

Fiber optic measurement system for detailed experimental analysis of reinforced concrete structures

The main purpose of this project is to purchase and setup a new Fiber Optic Measurement system at the laboratory facilities of SDU Structures.

The research group SDU Structures at the University of Southern Denmark conducts practice-oriented research. Often in cooperation with engineers and architects from the industry. Currently, two COWI Industrial PhD projects on reinforced concrete structures are ongoing in cooperation with SDU Structures. These projects combine experimental research with analytical modelling to develop new models and assessment methods for the load-bearing capacity of new and existing structures.

In SDU Structures' laboratory, a Digital Image Correlation (DIC) system is available. With this system, it is possible to measure strain and displacement on the surface of a structure. This system has been groundbreaking for the research practice on reinforced concrete structures in recent years. DIC allows for detailed measurements on the failure mechanism and crack kinematics, leading to much more detailed understanding than what was possible ten years ago. However, the system has one significant shortcoming; it can only capture the failure mechanisms on the surface.

This is exactly what can be developed with the fiber optic measurement system. With this system, a more detailed understanding of the strain and displacement inside the reinforced concrete can be captured. By glueing optical fibers onto the reinforcement, a detailed measurement of the activation of the reinforcement can be obtained. This enables the establishment of more detailed experimental evidence and a better understanding of failure mechanisms and reinforcement activation. This is important when developing new calculation procedures for the capacity of concrete structures.

This project will establish a fiber optic measurement system and establish knowledge and a pilot experimental programme to be able to connect the two systems, i.e. a project that connects the new optical measurement system with the Digital Image Correlation system and the other data acquisition systems at the laboratory. Furthermore, the project will incorporate fiber optic measurement into some of the already planned experimental programmes related to the PhD projects in the research group. These experiments are currently planned without fiber optic measurements. By introducing fiber optic measurements to these experiments, the experimental programme can capture more detailed evidence.

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