Allan Variance Analysis of Random Noise Modes in Gyroscopes

Alexander A. Trusov, Ph.D.

Alex.Trusov@gmail.com, AlexanderTrusov.com, MEMS.eng.uci.edu

MicroSystems Laboratory, Mechanical and Aerospace Engineering

University of California, Irvine, CA, 92697, USA

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Valeri V. Chikovani

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Whole-Angle MEMS Gyroscopes Doruk Senkal, Andrei M. Shkel, 2020-06-16 Presents the mathematical framework technical language and control systems know how needed to design develop and instrument micro scale whole angle gyroscopes This comprehensive reference covers the technical fundamentals mathematical framework and common control strategies for degenerate mode gyroscopes which are used in high precision navigation applications It explores various energy loss mechanisms and the effect of structural imperfections along with requirements for continuous rate integrating gyroscope operation It also provides information on the fabrication of MEMS whole angle gyroscopes and the best methods of sustaining oscillations Whole Angle Gyroscopes Challenges and Opportunities begins with a brief overview of the two main types of Coriolis Vibratory Gyroscopes CVGs non degenerate mode gyroscopes and degenerate mode gyroscopes It then introduces readers to the Foucault Pendulum analogy and a review of MEMS whole angle mode gyroscope development Chapters cover dynamics of whole angle coriolis vibratory gyroscopes fabrication of whole angle coriolis vibratory gyroscopes energy loss mechanisms of coriolis vibratory gyroscopes and control strategies for whole angle coriolis vibratory gyro scopes The book finishes with a chapter on conventionally machined micro machined gyroscopes followed by one on micro wineglass gyroscopes In addition the book Lowers barrier to entry for aspiring scientists and engineers by providing a solid understanding of the fundamentals and control strategies of degenerate mode gyroscopes Organizes mode matched mechanical gyroscopes based on three classifications wine glass ring disk and mass spring mechanical elements Includes case studies on conventionally micro machined and 3 D micro machined gyroscopes Whole Angle Gyroscopes is an ideal book for researchers scientists engineers and college graduate students involved in the technology It will also be of great benefit to engineers in control systems MEMS production electronics and semi conductors who work with inertial sensors

Vibratory Gyroscopes Based on Micro-Electro-Mechanical and non-Micro-Electro-Mechanical Systems Valeri V. Chikovani,2023-12-15 This book provides a unified approach for the two versions of Coriolis vibratory gyroscopes Micro Electro Mechanical System MEMS and non MEMS It describes a new differential mode of operation analyzing the new triple mode gyro rate rate integrating and differential The latter provides the gyro with an increased versatility by providing the maximum possible accuracy under changeable motion parameters and environmental conditions The book also presents computer simulation experiments and test results on the rejection of external disturbances and considers the fabrication processes of MEMS metallic and quartz resonators It will interest researchers scientists engineers and students specializing in the field of inertial sensors as well as engineers of digital control systems and inertial sensors test engineers It can also be used as a reference book when designing vibratory gyros

Advances in Intelligent Systems and Computing IV

Natalya Shakhovska, Mykola O. Medykovskyy, 2019-11-01 This book reports on new theories and applications in the field of intelligent systems and computing It covers computational and artificial intelligence methods as well as advances in

