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Optimal Fault Detection And Resolution During Maneuvaring For AutonomousUnderwater Vehicles



Synopsis

This is a NAVAL POSTGRADUATE SCHOOL MONTEREY CA report procured by the Pentagon and made available for public release. It has been reproduced in the best form available to the Pentagon. It is not spiral-bound, but rather assembled with Velobinding in a soft, white linen cover. The Storming Media report number is A045673. The abstract provided by the Pentagon follows: In order to increase robustness, reliability, and mission success rate, autonomous vehicles must detect debilitating system control faults. Prior model-based observer design for 21UUUV was analyzed using actual vehicle sensor data. It was shown, based on experimental response, that residual generation during maneuvering was too excessive to detect manually implemented faults. Optimization of vehicle hydrodynamic coefficients in the model significantly decreased maneuvering residuals, but did not allow for adequate fault detection. Kalman filtering techniques were used to improve residual reduction during maneuvering and increase residual generation during fault conditions. Optimization of the Kalman filter's system noise matrix, measurement noise matrix, and input gain scalar multiplier produced fault resolution which allowed for accurate detection of fault of relatively minor magnitude within minimal time constraints.

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