

29th SAINT PETERSBURG INTERNATIONAL CONFERENCE
ON INTEGRATED NAVIGATION SYSTEMS
30 May - 1 June 2022

PRELIMINARY PROGRAM

MONDAY, 30 MAY

10.00–10.15 O P E N I N G C E R E M O N Y

SESSION I – INTEGRATED SYSTEMS

PLENARY PAPERS

- 10.15–10.35 1.² **M. Belyaev** (*S.P. Korolev Rocket and Space Corporation Energia, Korolev, Russia*), **J. Wepler** (*DLR, Bonn, Germany*), **M. Wikelski** (*Max Planck Institute for Ornithology, Radolfzell, Germany*), **O. Volkov** (*S.P. Korolev Rocket and Space Corporation Energia, Korolev, Russia*), **U. Muller** (*Max Planck Institute for Ornithology, Radolfzell, Germany*), **W. Pitz** (*SpaceTech, Immenstadt, Germany*), **O. Solomina**, **G. Tertitski** (*Institute of Geography, RAS, Moscow, Russia*)
8¹ Results of Animal Migration Studies Using Icarus Scientific Equipment on the ISS RS
- 10.35–10.55 2. **Haoyu Cai** (*Undergraduate School, Changsha, Hunan, China*), **Dingjie Wang**, **Jie Wu** (*Staff Room of Flight Dynamics and Control, College of Aerospace Science and Engineering, National University of Defense Technology, Changsha, Hunan, China*)
60/61 A high-accuracy SINS/GNSS/RCNS tight integration approach for Automated Transfer Vehicle (ATV) navigation
- 10.55–11.25 COFFEE BREAK

PLENARY PAPERS

- 11.25–11.45 3. **R.R. Bikmaev** (*Institute of Engineering Physics, Serpukhov, Russia*)
39 A Globally Consistent Solution to the Simultaneous Localization and Mapping Using Orthoimage as Prior Information
- 11.45–12.05 4. **LIU Tianyi**, **ZHOU Yicheng** (*Xi'an Modern Control Technology Institute, China*)
113 Distributed Cooperative Navigation for Unmanned Aerial System Based on Dynamic Priority

POSTER PAPERS³

- 12.05–13.00 5. **M.E.Rulev**, **V.M.Achildiev** (*Scientific Production Unity «GEOPHIZIKA-NV», JSC, Moscow, Russia, Mytischki Branch of Bauman Moscow State Technical University, Mytischki, Russia*), **Yu.K.Gruzevich** (*Scientific Production Unity «GEOPHIZIKA-NV», JSC, Moscow, Russia, Bauman Moscow State Technical University, Moscow, Russia*), **N.A.Bedro** (*Scientific Production Unity «GEOPHIZIKA-NV», JSC, Moscow, Russia*)
29 Primary Processing of Biophysical Signals of Electroseismocardiography System

¹ Paper No. in CoMS-Elektropribor system (not indicated in the final program)

² Paper No. in the Conference program

³ The authors of poster papers at the plenary session are given 3 min to present the main idea of the paper with 1-2 slides, if any; 2 min are given for Q&A (1-2 questions). In case of in-person participation the further discussion will continue at the posters. In case of online participation the discussion continues at the forum on the Conference website.

6. **Guohu Feng, Maosong Wang, Chan Liu** (*College of Intelligent Science and Technology, National University of Defense Technology (NUDT), Changsha, China*)
99 Fault Tolerant Damping Method of Marine Navigation Based on Normal Vector Position Model
7. **D.A. Trofimov, S.D. Petrov** (*Saint Petersburg State University, St. Petersburg, Russia*), **I.V. Chekunov, V.A. Usachev** (*Bauman Moscow State Technical University, Moscow, Russia*)
27 Alignment of Inertial Navigation Systems Based on Radio Interferometric Observations of Bright Natural and Artificial Radio Sources
8. **A. Dumitrascu** (*Maritime University of Constanta, Constanta, Romania*)
34 Integrated INS/GPS System for Performance Characteristics Analysis in Motorsports
9. **S.B. Berkovich, N.I. Kotov, A.V. Sholokhov** (*Institute of Engineering Physics, Serpukhov, Russia*)
35 Formation of Inertial Kinematic Parameters for Simulation of Terrain Navigation Systems Aided with Geospatial Data
10. **A.V. Chernodarov, A.P. Patrikeev** (*“NaukaSoft” Experimental Laboratory, Ltd., Moscow, Russia*), **S.E. Perelyaev** (*Ishlinsky Institute for Problems in Mechanics, RAS, Moscow, Russia*), **A.A. Polyakova** (*Bauman Moscow State Technical University, Moscow, Russia*)
40 Geophysical Invariants and Observability of Integrated Inertial Navigation Systems
11. **A.V. Chernodarov, A.P. Patrikeev** (*Nauka Soft Experimental Laboratory, Ltd., Moscow, Russia*), **S.P. Timoshenkov** (*MIET University, Moscow, Russia*), **S.A. Ivanov** (*Ramensky Instrument Engineering Plant, JSC, Ramenskoe, Russia*)
42 Dynamical Calibration and Testing of MEMS Unit Using a Reference INS/GNSS Navigation System
12. **S.V. Astakhov, O.V. Kubryak, I.G. Ninalalov, I.V. Merkuriev** (*National Research University MPEI, Moscow, Russia*)
64 Methods for Improving the Accuracy of an Autonomous Orientation and Navigation System Based on Micromechanical Gyroscopes and Optoelectronic Sensors
13. **V.A. Smirnov, A.V. Prokhortsov, N.I. Babukhin** (*Tula State University, Russia*)
86 A Method for Integration of Optical and Inertial Data to Determine the Parameters of Orientation and Navigation
14. **Haibing Gu, Zhanqing Wang** (*School of Automation, Beijing Institute of Technology, Beijing, China*)
116 Gait Analysis Based on Multi Wearable Inertial Measurement Units Mounted on Lower Limbs
15. **V.N. Kovregin, G.M. Kovregina, A.S. Murzaev** (*St. Petersburg State University of Aerospace Instrumentation, St. Petersburg, Russia*)
2 A Unified Method for Adaptive-Robust Observation of an Aerial Object with a Complex Spectrum in Radars with Quasi-Continuous Chirp Radiation and (Micro)Navigation
16. **K.S. Lel’kov** (*Moscow Aviation Institute (MAI), Moscow, Russia*)
Integrated Navigation System of a Ground Wheeled Robotic Vehicle

