## Contents

**Part I Precise Orbit Determination and Positioning**

1. **Parametric Study of Solar Radiation Pressure Model Applying to Navigation Satellite Orbit Determination for Long Arc**  
   Qiuli Chen, Haihong Wang, Hui Yang and Zhonggui Chen  
   Page 3

2. **BDS/GNSS Real-Time Kinematic Precise Point Positioning with Un-differenced Ambiguity Resolution**  
   Lizhong Qu, Qile Zhao, Jing Guo, Guangxing Wang, Xiangxin Guo, Qiang Zhang, Kecai Jiang and Liang Luo  
   Page 13

3. **Characteristics Analysis of BeiDou Melbourne-Wübbena Combination**  
   Xiyang He and Xiaohong Zhang  
   Page 31

4. **Refining of BDS Differential Code Bias Model**  
   Qiankun Liu, Lifen Sui, Guorui Xiao, Yu Gan, Guobin Qi and Tian Zheng  
   Page 47

5. **Estimation Strategy and Accuracy Analysis of GNSS Real-Time Precise Satellite Clock Error**  
   Liang Chen, Changjiang Geng, Quan Zhou and Wenhai Jiao  
   Page 57

6. **Integrating BDS and GPS to Accelerate Convergence and Initialization Time of Precise Point Positioning**  
   Zongpeng Pan, Hongzhou Chai, Zehui Liu, Kefan Yang, Yang Chong and Yangyin Xu  
   Page 67

7. **Study on BeiDou Navigation Satellite Precise Orbit Determination Based on the Extended Kalman Filtering**  
   Yan Wang, Chuanding Zhang and Lijie Song  
   Page 81
8 Analysis of Multi-frequency BDS/GPS RTK Positioning .......................... 95
Yijun Tian, Dongqing Zhao, Shuangna Zhang, Zhiyong Huang and Hang Dong

9 Upper Atmospheric Density Retrieval from Accelerometer on Board GRACE Mission ......................................................... 105
Runjing Chen and Bibo Peng

10 Dynamic GPS Precise Point Positioning for Deformation Monitoring Using Prior Information .................................................. 117
Zhiping Liu, Ziqiang Zhao and Qiuzhao Zhang

11 Positioning Accuracy Analysis of Beidou Continuous Operation Tracking Stations .......................................................... 129
Xiangxin Guo, Qile Zhao, Shenghua Jiang and Min Li

12 A Parallel Processing Strategy of Large GNSS Data Based on Precise Point Positioning Model ............................................. 139
Yang Cui, Zhiping Lu, Hao Lu, Jian Li, Yupu Wang and Lingyong Huang

13 New Results of Multi-GNSS Orbits Validation Based on SLR Observations .............................................................. 149
Jinchao Xia, Geshi Tang, Chao Han, Jianfeng Cao, Hongzheng Cui and Xie Li

14 Study in BDS Uncombined PPP Ionospheric Delay Estimation and Differential Code Biases ...................................................... 161
Huarun Wang, Hongzhou Chai, Min Wang, Zongpeng Pan and Yang Chong

15 Research of KeyTechnology on the Combination of GPS, VLBI, SLR and DORIS Solution for Station Coordinates and ERPs .... 173
Min Li, Tian-he Xu and Hang Yu

16 Cycle-Slip Detection and Correction Based on Polynomial-Fitting Ionosphere-Free Combination and Ionospheric Total Electron Contents Rate .......................................................... 191
Ming Liu, Hongzhou Chai and Di Li

17 BDS and GPS Ultra-Short Baseline Measurement Performance Comparison and Analysis ..................................................... 201
Kang Zhang, Jinming Hao, Yu Zhang, Qiang Li and Tuansheng Yang
18 The iGMAS Combined Products and the Analysis of Their Consistency ........................................... 213
   Hongliang Cai, Kangkang Chen, Tianhe Xu and Guo Chen

