**"Gyroskopiya i Navigatsiya" №4, 2005**

**CONTENTS**

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| **G.Boedecker** | **Sensor Orientation from Integrated Multi-Antennae GPS and Gyros** | **3** |
| For the application in strapdown airborne gravimetry, the problem of attitude determination is studied. For principal reasons, the attitude shall be based on geometric observations only, i.e. on GPS-multi antennae and angular rate sensors only, without using gravity field aiding as is common in e.g. inertial positioning; optical sensors like in GIS applications are not employed. Further, the alignment of the angular rate sensors to the navigation frame realised by the multi antennae GPS receiver is accomplished without prior calibration of the angular rate sensors in the laboratory, i.e. the rate sensors are neither calibrated nor strictly orthogonal. For the rate sensors, vibratory or fibre optical gyros were selected because of their light weight, compact dimensions and high resolution. A general transformation matrix is derived from the combination of the data of the two sensors collected in some flight manoeuvres in order to refer the rate sensor data to the local navigation frame. The data fusion of the two attitude (rate) sensors with an integrating filter provides high sampling rate high resolution attitudes in the navigation reference frame. The two sensors complement each other in that the multi antennae GPS conceptually provides 'drift free' but low sampling rate high noise information whereas the angular rates sensors contribute high rate high resolution but drift affected data.Another problem is whether these attitudes are really absolute values and what is the stability of the reference frame realised this way. The experiments draw the attention to the multipath effects of GPS receivers aboard aircraft. In a few static tests on top a roof of a building and in a stationary aircraft, this problem is investigated. The result is that currently multipath at aircraft may be the most severe problem and limits the absolute attitude accuracy to somewhere below 1o, where this value depends on numerous details. |  |

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| **N.A.Lookin, L.V.Vodicheva, I.G.Ponomarev** | **A Miniature Precise SINS for High Maneuvering Moving Vehicles: Cost Efficiency Analysis for Algorithm Realization** | **14** |
| The problems of development of efficient special-purpose board computers for data processing in Strapdown Inertial Navigation System are considered. A new approach to processor efficiency estimation is proposed. For well-known microprocessor architectures the results of hardware and architecture performance estimation are discussed.The processor that was developed on the base of combined optimization of SINS algorithms and processor architectures especially for small-size SINS by Science Production Association of Automatics in collaboration with Institute of Engineering Science is shown to have the maximal architecture performance. This is Functional Oriented Processor (FOP 1843). One of the peculiarities of its architecture is specific processor core that permits to obtain maximum of architecture performance. Its architecture is shown on Fig. 1. Comparative estimates of architecture performance are depicted on Fig. 2.The approach proposed by the authors may be used as a base for computer aided design of SINS processors especially for processors realized as "System-on-Chip". |  |

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| **Ya.I.Binder** | **Strapdown Gyroinclinometer with Main Axis of Two-Axis Angular Rate Sensor Oriented in the Diametral Borehole Plane** | **23** |
| Recently increased commercial and technical interest to drilling and laying the boreholes and mains of intricate shape has led to a number of novel technical solutions providing extended accuracy and reliability of inclinometric measurements, which is realized by application of new gyroinclinometer designs. In a number of cases the prior factor that determines the type of inclinometric system is decrease in borehole survey time, as an inclinometer operating both as a point compass and an analytical direction gyroscope (DG), is requested. A new kinematic design ("diametral" design) for a strapdown gyroinclinometer is proposed in the paper. The design features the possibility for combination of continuous DG mode with point compassing in boreholes of any orientations and provides gyrocompassing, invariant to starting errors of the two-axis angular rate sensor. |  |

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| **G.I.Emeliantsev, Cai Tijing** | **On observability of IMU "Eastern" Drift during Vessel Special Maneuvers** | **32** |
| The paper is devoted to the problem of estimation of inertial measurement unit (IMU) "eastern" drift, caused by the Earth magnetic field effects on the gyroscopes, when IMU is installed on a vessel.The gimballess IMU, in which angular rate sensors are used as gyros, is supposed to be incorporated in the integrated orientation and navigation system (IONS), comprising GPS/GLONASS receivers.A specific feature of the subject problem is the determination of vessel motion conditions, under which IMU "eastern" drift can be observed, and hence, systematic course error can be monitored on the basis on speed and position GPS/ GLONASS measurements. The results of simulating the algorithms of ANIS observation mode with accuracy estimation for the task to be solved are given. Kalman filter with feedback is used for processing measurements in ANIS. Then considerations are made for IMU reverse modulation turns, vessel motion conditions and distance between place of IMU installation and ship center of mass. |  |