Paper is recommended by the YSC Program Committee

13.00–14.00

LUNCH

PLENARY PAPERS

- 14.00–14.20 17. **J. F. Wagner, M. Kohl, B. Györfi** (*University of Stuttgart, Chair of Flight Measuring Technology, Stuttgart, Germany*)
84 Reevaluation of ZUPT-based Pedestrian Navigation Data by Checking the Numerical Influence of Traditional Algorithmic Features
- 14.20–14.40 18. **O.A. Stepanov** (*Concern CSRI Elektropribor, JSC, ITMO University, St. Petersburg, Russia*), **V.A. Vasil'ev** (*Concern CSRI Elektropribor, JSC, ITMO University, St. Petersburg State Electrotechnical University LETI, St. Petersburg, Russia*), **A.B. Toropov** (*Concern CSRI Elektropribor, JSC, ITMO University, St. Petersburg, Russia*)
68 Map-Aided Navigation Algorithms Taking into Account the Variability of Position Errors of the Corrected Navigation System
- 14.40–15.00 19. **B. Banning** (*International Association of Institutes of Navigation, Amsterdam, The Netherlands*), **A. Mackay** (*NAV Canada, Ottawa, Canada*)
92 Magnetic to True North, Aviation Change by 2030

POSTER PAPERS¹

- 15.00–16.00 20. **Bo Wang and Tijing Cai** (*School of Instrument Science and Engineering, Southeast University, Nanjing, China*)
69 A Joint Gravity Matching Algorithm with Less Constraint by Gravity Fields
21. **A.V. Motorin, O.A. Stepanov, A.A. Krasnov, A.V. Sokolov** (*Concern CSRI Elektropribor, JSC, ITMO University, St. Petersburg, Russia*)
21 Joint Estimation of Gravity Anomalies and Inertial Accelerations of a Sea Vessel: Efficiency Evaluation
- 100 22. **Zhengbing Xue, Wenjing Wang** (*Beijing Institute of Aerospace Control Devices, Beijing, China*), **Fuqiang Liu** (*Institute of Remote Sensing Satellite, CAST, Beijing, China*), **Dongming Li** (*Beijing Institute of Aerospace Control Devices, Beijing, China*)
Ground-Vehicle Vector Gravimetry
- 90 23. **V.I. Baburov, V.A. Boyko** (*Navigator, JSC, St. Petersburg, Russia*), **N.V. Ivantsevich** (*Navigator, JSC, D.F. Ustinov Baltic State Technical University "Voenmeh", St. Petersburg, Russia*), **I.L. Fidlin, V.V. Khudoshin** (*Navigator, JSC, St. Petersburg, Russia*)
A Simulator for Testing and Debugging the Algorithms for an Aircraft Collision-Avoidance and Air Surveillance System
- 81 24. **H. Benzerrouk** (*École de technologie supérieure, Department of Electrical Engineering, Montreal, Canada*), **A.V. Nebylov, V.A. Nebylov** (*Saint Petersburg State University of Aerospace Instrumentation, St. Petersburg, Russia*)
Multi Pulsars Based Positioning, Navigation, and Timing in Deep Space Based on Uncertain Information Fusion Algorithms

