

This Thursday, 12 of May, there will be a guest lecture at the marine technology center, Tyholt (Room T1, 13:15 to 14:00) on the following topic:

Structure-graph Approach to Diagnosis and Control Reconfiguration Design Applied to Station-keeping Control

Lectured by

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Abstract

This seminar addresses the design process of diagnosis and control reconfiguration for systems required to operate under conditions of failures in multiple sensors or actuators. It is shown that existing methods fall short or give rise to highly complex analysis when multiple faults need be considered. Graph-theory based analysis of systems structure, by contrast, is shown able to cope with systems of real-life complexity.

Station-keeping control for ships is used where a surface ship supports inspection by remotely operated underwater vehicles. Such operation will be at short range to unknown objects or sub sea installations. If faults in sensors or in machinery cause the ship to move outside a narrow manoeuvring range, a safety hazard could rapidly occur. To prevent this, station-keeping control systems need include diagnostic algorithms to discover faults before they could give rise to unexpected motion of the ship. Methods to autonomously reconfigure defect sensors or machinery are also required.

Traditional station keeping control is manual and requires considerable attention of the ships officer on watch, and of the helmsman. As faults can develop causing the ship to accelerate rapidly to high speed, reaction within seconds is needed if a fault should occur, and the stress factor is high on the officer on watch. Autonomous fault handling is therefore much desired.

The structure-graph method is a relatively novel approach to analyse fault-tolerant systems. The lecture shows it to be proficient in rapidly discovering which faults are detectable, isolable and reconfigurable. As a salient feature, the method is also able to do this for the case of multiple faults. This is particularly useful when safety assessment should determine where diagnosability and controllability are retained in a system suffering from local faults.

The lecture demonstrates a Matlab® based tool to perform structural-graph analysis and exemplifies this using results from station-keeping control on a vessel from the Danish Navy.

All welcomed.