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| **V.E.Dzhashitov, V.M.Pankratov** | **Selection of Elastic Suspension Parameters for the Planar Micromechanical Gyroscope on the Basis of Determining its Natural Frequencies** | **42** |
| The system "elastic suspension - sensitive element" of micromechanical gyroscopes (MMG) is treated as a vibrating system with distributed parameters (fig. 1) and analyzed in the present paper. The proposed approach has allowed to set and to solve the important problems concerning practical design and development of micromechanical gyros. The mathematical model to the first approximation (2), (3), (4), (fig. 2, 3, 4) for calculation of natural frequencies of MMG system "elastic suspension - sensitive element" with straight-line elastic members is constructed. Supporting algorithms and software for the first approximation model are designed. The algorithms and the software enable the automated selection of the geometrical elastic suspension parameters for the MMG with straight-line elastic members. Example 1 illustrates selection of geometrical elastic suspension parameters for MMG with straight-line elastic members on the basis of determining the suspension natural frequencies.The mathematical model to the second approximation (5)-(30), (fig. 5, 6) for calculation of natural frequencies of MMG system "elastic suspension - sensitive element" with curvilinear elastic members is constructed. Supporting algorithms and software for the second approximation model are designed. The algorithms and the software enable the automated selection of the geometrical elastic suspension parameters for the MMG with curvilinear elastic members.Adequacy of the constructed models to the first and the second approximation is demonstrated.Example 2 illustrates selection of geometrical elastic suspension parameters for MMG with curvilinear elastic members on the basis of determining the suspension natural frequencies.The usage of curvilinear elastic members is demonstrated to provide additional possibilities of maintenance and analysis of the specified frequency features of MMG elastic suspension in mutually perpendicular directions. Analysis of influence of the technological tolerances for geometrical and other parameters of elastic suspension and sensitive elements on MMG natural frequency is shown to be possible. |  |

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| **V.N.Belobragin, V.D.Zaytsev, V.Ya Raspopov, V.I.Gorin, A.A.Gorin, V.A.Dmitriev, V.I.Sorokin, S.P.Ermilov** | **Experiment of Gyro-Device Development for Units with Roll Rotation** | **57** |
| A feature of the gyroscopes used in units with roll rotating is their functioning in rigid operational conditions, consequently the choice of structural decisions is limited. The gyroscopes with gimbal and liquid suspensions are in the greatest conformity with conditions of operation. The specificity of gyroscope functioning is a rotation of gimbals and, basically, transfer the rotation to a rotor through the gimbal. Constructive decisions when rotating gimbal takes place and the rotor runs out after starting irrespective of the gimbal are possible. The gyroscopes with both types rotating qimbals are two-componental instruments for measuring of unit angular position, and when using special measures at constructive adjustment gyroscopes with rotating gimbals can realize functions of device measuring as angles as angular velocities. |  |

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| **E.D.Bokhman, M.N.Burnashev, Yu.V.Filatov, D.P.Lukianov, A.V.Mironov, P.A.Pavlov, V.D.Aksenenko, I.E.Gutner, O.K.Epifanov, S.I.Matveyev** | **Development and Calibration of Angle Sensors with Microprocessor Autocorrection** | **72** |
| Angle-to-digital converters consisting of multipole resolvers and devices converting their signals to digital representation are widely used in mission-critical systems working in severe environment; they define substantially the accuracy and efficiency of such systems. The report presents the resolver self-calibration technique based on integrating two conversion channels having different error spectra. A goniometric setup and technique for the converter error investigation are also described. Experimental results are presented. |  |

**Brief note**

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| **N.A.Kaldymov, L.Ya.Kalichman, D.M.Kalichman, A.V.Polushkin** | **Unit for Recording Frequencies and Vibration Levels of Gyromotors** | **83** |
| The paper deals with a problem of development of plants providing effective check and detection of vibration level in ball bearing suspension gyroscopic devices |  |

**Materials of the XII Saint Petersburg International Conference
on Integrated Navigation Systems**

|  |  |
| --- | --- |
| **Paper abstracts** | **91** |

**International Public Association
The Academy of Navigation and Motion Control
*Official information***

|  |  |
| --- | --- |
| **XX General Meeting of the Academy of Navigation and Motion Control** | **111** |

**Information**

|  |  |
| --- | --- |
| **Russian and international conferences, symposiums, and exhibitions**  | **115**     |

|  |  |
| --- | --- |
| **Abstracts of the papers published**  | **117**     |

|  |  |
| --- | --- |
| **List of the materials published in the journal Gyroscopy and Navigation in 2005**  | **120**  |