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25. **V. B. Pudlovskiy** (*State Scientific Center of the Russian Federation VNIIFTRI, Mendeleevo, Moscow region, **Russia**, National Research University MPEI, Moscow, **Russia***), **N.I. Petukhov, A.A. Chugunov, A.P. Malyshev** (*National Research University MPEI, Moscow, **Russia***), **A.A. Frolov** (*State Scientific Center of the Russian Federation VNIIFTRI, Mendeleevo, **Russia***)
54 Joint GNSS and UWB Signal Processing for Seamless Navigation in urban environments
26. **M.Yu. Tkhorenko, E.V. Karshakov** (*V.A. Trapeznikov Institute of Control Sciences of the RAS, Moscow, **Russia***)
32 Estimating the Potential Accuracy of Magnetic Navigation Based on Magnetic Survey Data
27. **I. V. Belokonov, W. A. Cardenas Duran, J. G. Quijada Pioquinto** (*Samara National Research University, Samara, **Russia***)
22 Investigation of the Possibility of Using a Convolutional Neural Network to Detect the Sun in the Mode of Unstabilized Motion of a Nanosatellite
28. **I.N. Burdinsky, A.S. Mironov** (*Pacific National University, Khabarovsk, **Russia***)
14 Using Configurable On-Chip Systems in a Sonar Navigation System Receiver for Mobile Autonomous Robotic Complexes
29. **V.N. Kovregin, G.M. Kovregina, A.S. Murzaev** (*St. Petersburg State University of Aerospace Instrumentation, St. Petersburg, **Russia***)
3 Method of Observation/Recognition/Classification of a Helicopter by Chirp Echo Signals in Pulse-Doppler Helicopter Radars with Radio-Inertial Micronavigation
30. **P. K. Kuznetsov, G.I. Leonovich, B.V. Martemyanov, G.N. Myatov** (*Samara State Technical University, **Russia***)
80 Technique for the Rapid Detection, Recognition and High-Precision Determination of Ship Motion Parameters from the Images of Traces Left by Them on the Water Surface
31. **Y Zhao, DJ Wang, HB Zhang, GJ Tang** (*National University of Defense Technology, Changsha, Hunan, **China***)
A High-accuracy SINS/RCNS Integrated Navigation Algorithm

16.00–16.30 COFFEE BREAK

SESSION II – CONTROL SYSTEMS

PLENARY PAPER

- 16.30–16.50 **32. A. A. Galkin, A. S. Timoshenkov, P. V. Erkin, V. P. Zaharov, N. A. Solomkina, E. S. Kochurina** (*Laboratory of Microdevices, JSC, Zelenograd, National Research University of Electronic Technology, Moscow, **Russia***)
72 Development of a Precision Airdrop System Based on GKV-6 MEMS-IMU

POSTER PAPERS¹

- 16.50–18.20
33. **A.V. Molodenkov, Ya.G. Sapunkov** (*Institute for Precision Mechanics and Control Problems of the Russian Academy of Sciences (RAS), Saratov, **Russia***),
1 T.V. Molodenkova (*Yuri Gagarin State Technical University of Saratov, Saratov, **Russia***)
Analytical Quasi-Optimal Algorithm for the Time-Minimal Reorientation of a Spacecraft under Arbitrary Boundary Conditions
34. **I.A. Pankratov** (*Saratov National Research State University; Institute for Problems of Precision Mechanics and Control, Problems of the RAS, Saratov, **Russia***), **Yu.N. Chelnokov** (*Institute for Problems of Precision Mechanics and Control Problems of the RAS, Saratov, **Russia***)
6 Quaternion Models and Algorithms for Solving the Problems of Optimal Reorientation of the Spacecraft Orbit and Its Plane
35. **Ye.I. Somov, S.A. Butyrin, T.Ye. Somova** (*Samara State Technical University, Samara, **Russia***)
11 Control of a Space Robot at Changing Fuel Tanks of a Geostationary Satellite Propulsion Unit
36. **Ye.I. Somov, S.A. Butyrin, S.Ye. Somov** (*Samara State Technical University, Samara, **Russia***)
12 Autonomous Guidance and Control of a Geostationary Communication Satellite at Long-Term Conservation
37. **A.M. Popov, D.G. Kostygin, P.V. Krashanin, A.A. Shevchik** (*D.F. Ustinov Baltic State Technical University “Voennmeh”, St. Petersburg, **Russia***)
18 Development of an Algorithm for Guidance of a Swarm of Unmanned Aerial Vehicles
38. **E.V. Barinova, I.V. Belokonov, I.A. Timbai** (*Samara National Research University, Samara, **Russia***)
25 Motion features of aerodynamically stabilized CubeSat 6U nanosatellites
39. **I.V. Belokonov, M.S. Shcherbakov** (*Samara National Research University, **Russia***)
33 Investigation of a Single-Axial Control Algorithm for the Inspection Motion of a Gravitationally Stabilized Nanosatellite
40. **A.V. Nebylov, V.A. Nebylov** (*Saint Petersburg State University of Aerospace Instrumentation, St. Petersburg, **Russia***)
62 Relative Navigation and Joint Control of Aerospace Plane and Ekranoplane for Their Docking
41. **A.V. Nebylov, A.A. Kuznetsov** (*Saint Petersburg State University of Aerospace Instrumentation, St. Petersburg, **Russia***)
65 Analysis of the Methods Used to Determine the Maximum Control Error
42. **J. Yi, M.S. Selezneva, K.A. Neusypin** (*Bauman Moscow State Technical University, Moscow, **Russia***)
66 Research of Intelligent Parking System