19 Enhanced RTK Integer Ambiguity Resolution with BeiDou Triple-Frequency Observations ..................... 227
   Tao Li, Kongzhe Chen and Jinling Wang

20 GPS/BDS One-Step Combined Precise Orbit Determination Based on Double-Differenced Mode .................. 239
   Yao Kong, Baoqi Sun, Xuhai Yang and Xiaozhen Zhang

21 Research on Ranging Algorithm Based on Combined-Process Method Using Frequency-Difference, Time-Difference and Relative-Velocity .................................................. 249
   Rui-Qiang Yang, Peng Zhang, Xing-Wang Zhong, Deng-Feng Wang and Nian-Ke Zong

22 Multipath Effect on Phase Center Calibration of GNSS Antenna .................................................. 259
   Lixun Li, Baiyu Li, Huaming Chen and Feixue Wang

23 An Improved TCAR Based on the Optimal Combination of Carrier Phase and Pseudo-range Observations .................. 269
   Xing Wang, Wenxiang Liu, Yangbo Huang and Guangfu Sun

24 A Hybrid Navigation Constellation Inter-satellite Link Assignment Algorithm for the Integrated Optimization of the Inter-satellite Observing and Communication Performance .................. 283
   Bo Xu, Donghui Wang, Wenxiang Liu and Guangfu Sun

25 Distributed Orbit Determination Based on Increased Measurement Covariance EKF for Global Navigation Satellite System with Inter-satellite Link ........................................... 297
   Kai Xue, Yuanlan Wen, Ying Liao, Yisheng Song, Tianxiang Su and Zhi Zhang

26 Strategy and Accuracy Analysis of Space-Borne GPS Single-Frequency Real-Time Orbit Determination ............... 311
   Fuhong Wang, Lei Guo and Xuewen Gong
27 Orbit Determination Using Combined GPS + Beidou Observations for Low Earth Cubesats: Software Validation in Ground Testbed .................................................. 321
Yang Yang, Xiaokui Yue, Geshi Tang, Hongzheng Cui and Baiyan Song

28 Preliminary Analysis of Positioning Performance with BDS Virtual Reference Station Technology .................. 335
Dongfeng Yu, Pengbo Li, Guangxing Wang, Mingzhi Zhou and Zhigang Hu

Part II Atomic Clock Technique and Time-Frequency System

29 Development of Space Mini Passive Hydrogen Maser .............. 343
Yonghui Xie, Pengfei Chen, Shanmin Liu, Yuxian Pei, Shuai Tao and Chuanfu Lin

30 Development of High Frequency-Temperature Stability of OCXO for Aerospace Applications ..................... 351
Lei Yang, Yuhao Qin, Jian Huang, Xiaoqiang Zhang, Wei Jiang, Bing Cheng, Zhifu Feng and Fanghong Guo

31 Realization and Influencing Factors Analysis of ACES (Atomic Clock Ensemble in Space) Management .............. 359
Jun Xie, Yunfeng Sun, Yongsheng Qu, Dong He and Ming Zhao

32 Research of Navigation Constellation Independent Punctuality Based on Different Configuration of Satellite Clocks .......... 369
Yang Yang, Fan Jian jun, Hong Yuan, Jin Shu xin and Yang Yu fei

33 Fiber Based Radio Frequency Dissemination Scheme to Multiple Users ......................................................... 379
Wei Chen, Dan Xu, Nan Cheng, Qin Liu, Fei Yang, Youzhen Z. Gui and Haiwen W. Cai

34 Influence of Lamp Spectral Profile on Short-Term Stability and Light Shift of a Rubidium Atomic Clock .............. 387
Qiang Hao, Shengguo He, Feng Xu, Feng Zhao and Ganghua Mei
35 Evaluation and Monitoring on the Single Station Time Difference Based on the BDS, GPS and GLONASS Data ........................................... 399
Guang Sun, Hua Lu, Lirong Shen, Xiaolin Jia, Meijun Guo, Yijun Mo and Yingjie Hong

