Shipboard Fluid System Diagnostics using Non-Intrusive Load Monitoring

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Systems on modern naval vessels are becoming exclusively dependent on electrical power. One example of this is the replacement of distilling and evaporator plants with reverse osmosis units. As the system is in continuous operation, it is critical to have remote real-time monitoring and diagnostic capabilities. The pressure to reduce shipboard manning only adds to the difficulties associated with monitoring such systems. One diagnostic platform that is particularly well suited for use in such an environment is the non-intrusive load monitor (NILM). The primary benefit of the NILM is that it can assess the operational status of multiple electrical loads from a single set of measurements collected at a central point in a ship's power-distribution network. This reduction in sensor count makes the NILM a low cost and highly reliable system.

System modeling, laboratory experiments, and field studies have all shown that the NILM can effectively detect and diagnose several critical faults in shipboard fluid systems. For instance, data collected from the reverse osmosis units for two U.S. Coast Guard Medium Endurance Cutters indicate that the NILM can detect micron filter clogging, membrane failures, and several motor-related problems. Field-tested diagnostic indicators have been developed using a combination of physical modeling and laboratory experiments.

Cooperative Tracking for Persistent Littoral Undersea Surveillance

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The US Navy has identified a need for an autonomous, persistent, forward deployed system to Detect, Classify, and Locate submarines. In this context, we investigate a novel method for multiple sensor platforms acting cooperatively to locate an uncooperative target. We summarize the more traditional methods for tracking and consider their strengths and limitations, especially their assumptions and requirements. These traditional methods include Kalman filtering, Bayesian inference, particle filters and set based tracking. We then investigate a novel algorithm for tracking with bearing only sensors. The algorithm determines the minimum region than must contain the target at any given time based on the sensed data and an upper speed bound for the target. The algorithm was implemented and tested extensively using real data from the PLUSnet MB06 experiment. The performance of the algorithm was evaluated and future work recommended.