

Vibration and Strain Monitoring of an Offshore Structure

Modern structures like high-rise buildings, suspension bridges and offshore windmill turbines are becoming more flexible and their lifetime is typically governed by structural vibrations caused by external forces from for example wind and waves, which lead to metal fatigue. During the design of these structures the lifetime is assessed based on statistical models that are rarely validated. By measuring the vibrations of these structures, a more accurate state of health may be obtained.

The work in the PhD project did not directly quantify the state of health of these structures but proposed and demonstrated a set of tools that may be useful within this field. Thus, the purpose of the work presented in the PhD provides knowledge on and tools for:

- Specify a data acquisition system and automate the time-consuming task of estimating modal parameters (natural frequency, damping ratio and mode shape vectors) from measured data.
- In addition, the impact of changing environmental conditions on the estimated modal parameters was investigated.
- Finally, material strains were estimated and used for fatigue lifetime calculations.

The vibration measurements are useful for extracting information about resonances in the structure, that can be used to validate or update some of the models used during the design phase. The process of extracting this information is, however, very time-consuming as it requires some decision making by an expert operator. Therefore, an automated procedure for extracting vibration parameters was developed in this project. This method nullifies all decision making and at the same time successfully identifies similar vibrations parameters that an expert operator would also have found.