36 Prediction of Navigation Satellite Clock Bias by Gaussian Process Regression .......................................................... 411
Yu Lei, Danning Zhao, Zhaopeng Hu and Hongbing Cai

Part III PNT System and New Technologies of Navigation

37 Distributed GNSS Collaborative Positioning Algorithms and Performance Analysis .................................................. 427
Bin Huang, Zheng Yao, Xiaowei Cui and Mingquan Lu

38 Indoor Location Fingerprinting System Using DTMB Signal .... 439
Qiqi Wang, Shuai Li, Yingxin Zhao, Kun Chen, Bing Liu, Xiyuan Xu and Hong Wu

39 Simulation Analysis and Research on Key Technology for a Full-Time-Running Stellar Refraction Autonomous Navigation .................................................. 449
Qin Lin, Zhi Li, Huaiwen Li, Liang Song and Bo Meng

40 Experimental Investigation on CNS/SINS Integrated Navigation Using Star Tracker ........................................... 463
Dangwei Wang and Lei Zhou

41 Simultaneous Ranging and Communication Based on X-Ray Communications .................................................. 475
Shibin Song, Luping Xu, Hua Zhang, Yuanjie Bai and Liyan Luo

42 Cross Correlation Mitigation Algorithm for Indoor Positioning Receiver .......................................................... 485
Yang Hu, Zhongliang Deng, Jichao Jiao, Jie Xia, Yuezhou Hu and Zhuang Yuan

43 An Optimal Data Fusion Algorithm Based on the Triple Integration of PPP-GNSS, INS and Terrestrial Ranging System ............... 493
Wei Jiang, Yong Li and Chris Rizos
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>Pulsar Navigation Profile Folding and Measurement Based on Loop Tracking</td>
<td>Xinyuan Zhang, Ping Shuai and Liangwei Huang</td>
</tr>
<tr>
<td>45</td>
<td>Application of an Improved K Nearest Neighbor Algorithm in WiFi Indoor Positioning</td>
<td>Yeqing Fang, Zhongliang Deng, Chen Xue, Jichao Jiao, Hui Zeng, Ruoyu Zheng and Shunbao Lu</td>
</tr>
<tr>
<td>46</td>
<td>A New Pulse Time-of-Arrival Estimation Method for X-Ray Pulsar Navigation</td>
<td>Qingqing Lin, Ping Shuai and Liangwei Huang</td>
</tr>
<tr>
<td>47</td>
<td>A Research of Code Tracking Loop for Navigation Signal Based on DS/FH Modulation</td>
<td>Zhuxi Yu, Jiaolong Wei, ZuPing Tang, Zhihui Zhou and Yuan Xue</td>
</tr>
<tr>
<td>48</td>
<td>Method to Construct Database of X-ray Pulsar-Based Navigation Using Space-Based Observation Data</td>
<td>Xiao-long Hao, Qiang-wen Yang and Liang-wei Huang</td>
</tr>
<tr>
<td>50</td>
<td>GNSS P2P Cooperative Positioning System for Multiple Search-and-Rescue Robots</td>
<td>Yulong Song and Baowang Lian</td>
</tr>
<tr>
<td>51</td>
<td>A Position Approach Based on the Special Sub-frame in TDD LTE-A System</td>
<td>Dongyan Wei, Zhili He, Xuping Gong, Ying Xu and Hong Yuan</td>
</tr>
<tr>
<td>52</td>
<td>Research on the Pulsar Optimizing Method and the Database Construction</td>
<td>Xiao-Ming Bei, Ping Shuai, Liang-wei Hang and Xin-yuan Zhang</td>
</tr>
<tr>
<td>53</td>
<td>Study on the Transportation of Electrons in the Graphene-Based X-Ray Detector</td>
<td>Yaojun Wu, Ping Shuai, Hengbin Zhang, Qian Zhang and Lingzhong Fu</td>
</tr>
</tbody>
</table>
54 Concepts and Perspectives on Navigation Satellite Autonomous Health Management System Based on Cognitive Technology .......................... 613
Jun Xie, Jianjun Zhang and Ming Xue

