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微纳技术与精密机械

微装配正交精确对准系统的设计

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摘要： 针对平板类零件微装配系统设计过程中面临的问题,提出采用正交光学对准机构来实现用人机协同的微装配系统对微小型平板类结构件的高精度装配,并分析计算高精度对准机构模块产生的误差。建立了基于显微机器视觉及正交光学对准的微装配系统平台,用本文提出的方法进行了微装配实验,结果显示本装配系统在装配的一致性与装配效率方面有较大的改善与提高。提出的光学对准方法可有效地用于平板结构的硅微MEMS器件和非硅MEMS器件等集成的复杂微小型异构机电系统的装配,设计的平台具有很好的开放性和可移植性。棱镜正交对准机构产生0.001°的角度误差时,对准理论偏差小于0.98 μm,实际实验中微装配平台系统装配精度小于5 μm,满足平板类微小型结构件装配一般精度需求。

关键词： 微装配 正交对准 显微视觉 人机协同

Design of precise alignment orthogonal system used in micro-assembly

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Abstract: For the problems in the design of a flat part micro-assembly system, an orthogonal optical alignment mechanism was proposed to realize high-precision assembly of the miniature flat class structure by a man-machine cooperation micro-assembly system, and the error of high-precision alignment mechanism module was analyzed and calculated. Then, a micro-assembly system platform based on the microscopic machine vision and orthogonal optical alignment was established, and the micro-assembly experiments by proposed method were carried out. The optical alignment method proposed was effectively used in the assembly of integrated and complex micro heterogeneous electromechanical system such as the flat structures of silicon micro-MEMS devices and non-silicon MEMS devices. The results show that the consistency and efficiency of the micro-assembly are improved and enhanced greatly, and the designed platform has good openness and portability. When the prism orthogonal alignment mechanism produces the error of 0.001°, the theoretical deviation is less than 0.98 μm and the assembly accuracy of the actual experimental micro-assembly platform is less than 5 μm.The precision meets the general assembling accuracy requirements of the miniature flat class structure.

Keywords: micro-assembly orthogonal alignment micro-vision man-machine coordination

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