

## 采用互扫描法自动标定工作空间定位系统

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## Self-calibration of workspace measurement and positioning system by using inter-scanning

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摘要

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## 摘要

针对工作空间定位系统(wMPS)现有标定技术效率低,标定程序复杂且须依赖外部测量设备等问题,本文在研究wMPS测量原理的基础上提出了一种采用互扫描技术的自动标定方法。该方法结合该系统的扫描激光平面测量原理及使用特点,通过在基站上安装已知坐标的接收传感器,采用互扫描技术完成自动标定。文中以两台基站为基础,详细阐述了该方法的数学原理,并给出了基于几何约束的平差模型及其迭代解法。依托天津大学研发的wMPS实验平台对本方法进行了验证,并与基准尺标定法进行了比对。实验结果显示,采用本方法可以实现系统的自动标定,在距离基站5 m内的测量空间内可获得0.6 mm的坐标测量精度。该方法在保证系统测量精度的同时大大提高了系统的测量效率。

**关键词** : 大尺寸空间测量, 多平面交汇测量, 自动标定, 迭代优化, 互扫描

## Abstract :

As workspace Measurement and Positioning System (wMPS) has lower calibration efficiency, complex algorithms and relying on auxiliary equipment, this paper presents a novel self-calibration method by using inter-scanning method. According to the multi-plane intersection theory and system application characteristics, the automatic calibration was implemented by a inter-scanning technology on receivers mounted on the laser stations whose coordinates were known in advance. On the basis of two laser stations, the mathematical theory of the method was described, and the optimal algorithm (adjustment model) based on the geometrical constraint characteristics of the system was given in detail. The method was verified on a wMPS experimental platform developed by Tianjin University and was compared with the standard rule calibration method. The experimental results demonstrate that the inter-scanning method is an efficient solution for calibration of the stations, and the accuracy of the system achieves 0.6 mm in the space 5 m away from the station. Thus, the method proposed improves the calibration efficiency of the system while maintaining the measurement accuracy.

**Key words** : large-scale space measurement multi-plane intersection measurement self-calibration iterative optimization inter-scanning

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