55 An X-Ray Pulsar TOA Estimation Method Considering Spacecraft Orbit Motion ................................................................. 625
Liangwei Huang, Ping Shuai and Xinyuan Zhang

56 The Research of X-Ray Pulsar Signals Simulation Method .......................... 635
Lingzhong Fu, Ping Shuai, Mengfan Xue, Haifeng Sun and Haiyan Fang

57 Multi-frame Visual Odometry in Image-Aided Inertial Navigation System ................................................................. 649
N.S. Gopaul, J.G. Wang and B. Hu

58 Integration of GNSS and MEMS-Based Rotary INS for Bridging GNSS Outages ................................................................. 659
Shuang Du, Wei Sun and Yang Gao

59 An Integrated PDR/GNSS Pedestrian Navigation System ................................................................. 677
Haiyu Lan, Chunyang Yu and Naser El-Sheimy

60 Moving Target Autonomous Positioning Based on Vision for UAV ................................................................. 691
Long Zhao and Pengfeng Chen

61 An Orbit Determination Algorithm for Spacecrafts Navigated by a Single X-Ray Pulsar ................................................................. 703
Rong Jiao, Luping Xu, Hua Zhang and Yan Ma

62 Research on the Architecture of Cloud GNSS Based on Hadoop ................................................................. 717
Linyang Li, Zhiping Lu, Lihui Fan and Jian Li

63 Wi-Fi Fingerprint Positioning Updated by Pedestrian Dead Reckoning for Mobile Phone Indoor Localization ................................................................. 729
Qiang Chang, Samuel Van de Velde, Weiping Wang, Qun Li, Hongtao Hou and Steendam Heidi

64 Sequence-Based Motion Recognition Assisted Pedestrian Dead Reckoning Using a Smartphone ................................................................. 741
Chengxuan Liu, Ling Pei, Jiuchao Qian, Lin Wang, Peilin Liu and Wenxian Yu
65 An Unconventional Full Tightly-Coupled Multi-Sensor Integration for Kinematic Positioning and Navigation ............................................ 753
Jian-Guo Wang, Kun Qian and Baoxin Hu

66 A WIFI/INS Indoor Pedestrian Navigation System Augmented by Context Feature ................................................................. 767
Ling Yang, Yong Li and Chris Rizos

67 A Pedestrian Movement Direction Recognition Method Based on Inertial Sensors ................................................................. 781
Shunbao Lu, Zhongliang Deng, Chen Xue, Yeqing Fang, Ruoyu Zheng and Hui Zeng

68 High-Precision Simulator for Strapdown Inertial Navigation Systems Based on Real Dynamics from GNSS and IMU Integration ................................. 789
Gongmin Yan, Jinling Wang and Xinyi Zhou

69 A Research on All Source Navigation and Positioning and Its Critical Technology ................................................................. 801
YongBin Zhou, Jun Lai, XiYe Guo and Jun Yang

70 Mixed Interacting Filter for Tracking with Multiple System and Model ...................................................................................... 809
Xiaoguang Zhang, Dongyan Wei, Ying Xu and Hong Yuan

71 Research on Multi-Source Fusion Based Seamless Indoor/Outdoor Positioning Technology .................................................. 819
Ying Xu, Hong Yuan, Dongyan Wei, Qifeng Lai, Xiaoguang Zhang and Weina Hao

72 Study on Quantum Inter-satellite Link Technology ......................................................................................................................... 839
Xian’an Zheng, Ying Wang, Yansong Meng and Zhe Su

Part IV Policies and Regulations, Standard and Intellectual Property

73 The Urgency and Principals of the Industry Policy Optimization for Beidou Satellite Navigation System ............................................. 853
Junlin Yang and Xiangming Hu