Bolting with the Multi Angle Autonomous Bolting Machine – MA-ABM

Publieke samenvatting / Public summary

Aanleiding

Wind turbines are placed on ever higher towers, to catch more wind and thus generate more power. Additionally, blades increase in size and nacelle size has to increase as well. The mentioned components of tower, nacelle and blades are interconnected using bolted connections. Bringing all bolts and nuts to the right tension is of immense importance for the durability of the turbines. Owners, investors and operators or maintenance companies see the importance of bolt failure prevention and want to minimize the chance of occurrence. In addition to bring it to the right tension, accidentally skipping a bolt is also a substantial risk. To solve these problems and to reduce costs of these labour intensive activities, IntoMachines developed in 2021 an Autonomous Bolting Machine – ABM. The ABM-Electric development (project HER+ 01046636) is fully functional in horizontal positions, specifically focused on tower bolts.

Doelstelling

In 2021-2022 IntoMachines developed the ABM-Electric into a working robot, which is successfully tested in a real offshore environment at DWT's operated Wind park Nurthergrunde in the North sea. This project was funded by HER under project number HER+ 01046636, and is finalized in April 2022. In the fore laying project, the project partners IntoMechanics, IntoMachines and Nordex Netherlands want to develop a new robot type which can work at multiple angles. A concept prototype Multi Angle ABM is developed so far and

Projectinformatie / Project information

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HER+22-01-03173097
Subsidiebedrag / Grant amount
€ 288.610,00

Algemene informatie / General information

Penvoerder / Secretariat
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in the new project the partners want to develop this from TRL6 to TRL8 and test the MA-ABM in a relevant environment and demonstrate its operation. Before the MA-ABM can be tested and validated in a relevant environment (in a real wind turbine on- and offshore), a number of components still need to be developed.

Korte omschrijving

The research and development activities in the project are (main points): - In nacelle and blade environment: Detect, identify and bypass obstacles on flange level such as cables, welded brackets, structures on tilted flanges. Software program to control and arrange all stepping motions of the MA-ABM, to step from one bolt to the other. - Software to process and judge incoming sensor information on obstacles and determine required motor/actuator control to overcome / step over / avoid obstacle. - Autonomously control tension tool, store tension tool bolting parameters, and judge if tension cycle was completed correctly. - Be able to steer the MA-ABM along the angular flange shape on multi angle flange surfaces with passive guide system. - Research into the field installation of nacelles and blades, based on current Method Statement Criteria for Nordex wind turbines. Special focus on safety aspects of bolting robot operations in (offshore) turbines got nacelle and blade bolting. - Execute research and testing in Nordex's nacelle factory in Rostock Germany and during Nordex turbine installations and at offshore wind farm to develop and assess the MA-ABM's functions.

Resultaat

The result of the project is a validated, save, robust, low-cost and flexible MA-ABM that can be used in various angles from 0 degrees (horizontal) to flip 180 degrees (up side down) as a 100% error-free automated system on a wide range of offshore (and onshore) wind turbines. After the project, offshore turbine installation costs in the Dutch North Sea are reduced by € 27,009 per turbine, when using an MA-ABM to install the bolted connections. Moreover, the installation time per turbine decreases by 13.75%. This reduces the CO2 emitted by the installation

vessel by a considerable 13.75% per windfarm. The time savings can be used to install 13.75% more wind turbines before 2030, which further reduces CO2 emissions. Overall, if funded, this project will contribute to the Dutch climate goals for 2030 in a considerable way, by saving an estimated € 24.327.030,- on installation and maintenance costs for upcoming Dutch offshore windfarms. Compared to the project costs and requested grant, the MA-ABM project is very cost-effective.

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