

## 前言/Preface

GPS 和强震仪观测是获取高精度地表形变(位移、速度、加速度)的两种有效手段,它们已广泛应用于自然灾害监测且各具特色。GPS 易于获取高精度位移,但存在采样频率低、高频信噪比低、信号稳定性差的缺陷;而强震仪易于获取高分辨率加速度,但因基线漂移误差的存在,其积分后的速度和位移常存在偏差。当前的数据处理方式大多是单站模式或单传感器模式,导致大区域的密集台网和多传感器的观测资源没有充分利用,使得自然灾害实时监测与预警效率低下。

GPS and strong-motion are two effective and valuable tools to retrieve high precision ground motion information (displacement, velocity and acceleration), and had been widely used in natural hazard monitoring. Each of them with advantages and disadvantages, GPS can provide low-frequency displacement at an accuracy of centimeters in kinematic mode. Strong-motion sensors, have a very high sampling frequency and precision in the short-term but may be biased by baseline errors over long-term. However, the traditional data solution approaches are station-alone or sensor-alone, the advantages of the whole network and multi-sensors are not fully shared, it results in an inefficient for natural hazard real-time monitoring and early warning.

为了取长补短,优势互补,实现密集台网观测的最优估计和不同传感器观测的优势互补,作者综合了 GPS 和强震仪组合方面的最新研究成果和发展动态,并总结了自己多年的研究与教学成果,编写了本书。

In order to complement the advantages of the two sensors and get a robust result of the whole network. The author combines the latest research results and development tendency about the integration of GPS and strong-motion records, summarizes his research and teaching achievements of many years, and write this book.

本书以组合处理的模型与算法介绍为主,主要涉及三个方面的内容:第一个方面是多站组合增强模型,包括 GPS 增强模型、强震仪增强模型;第二个方面是多传感器组合模型,包括松组合模型、紧组合模型、自适应组合模型、改进的松组合和紧组合模型;第三个方面是组合处理中关键技术问题、基线漂移与地表倾斜的关系以及各传感器观测的特点分析等。

This monograph is mainly introduced the model and algorithm of the integration process, it involves three aspects of content. The first part is the augmentation model of

multi-station integration, includes the GPS augmentation model, strong-motion augmentation model. The second part is integration model of multi-sensors, includes the loose integration model, tight integration model, adaptive integration model, improved loose and tight integration model. The third part is the key issues about the integration process, the relationship between baseline shift and ground tilting, the characteristic analysis of different sensors.

由于作者专业知识和英语能力所限,书中难免存在不妥之处,恳请读者批评指正。本专著的编写得到德国波茨坦地学中心汪荣江研究员和葛茂荣研究员的悉心指导,并参阅了大量的国内外相关文献,对于他们的辛勤劳动,深表感谢。

Due to the limited professional knowledge and English ability, there must exist some shortcomings in this book. It is very pleased for the author to receive reader's comments and corrections. The author would like to express the thanks to the Dr. Rongjiang Wang and Dr. Maorong Ge at Germany Research Center for Geosciences (GFZ) who gave me kind guidance and the authors whose name are listed and not listed in the references for their hard work.

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