1. Record Nr. UNINA9910483666403321

Autore	Yang Tingwu
Titolo	Telemetry theory and methods in flight test / / Tingwu Yang ; translated by Yufeng Yang, Ting Zhang
Pubbl/distr/stampa	Gateway East, Singapore : , : Springer, , [2021] ©2021
ISBN	981-334-737-6
Descrizione fisica	1 online resource (475 pages)
Disciplina	621.379
Soggetti	Aerospace telemetry
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Preface -- Brief Introduction of the Content -- Terms and Definitions -- 1 Equipment Terms -- 2 Telemetry Terms -- 3 Data Processing Terms -- 4 Terms About Measurement Error and Uncertainty -- Contents -- 1 Overview -- 1.1 Introduction -- 1.2 Aeronautical Flight Test -- 1.3 Measurement During Aeronautical Test Flight -- 1.4 Flight Test Telemetry -- 1.4.1 Basic Concepts -- 1.4.2 Function -- 1.4.3 Characteristics -- 1.4.4 Main Equipment Used for Flight Test Telemetry -- 1.4.5 General Operating Procedure of Flight Test Telemetry -- References -- 2 Basic Theory of Flight Test Telemetry -- 2.1 Signals and Noises -- 2.1.1 Signals [1, 2] -- 2.1.2 Method of System Response Analysis -- 2.1.3 Random Process -- 2.1.4 System Transmission Characteristics -- 2.1.5 Noises -- 2.2 Analysis of Time-Domain Discrete Signals [3, 4] -- 2.2.1 Time-Domain Discrete Signals -- 2.2.2 Time-Domain Discrete System -- 2.2.3 Linear Constant-Coefficient Differential Equations -- 2.2.4 Fourier-Series Transform of Sequence -- 2.2.5 Z-Series Transform -- 2.2.6 Discrete Fourier Transform -- 2.2.7 Fast Fourier Transform and Inverse Transformation -- 2.2.8 Wavelet [5, 6] -- 2.3 Parameter Estimation -- 2.3.1 Least-Squared Estimation [8, 9] -- 2.3.2 Maximum Likelihood Estimation -- 2.3.3 Optimization Algorithm Without Restraint [11, 12] -- 2.4 Fuzzy Mathematic Theory [9, 13] -- 2.4.1 Basic Concepts of Fuzzy Mathematics and Comprehensive Evaluation -- 2.4.2 Fuzzy Set and Its Computation -- 2.4.3 Fuzzy Relation and Its Operation --

2.5 Error and Error Propagation Law -- 2.5.1 Test Error -- 2.5.2 Statistic Characteristics of Random Errors -- 2.5.3 Precision Index -- 2.5.4 Generalized Error Propagation Law -- 2.5.5 System Error Index -- 2.5.6 Correlations of Terms Related to Degree of Test Precision -- References -- 3 Aviation Sensors and Their Calibration.
