at the joints of the platform.

The fiberglass sensor development is at a more advanced stage. The first prototypes have been manufactured and tested to ensure a linear and proportionate response to different levels of bending deformation. A fiberglass specimen of significantly higher stiffness has also been fabricated to adhere the sensor and simulate the behavior of the sensor-blade system. The first tests of the whole system undergoing deformation and temperature variation show a good linearity and repeatability of the sensor response, validated against strain gauge measurements.

The first prototypes of metallic strain sensor have also been manufactured and tested in laboratory depicting the ability to measure compression strains when a preload is applied to the FBG before bonding. Finally, some bolts of different metrics (M8 and M20) have been fabricated with a FBG embedded in and will be tested in future test campaigns.