Abstract

Of thesis “Inertial measurement systems of unmanned aerial vehicle”

Mokhovtsev Kirill

The thesis consists of 110 pages of printed text and contains 25 illustrations, 5 tables, 4 appendixes and 34 bibliographical references.

The thesis is devoted to increasing of accuracy of moving object attitude estimation with inertial measurement unit (IMU) based on low cost MEMS sensors. Increasing of accuracy is reached by errors correction using IMU extension with additional sensors.

Motivation of the work connected with low accuracy of MEMS gyros, what limits their application for navigation systems, although numerous advantages in comparison with gyros of other types.

Goal of the work is development of IMU model taking into account characteristics of real sensors and development of attitude and heading reference system (AHRS) algorithm based on this IMU.

For achievement of the goal next **issues** are addressed: development of models of individual sensors, analysis of attitude representation parameterization methods, Kalman filter based measurements complexation algorithm synthesis, object rotational movement kinematics modeling, measurement system prototype development and sensors characteristics determination based on experimental data; simulation of AHRS operation.

Object of investigation — IMU and AHRS based on it.

Subject of investigation — inaccuracies of moving object attitude estimation.

Investigation methods used in the thesis: Allan variance for sensors noise characteristics analysis, attitude parameters and sensor biases estimation with nonlinear Kalman filtering, simulation methods.

Scientific contributions of obtained results

Models which describe MEMS sensors of IMU were developed, which provided a possibility to determine throw simulation main error sources and ways for moving object orientation estimation accuracy improvement with additional sensors.

Practical contributions of obtained results

Models developed can be used for estimation of characteristics of MEMS-based navigation means at designing stage; algorithm synthesized is suitable for use in attitude estimation systems; prototype made together with developed software can be used for future investigations and educational purposes.

Key words: INERTIAL NAVIGATION, ATTITUDE AND HEADING REFERENCE SYSTEM, MEMS SENSOR, ALLAN VARIANCE, KALMAN FILTER.