

压电惯性驱动器惯性冲击力的分析与检测

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Analysis and testing on inertial impact of piezoelectric inertial actuator

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摘要

图/表

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摘要 由于惯性冲击力是压电惯性驱动器产生运动的关键,故本文探讨了方波激励下压电振子的惯性冲击力大小,推导了压电双晶片振子在方波激励下的冲击响应,分析了惯性冲击力的时域特性和幅频特性,分析得到方波激励下惯性冲击力信号频率主要集中在0~500 Hz.采用加速度传感器初步测试了压电双晶片振子的加速度参数,测试结果与理论模型相近.结合压电双晶片振子的端部惯性质量计算得到惯性冲击力的数值,利用快速傅里叶算法获得了加速度参数的幅频特性.最后,采用摩擦学的方法对惯性冲击力的数值进行了验证,验证结果表明两种方法的最大相对误差为8.98%,表明加速度传感器测试惯性冲击力是可行的.

关键词 : 压电惯性驱动器, 惯性冲击力, 方波, 冲击响应

Abstract : The movement of a piezoelectric inertial actuator is come from the inertia impact, so this paper explores the inertia impact of a piezoelectric vibrator excited by a square wave. The impact response of the piezoelectric vibrator excited by the square wave was deducted. The time-domain and amplitude-frequency characteristics of the piezoelectric vibrator were analyzed and the theory and experiment results show that the frequency of the inertial impact signal mainly is concentrate on the 0—500 Hz in square wave excitation. An acceleration sensor was used to test the acceleration parameters and the test results are closed to that of the model. The inertial impact force was calculated by the end inertial mass of the piezoelectric bimorph vibrator, and the amplitude-frequency characteristics of acceleration parameter were obtained by the fast Fourier transfer algorithm. Finally, the tribology method was used to verify the test results. Theory and experiment results show that the maximum relative error of two methods is 8.98%, which verifies that the tests of inertial impacts by acceleration sensors are feasible.

Key words : piezoelectric inertial actuator inertial impact square wave impact response

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