3.1 Introduction to Sensors -- 3.1.1 Definition of Sensors -- 3.1.2 Characteristics of Sensors [3] -- 3.1.3 Static Characteristics of Sensors [3] -- 3.1.4 Dynamic Characteristics of Sensors -- 3.2 Airborne Sensors -- 3.2.1 Altitude Sensor and Speed Sensor -- 3.2.2 Pressure Sensor -- 3.2.3 Force Sensors -- 3.2.4 Linear Acceleration Sensor -- 3.2.5 Angular Speed Sensors -- 3.2.6 Aircraft Attitude and Heading Sensor -- 3.2.7 AOA and SSA Sensors -- 3.2.8 Displacement Sensor -- 3.2.9 Temperature Sensor -- 3.2.10 Flow Sensor -- 3.2.11 Sensors Measuring Aircraft Power Characteristics -- 3.2.12 Vibrating Sensors -- 3.2.13 Other Sensors (Systems) -- 3.2.14 How to Choose a Sensor -- 3.3 Sensor Calibration -- 3.3.1 Types of Sensor Calibration -- 3.3.2 Non-Linear Regression Calibration Model -- 3.3.3 Neural Network Calibration Model [8] -- 3.3.4 Calibration Model of Inertial Navigation System [9] -- 3.4 New Types of Sensors -- 3.4.1 Smart Sensors [10] -- 3.4.2 New Principle Sensors -- 3.4.3 Sensors Using New Technologies -- References -- 4 Airborne Data Acquisition and Recording -- 4.1 Overview -- 4.1.1 Types of Airborne Data -- 4.1.2 Primary Performance and Structure of the Data Acquisition System -- 4.2 Signal Conditioning and Filtering -- 4.2.1 Signal Conditioning -- 4.2.2 Signal Filtering -- 4.3 Synchronous Sampling -- 4.3.1 Sampling, Quantizing, and Encoding -- 4.3.2 Multichannel Synchronous Sampling -- 4.3.3 PCM Data Frames -- 4.4 Data Acquisition -- 4.4.1 PCM Data Acquisition -- 4.4.2 Network Data Acquisition -- 4.4.3 Comparison -- 4.5 Data Transmission -- 4.5.1 Time-Division Multiplexing (TDM) -- 4.5.2 Wavelength Division Multiplexing (WDM) -- 4.6 Data Recording -- 4.6.1 Data Recording Types -- 4.6.2 Airborne Solid State Recorder -- 4.7 Network Performance -- 4.7.1 Methods for Detecting Network Performance -- 4.7.2 Performance Detection Indexes.
4.8 Wireless Sensor Network -- 4.8.1 Concept of Wireless Sensor Network -- 4.8.2 Wireless Sensor Network Architecture -- 4.8.3 Wireless Network Properties -- 4.8.4 The Wireless Sensor Data Acquisition Network -- References -- 5 Telemetry Information Transmission -- 5.1 Wireless Channel -- 5.1.1 Relevant Terms and Their Relations -- 5.1.2 Influence of Earth Curvature on Visibility Distance -- 5.1.3 Transmission Loss of Radio Wave -- 5.2 Signal Modulation [2] -- 5.2.1 Modulation Methods -- 5.2.2 Analog Modulation -- 5.2.3 Digital Modulation -- 5.2.4 SOQPSK Modulation -- 5.2.5 OFDM Modulation -- 5.3 Multichannel Transmission -- 5.3.1 Introduction -- 5.3.2 Frequency-Division Multiplexing -- 5.3.3 Time-Division Multiplexing -- 5.3.4 Code-Division Multiplexing -- 5.3.5 Characteristics of Multichannel Transmission -- 5.3.6 Multi-carrier OFDM/TDMA Transmission -- 5.3.7 Single Carrier OFDM/TDMA Transmission -- 5.4 Transmitting and Receiving -- 5.4.1 Channel Coding -- 5.4.2 Source Coding -- 5.4.3 PCM Data Transmitting and Receiving System [12] -- 5.5 Security of Transmission Link -- 5.5.1 AES Algorithm -- 5.5.2 Hierarchical Protection -- References -- 6 Telemetry Data Processing and Analysis -- 6.1 Telemetry Data Pre-processing -- 6.1.1 Gross Error Filtering Algorithm -- 6.1.2 Gross Error Group Point Filtering Algorithm -- 6.1.3 Interpolation -- 6.1.4 Spline Function -- 6.1.5 Curve Fitting and Smoothing -- 6.2 Solving Algorithm of Non-linear Equation -- 6.2.1 Directly Solving Quadratic, Cubic, and Quartic Equations -- 6.2.2 Newton Solution for Transcendental Equations -- 6.2.3 Numerical Integration

and Numerical Differentiation -- 6.3 Vibration Signal Analysis Based on Fourier Transform [3] -- 6.3.1 Introduction -- 6.3.2 Fourier Transform -- 6.3.3 Vibration Characteristics Analysis Method [5] -- 6.3.4 Vibration Data Analysis.
