

Condition Monitoring: Energy-autonomous and wireless

Initial situation

Ships need to be inspected to prevent breakdowns. In this context, the gearbox is of particular importance as it is a critical element between the diesel engine and the propeller system, which ensures the reliability of the entire marine propulsion.

Because every inspection interval costs time and money, shipping companies invest in condition-based maintenance (CBM): the gearbox is continuously monitored by sensor nodes instead of occasionally maintenance by technicians. The sensors measure torques, vibrations and temperatures around the clock. If the measurement data indicate an impending damage, an inspection interval can be planned in time.

So far, CBM systems are expensive, because lots of cables must be routed from the board computer and power supply to the gearbox. In the future wireless CBM is possible.



Results

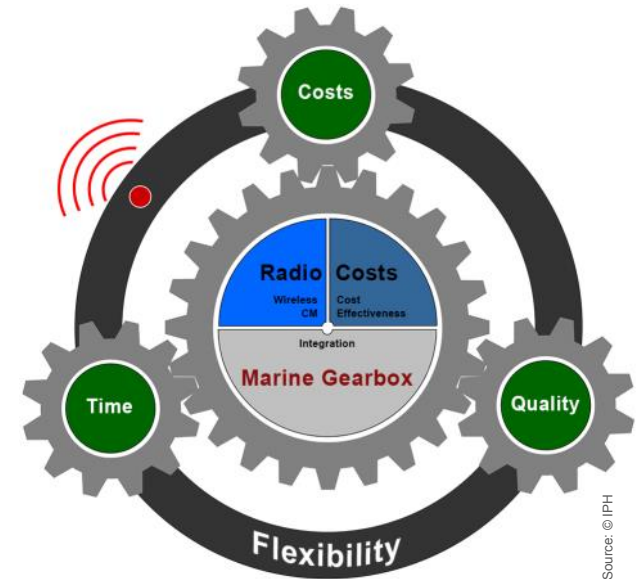
In the research project 'DriveCoM' the IPH developed a sensor system in cooperation with project partners that works without cables for energy supply or data transmission – and does not even need batteries. Sensor nodes at the gearbox surface measure continuously torque, vibrations and temperatures. Key figures are calculated automatically from the measurement data and indicate whether a potential damage is about to occur. With the help of RFID technology the data are transmitted wirelessly to the board computer.

The energy for the measurement and transmission system is generated right at the sensor node. This is possible with the help of energy harvesting systems, which use the temperature difference between sea water and gearbox surface. The operating temperature of the gearbox surface is at a constant level of about 60°C. The sea water temperature depends on the region where the ship is operating: It may be 5°C cold or 25°C warm, but in any case it is much cooler than the gearbox surface. Thermoelectric generators use the temperature difference to supply the sensor nodes with electrical energy.

To protect the sensor nodes from dirt and sea water, the entire electrical components are housed in a sturdy metal case. The wireless sensor nodes can be retrofitted to the gearbox and the researchers estimate a working time for the sensors of at least ten years.

Benefit

The wireless condition-based monitoring decreases the maintenance costs, while making the marine gearbox more reliable. Because of the continuous monitoring the inspection intervals for ships can be extended – the ship companies save money. On the basis of measurement data it is possible to see whether a potential damage is about to occur.



Project Partners

The following companies and research institutes from Germany are involved in the research project 'Application of wireless technology for economic monitoring of maritime gearboxes':

bachmann.

Bachmann Monitoring GmbH
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HSG-IMIT
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on the basis of a decision
by the German Bundestag



DriveCoM

Wireless, energy-autonomous monitoring
for marine gearboxes



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