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43. **A.M. Gruzlikov** (*Concern CSRI Elektropribor, JSC, St. Petersburg, Russia*)
 Short and Ultra-Short Baseline Navigation of the AUV for Bringing It to the
 Bottom Docking Device
 77
44. **A.Yu. Knyazhsky, A.V. Nebylov** (*Saint Petersburg State University of Aerospace
 Instrumentation, St. Petersburg, Russia*)
 Minimizing the Altitude of a Low-Flying Vehicle in the Absence of an Altitude
 Map
 83
45. **D.O. Prokhorova, V.I. Shiriaev** (*South Ural State University, Chelyabinsk,
 Russia*)
 Analysis of the Pitch Angle Stabilization System with Consideration of Sensor
 Noise
 91
46. **N.A. Elisov, A.V. Kramlikh, I.A. Lomaka** (*Samara National Research
 University, Russia*)
 An Approach to the Control of the Nanosatellite's Longitudinal Axis Reorientation
 96
47. **V.M. Nikiforov, A.A. Gusev, K.A. Andreev, A.S. Shiryaev**
*(Academician Pilyugin Scientific-Production Center of Automatics and Instrument-
 Making, Moscow, Russia)*
 Elimination of Self-Oscillations at Terminal Control Endpoint by Kalman Filtering
 98
48. **Li-hui Deng** (*College of Intelligent Systems Science and Engineering, Harbin
 Engineer University, Tianjin Navigation Instrument Research Institute, China*),
Hong-jian Wang (*College of Intelligent Systems Science and Engineering, Harbin
 Engineer University, China*), **Ru-bin Yuan, Ting-ting Guo** (*Tianjin Navigation
 Instrument Research Institute, China*), **Zhi-kang Chi** (*College of Intelligent
 Systems Science and Engineering, Harbin Engineer University, China*)
 Research on Path Following Control of Unmanned Surface Vehicle Based on
 Model Predictive Control with Improved Artificial Bee Colony Algorithm
 106
49. **Haoqian Huang, Ruitong Liu, Shuang Zhang, Peng Wu** (*College of Energy and
 Electrical Engineering Hohai University, Nanjing, China*)
 Formation Control of AUVS Based on an Improved Fixed-Time Sliding Model
 Control
 115
50. **Bin He** (*Nanjing University of Science and Technology, Kumau*), **Qing Liang**
(HuaWei Technologies Co., Ltd (corporation limited), Nanjing, Kumau)
 UAV Trajectory Optimization Based on Adaptive Pseudospectral Method
 б/н

TUESDAY, 31 MAY

SESSION III - INERTIAL SYSTEMS AND SENSORS

PLENARY PAPERS

- 9.00 – 9.20 51. **A.O. Makalov, V.A. Smirnov, A.V. Prokhortsov** (*Tula State University, Russia*)
 50 Inertial-Acoustic System for Electronic Auscultation for the Diagnosis of
 Pulmonary Diseases

- 9.20–9.40 52. **Sergey Zotov, David Blumenfeld, Joel Paslaski, Andrew Popp** (*Emcore
79 Concord, CA, USA*)
Navigation-Grade IMUs: Compact Quartz MEMS and FOG Technology

POSTER PAPERS¹

- 9.40–10.30 53. **Y.V. Bolotin, A.V. Savin** (*Moscow Lomonosov State University, Moscow, **Russia***)
94 Calibration of a Micromechanical Inertial Measurement Unit on a Turntable Table
in the Spectral Domain
54. **J Cai, J H Cheng, Y H Xu, J X Liu** (*College of Intelligent Systems Science and
Engineering, Harbin Engineering University, Harbin, **China***)
7 Application of Unscented Kalman Filter with Neural Network in the Polar Rapid
Transfer Alignment
55. **L.V. Vodicheva, L.N. Belsky, Yu.V.Parysheva** (*Academician N.A. Semikhatov
28 Scientific and Production Association of Automatics, Yekaterinburg, **Russia***)
A Technique for Initial Autonomous Alignment of a Strapdown INS for Space
Launch Vehicles
56. **M.S. Selezneva, K.A. Neusypin, A.V. Proletarsky, Chen Danhe** (*Bauman
48 Moscow State Technical University, Moscow, **Russia***)
Algorithms for Inertial Navigation System Integration with Angular Acceleration
Sensors
57. **D.A. Burov** (*VNII Signal, Kovrov, **Russia***)
75 Peculiarities of Platform and Strapdown Angular Orientation Gyro Systems
Application as Part of Ground Mobile Objects
58. **Jian Liu, Xiangxiang Lu, Dongliang Pei, Junfeng Zhang, Weiren Liu,
108 Xiaoming Zhao** (*Tianjin Navigation and Instrument Institute, Tianjin, **China***)
The Angular Alignment of Separated Raman Beams Based on Optical Interference
for Atom-Interferometer Gyroscopes
59. **S.Yu. Perepelkina, A.A. Fedotov** (*Academician N.A. Semikhatov Scientific and
95 Production Association of Automatics, Yekaterinburg, **Russia***)
Determination of Strapdown Inertial Navigation System Significant Characteristics
as Part of the Control Object Using Typical Motion Sections
60. **Xiaoge Ning** (*Department of Automation, School of Electronic Information and
112 Electrical Engineering, Shanghai Jiao Tong University (SJTU), Shanghai, Beijing
Aerospace Times Optical-electronic Co. Ltd, Beijing, **China***), **Jixun Huang**
(*Beijing Institute of Aerospace Control Devices, Beijing, **China***), **Jianxun Li**
(*Department of Automation, School of Electronic Information and Electrical
Engineering, Shanghai Jiao Tong University (SJTU), Shanghai, **China***)
A New Method for Inertial Strapdown Navigation System Alignment Under Large
Misalignment Based on a Velocity Error Transformation

