System metrology: metrological systems and metrology of systems

V.A.Granovsky.

350 p.
Saint-Petersburg, CSRI "Elektropribor"

The book considers metrology both as a pure and application-oriented science basing on a system approach. The discussion is prefaced with the basics of the general theory of systems. Metrological problems of systems modeling are considered on the basis of the analysis of the conception of a system. It is shown that in the system information plays a role of an integral factor and control - an integral function. The essence of the system study is shown by the example of metrology.

The measurement traceability system (MTS) is dealt with as the basic metrological system. Its place in the measurement control system and national measurement system, the metasystems that rank next in the level, is shown. The structures of purposes, functions and subjects of the MTS are revealed, with emphasis on spacial(territorial) aspect or the level of localization.

The problem of centralization and decentralization are analyzed in the context of control in the MTS.

The structure and the scope of the problems of the main MTS subsystems: scientific, technical, organizational and legal are considered. Metrology of measuring systems, measuring information systems and measuring control systems were subjected to the methodological analysis. The advisability of applying the principles of metrological control to measuring information and control systems is justified. Measuring systems and measuring information systems are classified. A generalized structure of measuring control system including a measuring and information subsystems is presented. The role of classification as a general system function has been revealed. The necessity of estimating semantic information is shown, the requirements to estimates have been formulated, the relations used for estimation, as applied to the procedure of alternative and two-alternative check-in procedure, have been proposed.

The system outlook for the development of metrology is justified as a consequence of the present-day tendencies.

The discussion is illustrated with examples from measurements in navigation. A number of metrological problems are presented as a generalization of peculiarities of navigational measurements.

The book is intended for specialists of different branches of industry or science that make use of sophisticated measuring systems and complexes, as well as for

designers of this kind of instrumentation. The book can be used by students and postgraduates who study the present-day metrology.

References: 166. Illustrations: 35.

CONTENTS

7.2. The regional system of the measurement traceability
7.3. Interrelation of spatial and subject-matter aspects

Chapter 8. Control in the measurement traceability system: centralization and decentralization

8.1. The measurement traceability system as a controllable organizational and technical system
8.2. The principles of centralization and decentralization in the development of measurement traceability systems
8.3. The sphere of primarily centralized control
8.4. The sphere of decentralized control

Chapter 9. Scientific metrology subsystem

9.1.Scientific metrology as a measurement traceability subsystem
9.2. Theoretical metrology and the theory of measurements
9.3. The structure of theoretical metrology subjects

Chapter 10. The technical subsystem of metrology

10.1. Classification of metrological instruments
10.2. International reference standards
10.3. The national system of reference standards
10.4. Reference materials, calibration blocks and standard reference data

Chapter 11. Organizational subsystem of metrology

11.1. Metrological activity
11.2.Interrelation of metrology and standartization
11.3. Organizational realization of metrology purposes and metrological functions
11.4. The international organizational and procedural system of metrology
11.5. The national system of organization of metrological activity

Chapter 12. The legal subsystem of metrology

12.1.Interrelation of the legal and organizational subsystems: the system level and the status of a metrological document

Part 3. METROLOGY OF MEASURING, MEASURING INFARMATION AND MEASURING CONTROL SYSTEMS

Chapter 13. Measuring systems

13.1 The concept of a measuring system: a measuring system as a aggregation of measuring instruments
13.2. Classification of measuring systems
13.3. Insurance of uniformity of measuring instruments

Chapter 14. Measuring information systems

14.1. The concept of a measuring information systems
14.2. Classification of measuring information systems
14.3. Measuring and information functions of a system
14.4. Assignment indices for a measuring information system

356 p.
Saint-Petersburg, CSRI "Elektropribor"

The book deals with integrated orientation and navigation systems (IONS) which are the main source of information of automatic motion control systems of marine vehicles.

The purpose and the basic design of IONS are considered, the algorithms for the operation of strapdown inertial measurement units (SIMU) and receivers of spacecraft navigation systems (SNS) are given**.** The purpose and the problems solved by electronic chart display information systems (ECDIS) are described. The SIMU mathematical error models based on different types of gyroscopes and gyroless SIMU are presented, as well as IONS error models for alignment and calibration modes, autonomous and observation operational modes.

The state of the art in the development of the main modules of IONS, in particular, SIMU sensitive elements, receivers of SNS and ECDIS is reviewed. The present-day requirements are formulated and structure of IONS for ships and vessels of various classes is described.

The accuracy in generation of navigational and dynamic motion parameters of marine vehicles provided by IONS based on SIMU with electrostatic, laser and fiber-optic gyros, as well as gyroless SIMU with angular accelerometers is analysed. A mathematical model, analytical expressions for errors and the results of computational error modeling are given for each of IONS considered in the book.

The book is intended for engineers, technicians and researchers engaged in marine engineering, navigation and marine motion control problems. The book can be used by teachers, postgraduates and senior students of naval schools.

References: 79. Illustrations: 71.

The book review published in journal "Gyroscopy and Navigation" No 1(28), 2000.

CONTENTS

Appendices