6.4 Flutter Test Data Analysis Based on Wavelet [7] -- 6.4.1 Introduction -- 6.4.2 Multidimensional Laplace Wavelet [12, 13] -- 6.4.3 Numerical Emulation -- 6.4.4 Applications of Two-Dimensional Laplace Wavelet -- 6.4.5 Analysis of Flight Test Flutter Data -- 6.5 Flight Test Safety Monitoring -- 6.5.1 Data Processing in Real Time -- 6.5.2 Safety Monitoring in Real Time -- 6.6 Analysis of Measurement Uncertainty -- 6.6.1 Calculation Error -- 6.6.2 Measurement Uncertainty [14, 15] -- References -- 7 Test Data Management and Data Mining -- 7.1 Flight Test Data Management [1] -- 7.1.1 Characteristics of Flight Test Data -- 7.1.2 Service-Oriented Architecture (SOA) [2-4] -- 7.1.3 SOA-Based FTDMS [5] -- 7.1.4 Distributed Test Data System -- 7.2 Data Warehouse and Data Mining -- 7.2.1 Introduction to Data Warehouse -- 7.2.2 Structure and Characteristics of Data Warehouse -- 7.2.3 Data Mining -- 7.2.4 Clustering Reduction Method of Flight Test Data [11] -- 7.2.5 Fuzzy Comprehensive Evaluation Method of Flight Test Data -- 7.2.6 Visualization Data Mining Method -- 7.3 Application of Big Data and Cloud Technology [19, 20] -- 7.3.1 Proposing of Problems -- 7.3.2 Basic Concept of Cloud Computing -- 7.3.3 Cloud Computing in Flight Test -- 7.3.4 Development Trend -- References -- 8 Integrated Space-Ground Telemetry Network -- 8.1 Military Test Research Plan of U.S. DOD -- 8.1.1 Overview of Test Investment Plan -- 8.1.2 Test Integration Architecture -- 8.1.3 Basic Initiatives 2010 -- 8.1.4 Comprehensive National Cybersecurity Initiative -- 8.2 Integrated Telemetry Network -- 8.2.1 Introduction -- 8.2.2 Telemetry Networking Trend [8] -- 8.2.3 Network Architecture [9] -- 8.2.4 Real-Time Ethernet Transmission Protocol [9] -- 8.2.5 Time Synchronization -- 8.2.6 Network Data Packages -- 8.3 Prospect to Space-Ground Integrated Telemetry Network -- 8.3.1 System Structure.
8.3.2 Telemetry Network System -- 8.3.3 Networking of Telemetry System -- 8.3.4 Network System Management -- 8.4 Summary -- References -- Appendix A Time System -- A.1 Significance of Time System -- A.2 Concepts About Time System -- A.2.1 Universal Time System -- A.2.2 Atomic Time System -- A.2.3 Dynamical Time System -- A.2.4 GPS Time System -- A.2.4.1 Definition -- A.2.4.2 Relation Between GPST and Beijing Time System -- A.2.5 GLONASS Time System -- A.2.6 BDS Time System -- A.2.6.1 Relationship Between BDST and Beijing Time System -- A.2.6.2 BDS Positioning Function -- Appendix B Telemetry Standards -- B.1 IRIG106 Telemetry Standard -- B.1.1 IRIG106-07 Telemetry Standard -- B.1.2 IRIG106-09 Telemetry Standard -- B.1.2.1 IRIG106-09 Telemetry Standard (Part I) -- B.1.2.2 IRIG106-09 Telemetry Standard (Part II) -- B.2 China's Telemetry Standards -- B.3 Integrated Network Enhanced Telemetry (iNET) Standard -- B.3.1 Brief Introduction of iNET Standard -- B.3.2 Test Article (TA) Standard -- B.3.3 RF Network Element (RFNE) Standard -- B.3.4 Communication Link (CL) Standard -- B.3.5 Component Interface (CI) Standard -- B.3.6 System Management (SM) Standard -- B.3.7 Metadata (MD) Standard.