computer vision current issues in big data and cloud computing computation linguistics and cyber physical systems It also reports on important topics in intelligent information management Written by active researchers the respective chapters are based on selected papers presented at the XIV International Scientific and Technical Conference on Computer Science and Information Technologies CSIT 2019 held on September 17 20 2019 in Lviv Ukraine The conference was jointly organized by the Lviv Polytechnic National University Ukraine the Kharkiv National University of Radio Electronics Ukraine and the Technical University of Lodz Poland under patronage of Ministry of Education and Science of Ukraine Given its breadth of coverage the book provides academics and professionals with extensive information and a timely snapshot of the field of intelligent systems and is sure to foster new discussions and collaborations among different groups Guidance, Navigation and Control Liang Yan, Haibin Duan, Yimin Deng, 2025-02-27 This book features the latest theoretical results and techniques in the field of guidance navigation and control GNC of vehicles and aircrafts It covers a wide range of topics including but not limited to intelligent computing communication and control new methods of navigation estimation and tracking control of multiple moving objects manned and autonomous unmanned systems guidance navigation and control of miniature aircraft and sensor systems for quidance navigation and control etc Presenting recent advances in the form of illustrations tables and text it also provides detailed information of a number of the studies to offer readers insights for their own research In addition the book addresses fundamental concepts and studies in the development of GNC making it a valuable resource for both beginners and researchers wanting to further their understanding of guidance navigation and The Fiber-Optic Gyroscope, Second Micromachining Technology for Micro-optics and Nano-optics, 2004 control Edition Herve C. Lefevre, 2014-10-01 Written by one of the field's leading experts this landmark reference presents a thorough system analysis of the fiber optic gyroscope FOG describing the concepts that have emerged as the preferred solutions for obtaining a practical device This book s first edition was published in the early 1990 s If the basic design rules of the FOG have remained unchanged the technology has certainly matured and the expectations presented in the first edition have been largely exceeded This second edition is updated throughout featuring new content on Allan variance testing with optical coherence domain polarimetry the Shupe effect and rare Earth doped fiber ASE sources In addition brand new comprehensive appendixes cover the optics single mode fiber optics and integrated optics necessary to understand the fiber gyro and provide an appropriate vocabulary for communicating with electronic component designers Fiber Optic and Laser Sensors ,1993 Government Reports Announcements & Index ,1978-06 Science Abstracts .1993 The Fiber-Optic Gyroscope, Third Edition Herve C. Lefevre, 2022-01-31 This landmark work considered by many in the field to be THE reference on fiber optic gyroscopes FOGs provides you with a complete and thorough system analysis of the FOG and remains unmatched by any other single source Now in its third edition this fully updated and authoritative book Gives you access to all the details you need to know about optics single mode fiber optics and integrated

optics to fully grasp the design rules of the fiber optic gyroscope Helps you understand the concepts that have emerged as the preferred solutions to obtain a practical device Guides you through the advances that have occurred in the last seven years since the previous edition was published and how they are implemented in the current FOGs Drawing on 45 years of research and development The Fiber Optic Gyroscope Third Edition features new content on the relationship between white noise power spectral density and random walk Allan variance testing with optical coherence domain polarimetry a new simple mechanical model of the thermally induced stresses and related strains in the sensing coil simple viewing of the reduction of the Shupe effect with symmetrical windings and comments about dispersion and birefringence dispersion The book contains over 350 illustrations including 70 new figures and many helpful appendixes and gives you everything you need to understand the fiber gyro The author is a leading expert in this field and is one of the early pioneers of the practical optical architecture and signal processing technique that is universally used in today s FOGs This is a must have reference for anyone working with FOGs from students and academics learning about the device to optoelectronics engineers and professionals needing to stay abreast of the current concepts and recent advances **Dual-Polarization Two-Port Fiber-Optic Gyroscope** Zinan Wang, 2017-03-23 This thesis demonstrates and investigates novel dual polarization interferometric fiber optic gyroscope IFOG configurations which utilize optical compensation between two orthogonal polarizations to suppress errors caused by polarization nonreciprocity Further it provides a scheme for dual polarization two port IFOGs and details their unique benefits Dual polarization IFOGs break through the restriction of the minimal scheme which conventional IFOGs are based on These innovative new IFOGs have unique properties. They require no polarizer and have two ports available for signal detection As such they open new avenues for IFOGs to achieve lower costs and higher Investigation of Allan Variance for Determining Noise Spectral Forms with Application to Microwave sensitivity Radiometry National Aeronautics and Space Administration (NASA), 2018-07-08 An investigation of the Allan variance method as a possible means for characterizing fluctuations in radiometric noise diodes has been performed. The goal is to separate fluctuation components into white noise flicker noise and random walk noise The primary means is by discrete time processing and the study focused primarily on the digital processes involved Noise satisfying the requirements was generated by direct convolution fast Fourier transformation FFT processing in the time domain and FFT processing in the frequency domain Some of the numerous results obtained are presented along with the programs used in the study Stanley William D Unspecified Center Allan Variance Estimated by Phase Noise Measurements ,2004 For short measurement times the Allan or two sample variance can be determined from the phase noise using the mathematical conversion between time and frequency domain This provides us with a useful tool to obtain the very short term frequency stability in the time domain which is difficult for a time interval counter to measure because of its resolution limitations Before carrying out the conversion bias from the measurement system and uncorrelated noises to the DUT device under test

e g power noise and environmental perturbations are considered and corrected in the raw data By doing this the proper characteristic of the DUT seems to be revealed reasonably If the above mentioned bias and noises were not corrected the generated variance would be apart from the corrected one irregularly depending on the sampling time In this paper both the numerical integration and the power law model are used to practice the conversion

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