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微纳技术与精密机械

大行程转动柔性铰链性能测试方法及实验

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摘要： 针对大行程柔性铰链铰链运动范围较大，转动误差相对较小，实现其转动精度的测量比较困难的问题， 提出了一种间接测量大行程柔性铰链转动精度的方法。首先对柔性铰链转动精度的衡量指标进行定义和比较；然后选择合适的指标，提出间接测量该柔性铰链转动中心漂移量和刚度的方法。该方法利用工具显微镜测量铰链运动刚体上的两个特征点在转动过程中的坐标值，从而解算出柔性铰链在不同转角时转动中心点的位置。由此不仅得到了转动中心漂移的大小，还可以得到轴漂的方向。基于该方法搭建了实验平台并对实验误差进行了分析，分析显示其误差主要为特征点坐标的测量误差。实验结果与有限元仿真对比表明，测量结果的误差小于0.006 mm，基本满足对大行程柔性铰链精度测试的要求。

关键词： 大行程柔性铰链 转动精度 刚度 工具显微镜 间接测量

Performance measurement and experiment for rotational flexural joint with large-stroke

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Abstract: A method to measure the rotational precision of a flexural joint with a large stroke was proposed to solve the problems that the flexural joint has relatively smaller rotational error and its rotational precision is difficult to be measured directly. Firstly, five kinds of criterions to evaluate the rotational precision were proposed and compared. Then, a proper criterion was chose, and an indirect method to measure the center-shift and stiffness of the flexural joint was developed according to the criterion. With the method, a measuring microscope was used to survey the coordinates of two mark points on the flexural joint, by which the rotational angle and the position of the real rotational center could be calculated, and the central shift of rotation and its shift direction also could be obtained. An experimental platform was built based on the method, and an isosceles trapezoidal flexural joint was used to validate the method. Experiments show that the rotational precision and the stiffness of the flexural joint can be measured at the same time in the experiment. The results are compared with the finite element analysis simulation and it indicates that the error of the experimental result is less than 0.006 mm, which satisfies the requirement of precision test for most common flexural joints with large-strokes.

Keywords: flexural joint with large-stroke rotational precision stiffness tool microscopes indirect measurement

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