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61. **R.S. Kulikov** (*National Research University MPEI, Moscow, **Russia***),
O.V. Denisenko (*State Scientific Center of the Russian Federation VNIIFTRI,
Mendeleevo, **Russia***), **O.V. Glukhov, I.V. Merkurev** (*National Research
University MPEI, Moscow, **Russia***)
- 67 Modeling the Influence of Time Scale Instability on Inertial Navigation Error

10.30–11.00 COFFEE BREAK

PLENARY PAPERS

- 11.00–11.20 62. **A.B. Tarasenko** (*Moscow Institute of Physics and Technology, Moscow, **Russia***),
D.E. Borodulin, A.B. Kolchev (*JSC LASEX, Dolgoprudny, **Russia***),
41 **P.V. Larionov, P.A. Filatov, A.A. Fomichev** (*Moscow Institute of Physics and
Technology, Moscow, JSC LASEX, Dolgoprudny, **Russia***)
Flight Tests of a Compact INS/GNSS Navigation System
- 11.20–11.40 63. **Cheng Li, Bo Yang, Xiang Zheng, Zhenyu Sun, Luqiang Zhou**
(*School of Instrument Science and Engineering Southeast University (SEU),
107 Nanjing, **China***)
A Seismic-Grade Optical MEMS Accelerometer with Force Feedback Control

POSTER PAPERS¹

- 11.40–13.00 64. **S.V. Egorov** (*JSC Michurinsky Plant “Progress”, Michurinsk, **Russia***)
Design of a Sensitive Element of a Wave Solid-State Gyroscope with a Wine Glass
17 Metal Resonator
65. **Qiao Tan, Xuefeng Wang** (*Beijing Institute of Aerospace Control Devices,
Beijing, **China***)
109 The Asymmetry of Geometric Parameters’ Effects on the Frequency Split of a
Hemispherical Resonator
66. **V.V. Matveev, V.V. Likhosherst, V.Ya. Raspopov, D.S. Streltsov** (*Tula State
20 University, Tula, **Russia***)
Parameter Identification of a Wave Solid-State Gyroscope with a Metal Resonator
under Positional Excitation of a Standing Wave
67. **K. Yang, X. Tang, Y. Pan, Y. Jia, L. Zeng, Y. Tao** (*National University of
Defense Technology, Changsha, **China***)
10 Investigation on Influence of Surface Roughness on Q Factor of Cylindrical
Resonator with Surface Metallization
68. **S.E. Perelyaev** (*Ishlinsky Institute for Problems in Mechanics, RAS, Moscow,
Russia*), **B.P. Bodunov, S.B. Bodunov** (*JSC RPE «MEDICON», Miass, **Russia***)
36 Navigation Grade Wave Solid-State Gyro for Air-Space Applications
69. **Wenming Zhang, Haoyu Gu, Zhihui Lin, Qi Wei, Bin Zhou, Rong Zhang**
(*Department of Precision Instrument Tsinghua University, Beijing, **China***)
114 The High Precision Synchronous Trimming Method for Fused Silica Hemispherical
Resonator

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70. **A.A. Maslov, D.A. Maslov, I.V. Merkurjev, V.V. Podalkov** (*National Research University MPEI, Moscow, Russia*)
 24 Scale Factor of Wave Solid-State Gyroscope Operating in the Angular Velocity Sensor Mode
71. **M.A. Basarab, A.V. Proletarskiy** (*Bauman Moscow State Technical University, Moscow, Russia*), **B.S. Lunin** (*Lomonosov Moscow State University, Moscow, Russia*), **A. Giani, P. Combette, A. Kechaf** (*University of Montpellier, Institut d'Electronique et des Systèmes (IES), Montpellier, France*)
 26 Simulation of the Gas Flow Gyrometer Using the Meshless Techniques
72. **K. Delong, C. Weiting, W. Jeying, P. Dongliang, L. Weiren, Z. Xiaoming** (*Tianjin Navigation and Instrument Institute, China*)
 104 Method for Shifting Laser Frequency of Atomic Gravimeter Based on Optical Phase-Locking
73. **Dong Lihong, Wang Jianlong, Gao Hongyu, Zhang Junfeng, Liu Xiaoyan, Pei Chuang, Liu Weiren, Zhao Xiaoming** (*Tianjin Navigation and Instrument Institute, China*)
 105 Study of the Relation Between Spin Polarization and Pumping Power in Atomic Spin Gyroscope
74. **D.G. Gryazin** (*Concern CSRI Elektropribor, JSC, ITMO University, St. Petersburg, Russia*), **T.V. Paderina** (*Concern CSRI Elektropribor, JSC, St. Petersburg, Russia*)
 78 Electronic Marine Roll and Trim Meter Based on MEMS IMU
75. **Yinan Zhang, Haoyu Gu, Qi Wei, Rong Zhang** (*Department of Precision Instrument Tsinghua University Beijing, China*)
 110 A System-Level Synthetical Modeling Method for Lissajous Frequency-Modulated MEMS Gyroscope
76. **Yu.N. Korkishko, V.A. Fedorov, S.V. Prilutskiy, D.V. Obuhovich, V.E. Prilutskiy, V.G. Ponomarev, I.V. Fedorov, A.I. Zuev, V.K. Varnakov, S.M. Kostritskii, I.V. Morev** (*Optolink RPC LLC, Zelenograd, Russia*)
 23 Miniature Inertial Measurement Units IMU200 and IMU400 Based on FOG with MEMS-Accelerometers: Development and Studying of Characteristics
77. **A.V. Kalikanov, V.Ya. Raspopov, V.V. Matveev, V.V. Likhosherst, M.G. Pogorelov** (*Tula State University, Tula, Russia*)
 56 Studying the Feasibility of Constructing a Roll-Angle Sensor Based on Coriolis Vibratory Gyroscopes
78. **A.V. Bolshakova, A.M. Boronachin, E.D. Bokhman, D.Yu. Larionov, L.N. Podgornaya, A.N. Tkachenko, R.V. Shalymov** (*St. Petersburg Electrotechnical University LETI, St. Petersburg, Russia*)
 74 A possibility of Using Data of Inertial Sensors for Long-Length Rail Unevenness Detection
79. **D.M. Kalikhman, E.A. Deputatova** (*Branch of Academician Pilyugin Center – Production Association “Korpus”, Saratov, Russia*), **S.V. Pchelintseva, V.O. Gorbachev** (*Yuri Gagarin State Technical University of Saratov, Saratov, Russia*), **V.M. Nikiforov** (*Academician Pilyugin Center, Moscow, Russia*)
 16 Development of a Design Concept for a Class of Precision Mechatronic Test Benches with Inertial Sensing Elements Combined with Precision Angle Sensors

