Supergen ORE Hub ECR fund blog

Offshore floating foundations using self-sensing carbon fibre textile-reinforced concretes

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Survivability of floating platforms under harsh sea environment, especially for floating offshore wind turbines, remains a key challenge. Fatigue degradation and structural integrity need to be better understood, where cost-effective monitoring techniques are essential for long-term real-time data acquisition which helps to understand structural behaviour in offshore. This project targets the multi-functional carbon-fibre textile reinforced concrete (CTRC) for floating platforms. Taking advantage of the electrical conductivity of the carbon fibre reinforcement, a new self-sensing technique has been tested. Preliminary test data on the off-the-shelf carbon fibre textiles have been collected over the past two years.

Due to the national lockdowns soon after the project started in 2020, the experimental work were significantly impacted. However, it prompted the development of a new testing method that could be carried out at home. A multi-channel electric measurement system has been developed using Arduino Mega 2560 as a microcontroller.

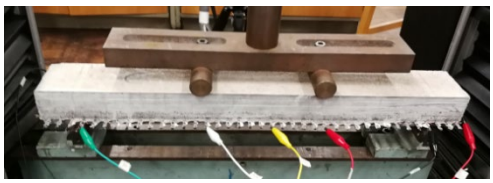

Fig. 1 Four point bending test using Arduino microcontroller

To enable most of the lab work to be carried out in restrained conditions at home, small scale testing method has been developed to obtain statistics of fundamental material properties, including electrical resistance measurements of carbon fibre tows, textile grid contact resistance, and the electrical resistance sensitivity to external loading.

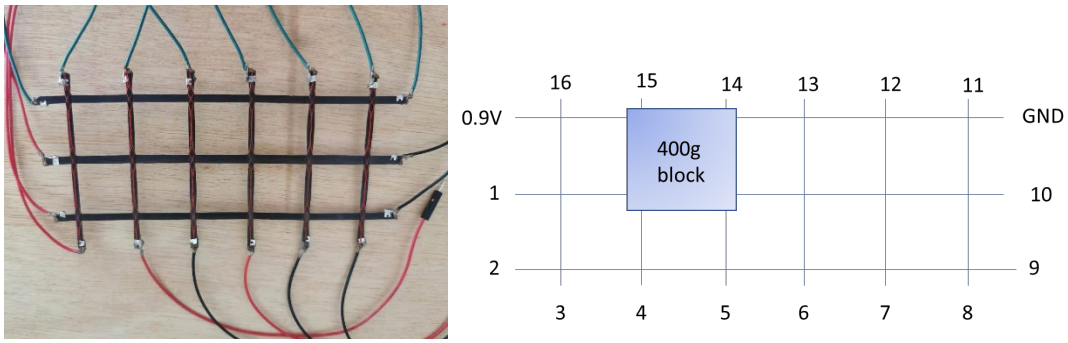

Fig. 2 Electrical resistance sensitivity of the fibre mesh to external loading

The research results have been presented on the 8th PRIMaRE conference held on 29th – 30th June 2021. It has helped to enhance my visibility and research capacity in this field. Two research proposals have been submitted on the ground of this trial study.