光学 精密工程
OPTICS AND PRECISION ENGINEERING
核心期刊
主管：中国科学院
主办：中国科学院长春光学精密机械与物理研究所
中国仪器仪表学会
主编：曹健林

光学精密工程 2012, 20(9) 2029-2034 ISSN: 1004-924X CN: 22-1198/TH

微纳技术与精密机械

压电驱动共振式高频疲劳试验机构的设计与实验

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摘要： 针对在小振幅、高频受力工况下微小与硬脆材料构件的疲劳检测,提出利用压电振子(PZT、PLZT或PMN)作为高频疲劳试验机构的驱动力源,并利用系统共振方法设计高频疲劳试验机构。首先,介绍压电共振式疲劳试验机构的工作原理,建立了动力学模型,获得了系统的动态特性。然后,设计和制作了样机。最后,利用样机测量了作用在试件上的动载荷。实验结果表明:改变输入交流电压幅值(100~250 V)和板弹簧厚度(1.1~0.6 mm),可施加在试件上的动载荷为24.7~99.2 N。本文制成的样机适用于测试动载荷在为24.7~99.2 N,且在小振幅、高频受力工况下试件的拉伸和弯曲疲劳性能。

关键词： 压电驱动 压电振子 共振式疲劳试验机 拉伸和弯曲疲劳测试

Design and experiment of piezoelectric resonance high frequency fatigue testing machine

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Abstract: To get fatigue properties of the small and hard brittle components working at conditions of little amplitudes and high frequency forces, this paper presents a novel kind of resonance and high frequency fatigue testing machine driven by a piezoelectric vibrator (PZT、PLZT or PMN). First, the working principle of the piezoelectric resonance and high frequency fatigue testing machine was introduced, and the dynamic model of the machine was established and its systemic dynamic characteristics were obtained. Then, a prototype was designed and produced. Finally, the dynamic load on the specimen was measured by the prototype. The results indicate that the dynamic load on the specimen is 24.7-99.2 N by changing the AC voltage amplitude (100-250 V) and the thickness of the plate spring (1.1-0.6 mm). The prototype designed in this paper is suitable for the tensile and bending fatigue testing under conditions of little amplitudes and high frequency forces with the dynamic load mentioned above.

Keywords: piezoelectric driving piezoelectric vibrator resonance fatigue testing machine tensile and bending fatigue testing

收稿日期 2012-05-08 修回日期 2012-06-11 网络版发布日期

基金项目:

国家自然科学基金资助项目(No.51075175)

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