13.00–14.00

LUNCH

PLENARY PAPER

- 14.00–14.20 80. **Da Li** (*College of Intelligent Systems Science and Engineering, Harbin Engineer University, Harbin, Tianjin Navigation Instrument Research Institute, Tianjin, China*), **Lin Zhao** (*College of Intelligent Systems Science and Engineering, Harbin Engineer University, Harbin, China*), **Hai-na Weng, Hong-wei Gao** (*Tianjin Navigation Instrument Research Institute, Laboratory of Science and Technology on Marine Navigation and Control of China State Shipbuilding Corporation, Tianjin, China*), **103 Cheng-suo Li** (*Tianjin Navigation Instrument Research Institute, Tianjin, China*), **Zhong Li** (*Tianjin Navigation Instrument Research Institute, Laboratory of Science and Technology on Marine Navigation and Control of China State Shipbuilding Corporation, Tianjin, China*)
Data Processing Method of Dynamic Gravity Gradiometer Based on Time-Frequency Combination

POSTER PAPERS¹

- 14.20–15.50 81. **E.A. Petrukhin** (*JSC Serpukhov plant “Metallist”, Serpukhov, Russia*),
9 **A.S. Bessonov** (*MIREA - Russian Technological University, Moscow, Russia*)
Effect of Diffraction Nonreciprocity in a Laser Gyro
82. **P. Zhang, J.Q. Wang, H.G. Chen, W. Hong, Y.J. Li, B. Huang, W. Jiang, G. Wang** (*No.16 Institute The 9th Academy China Aerospace Science and Technology Corporation, Xi’an; China*)
102 Research on the Technology for Suppressing Shupe Error of Fiber Optic Gyroscope Based on Structure That Integrates Thermal Conduction and Insulation
- 101 83. **H.G. Chen, J.Q.Wang, P. Zhang, W. Jiang, H. Chen** (*No.16 Institute The 9th Academy China Aerospace Science and Technology Corporation, Xi’an; China*)
Research on Rapid Thermal Balance Technology of Fiber Coil
84. **P.A. Filatov** (*Moscow Institute of Physics and Technology, Moscow, Russia*),
38 **A.A. Fomichev** (*Moscow Institute of Physics and Technology, Moscow, Russia*), **JSC LASEX, Dolgoprudniy, Russia**), **A.B. Tarasenko** (*Moscow Institute of Physics and Technology, Moscow, Russia*), **A.D. Morozov, P.V. Larionov** (*JSC LASEX, Dolgoprudniy, Russia*), **I.S. Kruzhilin** (*Moscow Institute of Physics and Technology, Moscow, Russia*)
Evaluation of the Accuracy of a Navigation System Based on Laser Gyroscopes with a Flat Contour and Q-Flex Type Accelerometers
85. **G.O. Barantsev, A.V. Kozlov** (*Lomonosov Moscow State University, Moscow, Russia*), **I.Kh. Shaimardanov, A.V. Nekrasov** (*JSC “Inertial Technologies of Technocomplex”, Ramenskoye, Russia*)
47 Model of the Elastic Dynamic Vibrational Suspension Deformation of a Ring Laser Gyroscope and Method of Its Calibration
86. **A.V. Nebylov, A.A. Kuznetsov** (*Saint Petersburg State University of Aerospace Instrumentation, St. Petersburg, Russia*)
65 Analysis of the Methods Used to Determine the Maximum Control Error
87. **N. V. Tikhmenev, D. A. Bannikov, I. V. Knyazev** (*PJSC Elektropribor, Tambov, JSC GosNIIP, Moscow, Russia*)
57 The Effect of Induced Absorption on Lock-in of Frequencies in a Laser Gyroscope

