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ILLUSTRATION FOR LAYING OUT THE PAPER

INFORMATION MONITORING AND DIAGNOSTICS OF DUPLICATE INERTIAL SYSTEMS

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Abstract

Key words: information failures, information redundancy, multialternative filtering, Kalman filter

An algorithm for monitoring and diagnosing information failures of gyroscopes and accelerometers of two semianalytic inertial navigation systems (INS) included in the navigation complex (NC) of a submarine has been suggested and is considered in this paper. The NC is supposed to use the information from a water speed log (WSL). The algorithm for monitoring and diagnostics is intended to detect the type of fault (higher zero bias of one of the two "horizontal" accelerometers and higher drift of one of the three gyroscopes that are undetectable by INS monitoring facilities), to estimate its value and determine which of the two INS is faulty. The possibilities to recover the faulty INS are discussed. The simulation data and the results of experimental test of the algorithm are given.

Introduction

The concept of information failures of a navigation system discussed here as a situation caused by a failure to meet the requirements to the accuracy of navigation data in the absence of any hardware faults [1] calls for new approaches to the solution of the problem of monitoring and diagnostics (M&D). It is obvious that the detection of such failures requires information redundancy and is based on the analysis of pairwise differences of similar navigation parameters generated by two and more navigation systems.

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Let us introduce the state vector as

$$X = (\Delta S, \Delta U, \alpha, \omega, a)^T \quad (1)$$

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Conclusions

Duplicate inertial systems are included in autonomous navigation complexes not only to increase the accuracy but also to solve the problem of monitoring and diagnostics of information failures. A method of multialternative filtering with measurements formed on the basis of pairwise differences of displacements and headings generated by two INS has been specially devised to solve this problem.

References

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