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Dynamic testing of high performance concrete for large wind turbine towers

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Recently there has been an increasing interest in concrete towers for wind turbines primarily due to the fact that there is a larger demand for bigger wind turbines and higher towers, resulting in larger base diameters for these towers. Production of such towers in steel is complicated and expensive and so is transportation and erection of the towers on site. Instead smaller segments of Ultra High Performance Fibre Reinforced Concrete (UHPFRC) can be transported to the site by trucks and assembled on site. UHPFRC is characterized by high and compressive strength combined with an extreme high fracture energy makes it possible to make wind turbine towers of heights of over 200 m. The two main concerns are the eigenfrequencies of the tower and the fatigue resistance. This study is on the dynamic behavior of an 31.2 m high experimental UHPFRC post-tensioned wind turbine tower. The dynamic stiffness of the whole system and the soil-foundation-structure interaction is determined using Operational Modal Analysis (OMA). In addition a series of low-cycle fatigue experiments have been performed. Experiments on beams in three point bending have been performed in a newly developed test set-up. Both static and fatigue loading were carried out. Due to the high fatigue resistance of the material, focus has been on low cycle fatigue. In the tests, it is seen that the descending branch of the static experiments can be correlated to the fatigue life, indicating static tests can be used for quality control of the fatigue life.

Biography

Jens Peder Ulfkjær has completed his PhD from Aalborg University, Denmark and Postdoctoral studies at the Joint Research Center in Ispra Italy. He is an associate Professor at Aarhus University and is working with fracture of materials especially ultra high performance concretes. He has published more than 40 papers.

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