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88. **N.V. Tikhmenev, D.A. Bannikov, S.E. Korshunov, I.G. Protsenko** (*PJSC Elektropribor, Tambov, JSC GosNIIP, Moscow, Russia*)
58 Measuring Losses of Ring-Laser Precision Mirrors
89. **Yu.Yu. Broslavets, A.A. Fomichev, E.A. Polukeev, V.G. Semenov, V.P. Surovtseva** (*Moscow Institute of Physics and Technology, Moscow, Russia, JSC "Lasex", Dolgoprudny, Russia*)
71 Multi-frequency YAG:Cr⁴⁺ Solid-State Laser Gyroscope, Perimeter Control and Dither Creation System, Operating Regimes
90. **Yu.Yu. Broslavets, V.G. Semenov, A.A. Fomichev, E.A. Polukeev** (*Moscow Institute of Physics and Technology, Moscow, Russia, JSC LASEX, Dolgoprudny, Russia*)
73 Four-frequency Zeeman Laser Gyro with Nonplanar Symmetric Resonator and Its Perimeter Control System
91. **I.N. Khokhlov, A.O. Sinelnikov, N.E. Fetisova** (*POLYUS Research Institute of M.F. Stelmakh, JSC, Moscow, Russia*)
87 Scale Factor Correction Model for Zeeman Laser Gyroscopes
92. **Ya.A. Zubarev, A.O. Sinelnikov, N.E. Fetisova** (*POLYUS Research Institute of M.F. Stelmakh, JSC, Moscow, Russia*)
88 Influence of Structural Elements on Temperature Deformations of the Zeeman Angular Velocity Sensor Perimeter
93. **M.A. Barulina, A.V. Golikov** (*Institute for Precision Mechanics and Control Problems of the RAS, Saratov, Russia*), **D.M. Kalikhman, L.Ya. Kalikhman, E.A. Deputatova** (*Branch of Academician Pilyugin Center – Production Association "Korpus", Saratov, Russia*)
15 Ensuring Temperature Stability of the Unit of Linear Acceleration Meters under Spaceflight Conditions
94. **V.M. Nikiforov, A.A. Gusev, K.A. Andreev, C.A. Osokin** (*Academician Pilyugin Center, Moscow, Russia*), **D.M. Kalikhman, A.A. Akmaev** (*Branch of Academician Pilyugin Center – Production Association "Korpus", Saratov, Russia*)
97 Optimisation of the Parameters of a Compensation Pendulous Accelerometer Controller
- Paper is recommended by the YSC Program Committee 95. **D.V. Ryl'ko, P.N. Nikolaev** (*Samara State University, Samara, Russia*)
An Onboard Algorithm for Determining SamSat-ION Nanosatellite Attitude
- Paper is recommended by the YSC Program Committee 96. **D.A. Gontar', E.V. Dranitsyna** (*Concern CSRI Elektropribor, JSC; ITMO University, St. Petersburg, Russia*)
Comparison of Various Machine Learning Methods for Fiber-Optic Gyroscope Temperature Compensation
- Paper is recommended by the YSC Program Committee 97. **D.G. Gilev** (*Perm State National Research University (PGNIU); Perm National Research Polytechnic University (PNIPU), Perm, Russia*), **V.V. Krishtop**
Resonance Peak Approximation Method for Noise Minimization in Angular Rate Sensor
- Paper is recommended by the YSC Program Committee 98. **E.A. Popov** (*ITELMA Research and Production Company Ltd, Moscow, Russia*), **G.Yu. Kiryachenko** (*Central Research Institute of Automation and Hydraulics (CNIAG), JSC, Moscow, Russia*), **Yu.G. Egorov** (*Bauman Moscow State Technical University, Moscow, Russia*)
Study of Invariant Calibration Programs for Vector Sensor

15.50–16.20

COFFEE BREAK

SESSION IV – RELEVANT ISSUES OF THEORY

PLENARY PAPER

- 16.20–16.40 99. **V.F. Zhuravlev, S.E. Pereliaev** (*Ishlinsky Institute for Problems in Mechanics, RAS, Moscow, **Russia***)
37 Spatial Effect of Elastic Waves Inertness on a Sphere. Technical Applications in Modern Gyroscopy
- 16.40–17.00 100. **Maoran Zhu, Yuanxin Wu** (*Shanghai Jiao Tong University, Shanghai, **China***)
45 Lightweight Precision Inertial Computation based on Chebyshev Polynomial Optimization

POSTER PAPERS¹

- 17.00–17.30 101. **Yu.N. Chelnokov** (*Institute for Precision Mechanics and Control Problems of the RAS, Saratov, **Russia***), **S.E. Perelyaev** (*Ishlinsky Institute for Problems in Mechanics, RAS, Moscow, **Russia***)
4 Equations and Algorithms of Strapdown Inertial Navigation Systems to Determine Apparent, Gravitational and Relative Velocities of a Moving Object and the Geographical Coordinates of the Object's Location
- 5 102. **Yu.N. Chelnokov, M.Yu. Loginov** (*Institute for Precision Mechanics and Control Problems of the RAS, Saratov, **Russia***)
Prediction and Correction of Spacecraft Motion Based on the Solutions of Regular Quaternion Equations in *KS*-Variables and Isochronous Derivatives
- 52 103. **I.V. Papkova, A.V. Krysko, V.A. Krysko** (*Yuri Gagarin State Technical University of Saratov, Saratov, **Russia***)
General Theory of Porous Functionally Gradient MEMS/NEMS Beam Resonators Subjected to Temperature Field
- 53 104. **R.V. Ermakov** (*Yuri Gagarin State Technical University of Saratov, Saratov, **Russia***), **D.V. Kondratov** (*Yuri Gagarin State Technical University Saratov, Institute of Precision Mechanics and Control, RAS, Saratov, **Russia***), **A.A. L'vov, D.Y. Livshits** (*Yuri Gagarin State Technical University of Saratov, Saratov, **Russia***)
Refinement of the Wave Solid-State Gyro Vibrational Error Model
- 93 105. **A. Mikov, S. Reginya, A. Moschevikin** (*Petrozavodsk State University, **Russia***)
Bayesian Estimation: the Comparison of EKF, IEKF, SPKF, ISKPF and PF Estimates for Unimodal and Bimodal Posterior Distributions
106. **O.S. Amosov, S.G. Amosova** (*V.A. Trapeznikov Institute of Control Science of the RAS, Moscow, **Russia***)
70 Machine Learning with Reinforcement for Optimal and Adaptive Estimation Problems in Navigation Applications

