光学精密工程 » 2015, **Vol. 23** » Issue (2): 497-503 DOI: 10.3788/OPE.20152302.0497

气体耦合式宽带/低频压电振动俘能器

王淑云, 张肖逸, 阚君武*, 张忠华, 于丽, 程光明

浙江师范大学 精密机械研究所, 浙江 金华 321004

Wideband/low frequency piezoelectric vibration energy harvester based on pneumato-coupling

WANG Shu-yun, ZHANG Xiao-yi, KAN Jun-wu*, ZHANG Zhong-hua, YU Li, CHENG Guang-ming

Institute of Precision Machinery, Zhejiang Normal University, Jinhua 321004, China

摘要 图/表 参考文献(0) 相关文章 (15)

全文: PDF (1528 KB) RICH HTML NEW

输出: BibTeX | EndNote (RIS)

摘要

为实现低频/宽频带/高强度振动能量回收及基于能量回收的主动振动控制,提出了一种气体耦合式振动俘能器。介绍了俘能器的系统构成原理,对其能量回收特性进行了理论与试验研究。理论分析结果表明,俘能器的发电能力及特性是由环境振动强度、气缸/压电振子的结构与性能参数、系统质量/背压等多种要素共同决定的;其它条件确定时,存在使电压最大的最佳频率以及使俘能器工作与否的最低临界频率;增加背压/质量可不同程度地提高俘能器的输出电压和有效带宽、降低临界频率,但对最佳频率无明显影响。采用Φ60×0.9 mm^{3}双晶压电振子及Φ16×100 mm^{3}气缸制作了样机,测试了不同背压及质量时俘能器的电压-频率特性。结果表明,俘能器最佳/临界频率、最大输出电压及有效带宽等与背压/质量关系均与理论分析结果相吻合。不同条件下所测得的最佳频率均为55 Hz左右; 背压0.4 MPa、质量10 kg时所获得临界频率/最大输出电压/对应25 V输出电压有效带宽为9 Hz/88 V/72 Hz,分别为质量2.5 kg时的0.36倍、2倍和2.2倍。

关键词 : 压电振动俘能器, 气体耦合振动, 能量回收, 发电

Abstract :

A piezoelectric energy harvester based on Pneumato-coupling Piezoelectric Vibration (PHPV) was presented for the energy harvesting of low-frequency/high-level vibration and the self-powered active vibration control based on energy harvesting. The structure and working principle of the PHPV were introduced, and the energy harvesting performance was studied theoretically and experimentally. The theoretic analysis results show that the output performance of the PHPV depends on the vibration level/frequency, the structural size and material parameters of the cylinder/ piezodisc, proof-mass, backpressure, and so on. Under constant other parameters, there are an optimal frequency for the PHPV to generate a peak voltage and a minimal critical frequency for the PHPV to work normally. The increasing of proof-mass and backpressure can enhance the output voltage and bandwidth in different degrees, but exerts no influence on the optimal frequency. By a piezodisc with with piezodisc measured Φ 60×0.9 mm^3 and cylinder measured Φ16×100 mm^3, a PHPV prototype was fabricated and its voltage-frequency performance was tested at different backpressures/proof-masses. The obtained influence regularities of proof-mass/backpressure on the optimal-frequency/critical-frequency/maximal-voltage/bandwidth are in agreement with the analysis results. The optimal frequency almost is the same of 55 Hz at different test conditions. At given backpressure of 0.4 MPa and proof mass of 10 kg, the obtained critical-frequency/maximal-voltage/bandwidth relative to output voltage of 25 V are 9 Hz/88 V/72 Hz, which are 0.36/2/2.2 times those at 0.4 MPa and 10 kg, respectively.

Key words : piezoelectric vibration energy harvester pneumato-coupling vibration energy harvesting electric energy generation

收稿日期: 2014-06-20

中图分类号: TN384

TM619

基金资助:

国家自然科学基金资助项目(No. 51377147, No.51277166, No.51205366, No.51175478);浙江省科技计划资助项目(No. 2013C31110).

通讯作者: 阚君武(1965-),男,吉林榆树人,教授,博士生导师。E-mail:jutkjw@163.com **E-mail:** jutkjw@163.com

作者简介: 王淑云(1965-),女,吉林长岭人,教授。E-mail:jutwsy@163.com;张肖逸(1991-),女,浙江海宁人。E-mail:wshnyxz@163.com

引用本文:

王淑云, 张肖逸, 阚君武*, 张忠华, 于丽, 程光明. 气体耦合式宽带/低频压电振动俘能器[J]. 光学精密工程, 2015, 23(2): 497-503. WANG Shu-yun, ZHANG Xiao-yi, KAN Jun-wu*, ZHANG Zhong-hua, YU Li, CHENG Guang-ming. Wideband/low frequency piezoelectric vibration energy harvester based on pneumato-coupling. Editorial Office of Optics and Precision Engineering, 2015, 23(2): 497-503.

链接本文:

http://www.eope.net/CN/10.3788/OPE.20152302.0497 或 http://www.eope.net/CN/Y2015/V23/I2/497

服务

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- E-mail Alert
- RSS

作者相关文章

- 王淑云
- 张肖逸
- 阚君武*
- 张忠华
- 于丽
- 程光明