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信息科学

光束平差在激光跟踪仪系统精度评定中的应用

周维虎[1], 丁蕾[1,2], 王亚伟[3], 张滋黎[1]

1. 中国科学院 光电研究院, 北京 100094;
2. 中国科学院 研究生院, 北京 100049;
3. 北京航空航天大学 仪器科学与光电工程学院, 北京 100191

摘要： 对自主研制的激光跟踪仪的精度评定进行研究,以期解决大尺寸空间坐标测量系统的空间坐标精度难于评定的问题。 考虑现场环境条件、仪器状态和操作者技能等因素对测量精度影响都很大,提出了基于光束平差原理对激光跟踪仪系统进行精度评定的方法。通过Matlab软件对激光跟踪仪的精度评定进行了仿真,仿真结果显示光束平差法能客观地反映激光跟踪仪的测量精度。另外,使用Faro生产的激光跟踪仪进行了实物实验,实验结果显示其水平角精度σ_H为1.97″,垂直角精度σ_V为2.61″,测距精度σ_D为3.75×10^{-6},对比Faro生产的激光跟踪仪精度(σ_H=2.0″;σ_V=2.0″;σ_D=4 μm)可证明采用光束平差法评定自主研发的激光跟踪仪测量精度是正确、可行的。该方法为探索激光跟踪仪新的应用技术、开展面向对象的测量不确定评定奠定了基础。

关键词： 激光跟踪仪 空间坐标测量 精度评定 光束平差

Application of bundle adjustment to accuracy evaluation of laser tracker

ZHOU Wei-hu[1], DING Lei[1,2], WANG Ya-wei[3], ZHANG Zi-li[1]

1. Academy of Opto-electronics, Chinese Academy of Sciences, Beijing 100094, China;
2. Graduate University of Chinese Academy of Sciences, Beijing 100049, China;
3. School of Instrumentation Science and Opto-electronics Engineering, Beihang University, Beijing 100191, China

Abstract: The accuracy evaluation methods for a laser tracker developed by ourselves are investigated to solve the problem that the coordinate precision in a large-size space coordinate measuring system is difficult to be evaluated. In consideration of the great impacts of environmental conditions, equipment status, operator skills and other factors on measurement accuracy, this paper proposes a bundle adjustment method to evaluate the accuracy of the laser tracker under practical conditions. The Matlab is used to simulate the accuracy evaluation, and results show that the bundle adjustment can generally reflect the measurement accuracy of laser tracker measurement system. Furthermore, a practical experiment is performed on a laser tracker made from Faro company, and results show that the measuring accuracies of horizontal angle σ_H and vertical angle σ_V are 1.97″ and 2.61″,respectively, and measuring accuracy σ_D for the distance is 3.75×10^{-6}.As compared with the instrument accuracy of the Faro (σ_H=2.0″,σ_V=2.0″,σ_D=4 μm), It proves that using bundle adjustment to evaluate the performance of the laser tracker developed is feasibility and correctness. The method will be useful to broaden application of laser tracker technology and to open a way to task-oriented uncertainty evaluation.

Keywords: laser tracker space coordinate measurement accuracy evaluation bundle adjustment

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通讯作者: 周维虎 (1962-),男,安徽无为人,研究员,硕士生导师,2000年于合肥工业大学获得博士学位,主要从事光电测量系统总体技术研究及光电精密测量技术研究。 E-mail:zhouweihu@aoe.ac.cn

作者简介:

作者Email:

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