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WEDNESDAY, 1 JUNE

SESSION - SATELLITE NAVIGATION SYSTEMS

PLENARY PAPER

- 9.30–9.50 107. **N.S. Gujva** (*Cognitive Technologies, Moscow, NITU «MISIS», Moscow, **Russia***),
M.G. Lobanov, V.E. Prun (*Cognitive Technologies, Moscow, **Russia***),
19 **R.N. Sadekov, V.V. Postnikov** (*Cognitive Technologies, Moscow, NITU «MISIS»,
Moscow, **Russia***)
Using 3D Networks to Predict Models of Vehicle Behavior in Self-Driving Tram
Task
- 9.50–10.10 108. **Saraswathi Sirikonda, Srinu Chittimalla, Laxminarayana Parayitam** (*NERTU,
Osmania University, Hyderabad, **India***)
59 Positional Performance of NavIC Software Receiver with Inertial Sensor
Measurements
- 10.10–10.30 109. **Bo Lu** (*Beijing Aerospace Automatic Control Institute (BAACI), **China***)
Double Residual Networks with Regional Position Encoding for Weak GNSS
111 Signal Acquisition

POSTER PAPERS¹

- 10.30–11.15 110. **V. B. Ilyin, I.A. Kopylov, E.G. Kharin, V. A. Kopelovich, A. F. Yakushev,
P. Yu. Zhabin** (*Gromov Flight Research Institute, Zhukovsky, **Russia***)
13 Flight Tests of Onboard SNS Equipment Characteristics during Operation with
Different Global Navigation Satellite Systems
111. **O.V. Minina, A.V. Prohortsov, V.A. Smirnov** (*Tula State University, **Russia***)
Highly Accurate Method of Determining the Angular Orientation of Unmanned
43 Aircraft by Signals of Satellite Navigation System
112. **D.A. Bedin** (*N.N. Krasovskii Institute of Mathematics and Mechanics of the Ural
Branch of the RAS, Yekaterinburg, **Russia***)
44 Positioning by Pseudorange Measurements Using the Bancroft Method:
Approaches to the Description of the Nonlinear Error Distribution
113. **J. Cheng, J. Li, C. Jiang, J. Jiang, C. Jia** (*College of Intelligent Systems Science
and Engineering, Harbin Engineering University (HEU), Harbin, **China***)
46 Assessment of BDS-3 Global Real-Time Kinematic Positioning Availability Based
on Redundant Dual-Receiver Configuration
114. **Jianhua Cheng, Chao Jiang, Jiaxiang Li, Jiachang Jiang, Chun Jia** (*College of
Automation, Harbin Engineering University, Harbin, **China***)
49 Performance Analysis Global Ambiguity Resolution for Beidou Satellite
Navigation System
115. **S.D. Petrov, P.V. Movsesian** (*Saint Petersburg State University, Saint Petersburg,
Russia*), **I.V. Chekunov, V.A. Usachev** (*Bauman Moscow State Technical
63 University, Moscow, **Russia***)
Control of the Pseudophase Continuity of Navigation Satellite Signals by
Integration with Clocks and Inertial Systems

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116. **A.A. Kumarin, S.V. Shafran, D.S. Malahov, I.A. Kudryavtsev** (*Samara University, Samara, **Russia***)
76 Navigation Receiver Signal Tracking Module Correction Based on Motion Data
117. **V.I. Baburov, N.V. Vasileva** (*Navigator, JSC, St. Petersburg, **Russia***),
N.V. Ivantsevich (*Navigator, JSC, St. Petersburg, D.F. Ustinov Baltic State Technical University “Voenmeh”, Saint Petersburg, **Russia***)
85 A study of the Coordinate Correction Method in GNSS Positioning Using Two Satellite Systems
118. **A.V. Nemov** (*Russian Institute of Radionavigation and Time, St. Petersburg, **Russia***), **D.Yu. Tyufiyakov** (*AO “KB NAVIS”, St. Petersburg, **Russia***)
б/н Algorithms for Estimating the Number of Signals in Data Samples Processed by GNSS Digital Antenna Arrays

11.15–11.45 COFFEE BREAK

11.45–13.00

**PANEL DISCUSSION:
 Navigational Support in the Moon Development**

Presentations:

13.00–13.15 **DISCUSSION**

15.15–13.30 **CLOSING CEREMONY**

13.30–14.30 LUNCH