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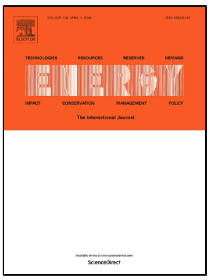

Scavenging wind energy by a Y-shaped bi-stable energy harvester with curved wings

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Scavenging wind energy by a Y-shaped bi-stable energy harvester with curved wings

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Abstract

In this paper we proposed a Y-shaped bi-stable energy harvester (YBEH) to scavenge the low-speed wind energy. The system is composed of a cantilever beam with a tip magnet and two curved wings, a piezoelectric laminate and two fixed magnets. To demonstrate the harvesting performance, corresponding validation experiments were performed over a range of velocities. The experimental results prove that this new wind harvester could execute snap-through and reach coherence resonance in a wide range of air flow speeds. Our findings may open a new opportunity to utilize coherence resonance to enhance the energy harvesting performance for low-speed wind flows.

Keywords: energy harvesting; snap-through; air flow excitations; piezoelectricity

1. Introduction

Providing green and endless energy has become one of greatest challenges for low-power electronic devices such as wireless sensors [1], data transmitters [2] and cell phones [3] due to the limited lifetime and hazardous environmental impact of conventional batteries [4]. Therefore, researchers are very much concerned about how to harvest efficient renewable energy from natural energy sources like wind [5, 6], solar [7], thermal [8], rain [9], ocean wave [10, 11] and acoustic [12-14]. Among these sources, geophysical flows (wind, tidal currents, river flows, etc.) energy has drawn great attention and has become a prominent research topic for a decade owing to its abundance with virtually pollution-free. In addition, piezoelectric materials have gained widespread attention to harvest flow energy power because of its high power output densities, flexibility, low cost, simplicity in the configuration [15]. Therefore, the piezoelectric flow-induced energy harvester has been received a significant attention. The piezoelectric flow-induced vibration devices could harvest flow energy by harnessing aerodynamic instability phenomena including limit cycle oscillations of

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