Fraunhofer LBF

SWIFT

# SHM
# Structural Health Monitoring

## Stand-alone Structural Analysis for long-term Industrial Application

Continuous structural health monitoring for mechanical structures, e.g. bridges, wind power plants or vessels can be used to identify nascent damages and to optimise maintenance strategies. The analysis of oscillation characteristics of the structure has been proven as a suitable approach. Based on resonance frequency and oscillation modes, parameters are generated indicating alterations of the structure.

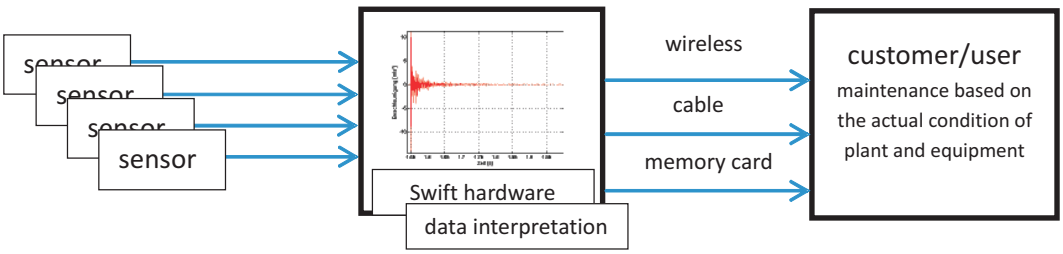
### Customer's Benefit

By detecting significant deterioration and consequentially preventing damages the **operational reliability** of the structure is enhanced. In conjunction with an on condition based maintenance approach the system will help to reduce total operational costs in a sizeable amount and to **avoid warranty claims**.

### System Development

The Fraunhofer LBF refined the algorithms for the oscillation analysis, which initially execute a correlation estimation and subsequently extract the interesting oscillation modes and resonance frequencies. As for an actual long term instrumentation the use of dedicated vibrators is out of question, therefore methods of operational modal analysis are used.

Innovation




Subject to technical alterations
(Rev. 2.6_Jun 2012)

**SWIFT GmbH is certified for aviation systems**

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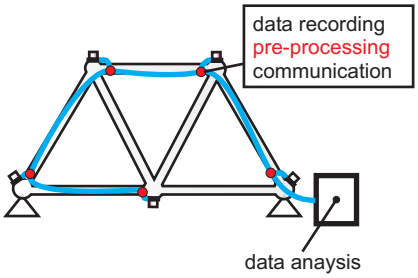
## Methods

The structural health monitoring by means of vibration analysis is based on recording auto- and cross-correlation functions at and between different test points of the structure. Input can be both strain and vibration signals. After averaging the time functions over a distinct period, the resonance frequencies and corresponding oscillation modes are extracted out of the measured data, and so the alteration of those parameters defining the structural condition can be analysed over time.

The "Effective Independence" (EI) method is a procedure for the evaluation of sensor redundancies based on the linear independence between the sensor data. The EI method is applied for analysing the test points in terms of their informational value. The result is used for optimising the number of test points and therefore to reduce the all-over efforts and costs.




The implementation of a system, without separate mechanical excitation, but by operational modal analysis for vibration analysis enables use-oriented detection of damages under realistic operational conditions at actual industrial long-term applications. The autonomous processing and analysis by the SWIFT hardware and the direct availability of the relevant information avoids the storage and handling of large data volumes, usually accumulated during long-term measurements.

## Hardware

The SHM-System was realised with hardware components from SWIFT GmbH which are tested for many years in different long-term applications. The proven hardware components were advanced for recording the vibration signals. Additionally a new powerful processor unit to facilitate the vast quantity of calculations for estimating the resonance frequencies and oscillation modes has been designed. Finally the system offers different interfaces including USB, Ethernet and remote data retrieval to provide flexible and easy to use communication links to the user's analysis routines.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