



Intelligent data flow for a ship's onboard-system

INTELLIGENT ALGORITHMS FOR PREDICTIVE MAINTENANCE

Reducing operating costs with Condition-Based Maintenance (CBM):

High cost pressure in the merchant shipping industry and increasing availability requirements from charterers' side require reliable maintenance of ships and their wear parts. This challenge can be met with optimized, condition-based maintenance strategies. Condition-based maintenance can lead to significant cost savings for maintenance and wear parts procurement.

One focus of condition-based maintenance procedures in shipping has so far been on the propulsion systems of merchant ships. To enable condition-based maintenance strategies also for other ship systems, such as generators, refrigeration systems and electronic

components, Fraunhofer CML develops intelligent algorithms for fault detection, fault prediction and maintenance optimization.

Approach of Fraunhofer CML for CBM algorithm development:

In order to develop suitable algorithms for error diagnosis and error prognosis, Fraunhofer CML uses a 4-stage process. This includes both the system selection and data analysis, the method conception and the implementation of the applicable software.

Finding the best approach for your system:

Subsequently, the analysis of the system state follows on the basis of the mea-

asured characteristics. A distinction is made here between fault diagnosis and failure prognosis. A fault diagnosis is the detection of the current system state from the sensor sensitivity values. The failure prognosis comprises the determination of the fault progression and the remaining useful lifetime.

The prerequisite for the enabling of relationships between certain sensor data constellations and present fault states from a training data record is the existence of a sufficiently large sensor data and maintenance history for the respective installation.

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Loading of a vessel propeller for maintenance procedures

Stage 1: System selection and fault analysis

The first step in the procedure model comprises the identification and selection of the shipbuilding equipment suitable for condition-based maintenance.

Its purpose is to identify such systems which are equally important for the operational capability and operational safety of the ship, and show a high error and failure frequency.

In addition to the assessment of criticality, a well-grounded cost analysis and identification of cost drivers form the basis for the system selection. When a corresponding system has been selected, a detailed system and error analysis is carried out to identify all system-specific error mechanisms.

Stage 2: Data provision

The second phase of the CBM focuses on the identification, provision, preparation and analysis of the data needed to implement the condition monitoring. Starting from the components and types of errors which are to be recorded in the context of condition monitoring, the necessary sensor data are determined.

In the case that data already exist, a special challenge is to merge them from different storage media. Finally, initial patterns and relationships with the detected errors and failures have to be analyzed.

Stage 3: Conception

In the concept phase, characteristics are extracted from the available sensor

data, which correlate as far as possible with the types of errors to be detected. If the acquired characteristics for the selected system have been determined, appropriate processing methods and the evaluation algorithms are selected.

Choosing the right procedures is a fundamental step towards achieving good diagnosis and prognosis results and depends heavily on the underlying system and the available data.

Step 4: Implementation and practice

The final step is the implementation of the algorithms and the user interface as well as tests and final adjustments to achieve an applicable software solution.

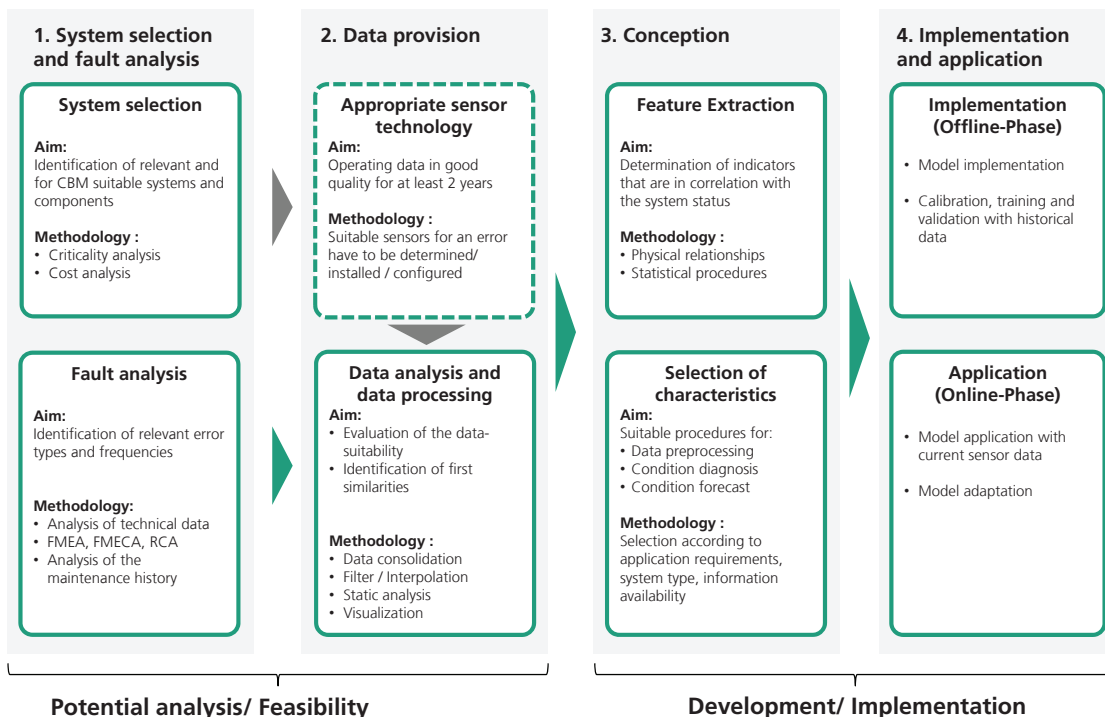


Figure 1: Approach for CBM algorithm development