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信息科学

基于多点合作目标的多线阵CCD空间物体姿态测量

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摘要： 为了精确测量悬浮试验场内姿态快速变换的空间物体的姿态角参数，提出了一种采用3个线阵CCD相机同时测量多个点合作目标的姿态测量方法，以解决传统的线阵CCD姿态测量系统中相机位置间的约束条件过多造成的非线性系统误差及校准参数多的问题。该方法采用柱面透镜和线阵CCD组成的3个一维相机，对被测物体上的多个点合作目标同时进行测量；并针对测量原理对姿态角限制的问题，采用模拟计算的方法进行姿态角测量范围的计算。由神经网络校准线阵CCD相机，直接给出点合作目标的空间三维坐标，并通过建立基于Rodrigues参数姿态解算模型求解被测物体的姿态角。实验结果表明，本文方法得到的空间点位置测量精度及空间姿态解算精度高于原线阵CCD姿态测量方法，验证了该姿态测量方法进行姿态测量的可行性和有效性。

关键词： 姿态测量 线阵CCD 姿态解算 相机校准

Attitude measurement of space objects based on multi-linear CCD and multi-point cooperation target

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Abstract: To measure accurately the attitude of a spatial object that was fast-changing in a suspension state, an attitude measurement method was proposed based on three linear CCD cameras for measuring multiple point cooperation targets. By proposed method, the nonlinear systemic errors and more calibration parameters caused by more overconstraints for camera positions were overcome in the traditional linear CCD attitude measurement. Three 1D cameras composed of linear CCDs and cylindrical lenses were used to measure simultaneously the multiple point cooperation targets on the measured object. Aiming at the restriction of measuring principle on the attitude angle, the simulated calculation method was used to calculate the attitude angle range and the BP neural network was taken to calibrate the CCD cameras and give the spatial 3D coordinates of point cooperation targets. Furthermore, an attitude calculation model based on Rodrigues parameters was established to solve the attitude angles of measured objects. Experimental results indicate that the measurement accuracy of spatial point position and the calculating precision of spatial attitude angle in this system are higher than those of traditional methods, which verifies that this attitude measurement method is feasible and available to measure the attitude.

Keywords: Attitude measurement Linear CCD Attitude calculation Camera calibration

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