



航空学报 » 2011, Vol. 32 » Issue (3) :561-570 DOI: CNKI:11-1929/V.20101229.0935.000

材料工程与机械制造

最新目录 | 下期目录 | 过刊浏览 | 高级检索

<< Previous Articles | >>

### Rainbow型压电单膜片换能结构负载电压和输出功率分析

刘祥建, 陈仁文

南京航空航天大学 智能材料与结构航空科技重点实验室, 江苏 南京 210016

### Analysis of Load Voltage and Output Power for Rainbow Shape Piezoelectric Monomorph Energy Transferring Elements

LIU Xiangjian, CHEN Renwen

Aeronautical Science Key Laboratory for Smart Materials and Structures, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China

摘要

参考文献

相关文章

Download: PDF (1604KB) HTML 1KB Export: BibTeX or EndNote (RIS) Supporting Info

**摘要** 给出了一种多方向振动能量收集装置的设计结构。为研究Rainbow型压电单膜片换能结构材料、尺寸参数、负载电阻对其输出功率的影响,根据压电材料的机电耦合方程和弹性力学理论,建立了Rainbow型压电单膜片换能结构负载电压及输出功率的理论模型。对所建理论模型进行了数值计算和验证测试,理论计算结果及测试结果具有较好的一致性,对应的最大输出功率误差为5%,说明了本文理论推导的可靠性。同时通过数值模拟发现:金属弹性基片长度、压电薄膜宽度的增加将会引起换能结构输出功率的增加;金属弹性基片宽度和厚度、换能结构初始曲率半径的增加将会使换能结构的输出功率下降;压电薄膜长度和厚度的增加将会使换能结构的输出功率先增加后减小;铍青铜基片换能结构要优于钢基片换能结构。

**关键词:** Rainbow 压电材料 换能结构 力学分析 负载电压 输出功率 多方向振动能量收集

**Abstract:** A design structure is developed in this article to harvest multi-direction vibration energy with piezoelectric monomorph energy transferring elements. According to the basic equations of piezoelectric materials and their mechanical analysis, the load voltage and output power models of the Rainbow shape piezoelectric monomorph energy transferring elements are established, which are then used to study the relationships between their output power and material shape parameters as well as their load resistance. A prototype of the Rainbow shape piezoelectric monomorph energy transferring elements is designed to validate the models. The results show that the calculation results are consistent with the experimental results, with the error of maximum output power being 5%. Moreover, the output power of the piezoelectric film increases as the length of the metal substrate and the width of the piezoelectric film increase, while it decreases as the width and thickness of the metal substrate and the initial curvature radius of the energy transferring elements increase. The output power of the piezoelectric film reaches maximum and then decreases as the length and thickness of the piezoelectric film increase. Furthermore, beryllium bronze substrate energy transferring elements are found to be superior to steel substrate energy transferring elements.

**Keywords:** rainbow piezoelectric materials energy transferring element mechanical analysis load voltage output power multi-direction vibration energy harvesting

Received 2010-06-22;

Fund:

国家自然科学基金(10972102); 高等学校博士学科点专项科研基金(200802870007); 江苏省科技支撑计划(BE2009163)

Corresponding Authors: Tel.:025-84893466-185 E-mail: rwchen@nuaa.edu.cn Email: rwchen@nuaa.edu.cn

About author: 刘祥建(1980-) 男,博士研究生。主要研究方向:智能结构力学、压电能量收集及压电驱动技术等。 Tel: 025-84893871 E-mail: liuxukd@126.com 陈仁文(1966-) 男,博士,教授,博士生导师。主要研究方向:智能材料与结构、智能监测与控制等。 Tel: 025-84893466-185 E-mail: rwchen@nuaa.edu.cn

#### Service

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

作者相关文章

引用本文:  
刘祥建, 陈仁文. Rainbow型压电单膜片换能结构负载电压和输出功率分析[J]. 航空学报, 2011, 32(3): 561-570.

LIU Xiangjian, CHEN Renwen. Analysis of Load Voltage and Output Power for Rainbow Shape Piezoelectric Monomorph Energy Transferring Elements[J]. Acta Aeronautica et Astronautica Sinica, 2011, 32(3): 561-570.

Copyright 2010 by 航空学报