INTERNATIONAL JOURNAL OF RESEARCH IN MECHANICAL, MECHATRONICS AND AUTOMOBILE ENGINEERING (IJRMMAE)
ISSN: 2454-1435 (Print) | 2454-1443 (online)
Volume 5 Issue 3 – www.ijrmmae.in – Pages 9-13

DESIGN AND ANALYSIS OF TRAPEZOIDAL SHAPED CANTILEVER BEAM ALONG WITH AEROFOIL BLUNT BODY FOR VIBRO WIND

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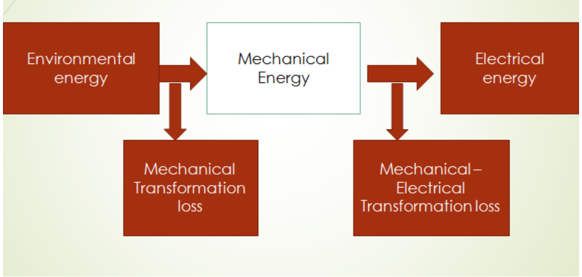
Abstract

The aim of this project is to convert vibration into electricity with help of piezo electric material. Here we are going to change the design of a blunt body and increase the frequency of produced vibrations. By increasing the vibration we can increase the electricity production. .By changing the shape of blunt body and cantilever beams we can improve the efficiency of the system

Introduction

Alternative fuels to reduce the consumption of fossil fuels. So here we are concentrating on the renewable energy resources, here vibro wind system is a new developing technology in renewable systems. In this vibro wind system mechanical energy (vibration source) can convert into electrical energy. This is a new developing technology now a day

In our project the mechanical energy (vibration) can be converted into useful electrical energy (electricity).Induced vibration can be produced by wind velocity which appears on different structures. We are using trapezoidal, conical and aerodynamic structure blunt body to produce induced vibration



Piezoelectric material

Since the discovery of ferroelectric materials such as barium titanate (BaTiO3) and lead zirconate titanate (PZT), piezoelectricity has been observed in a myriad of synthetic materials as researchers have continuously developed piezoelectric materials with various electromechanical, mechanical, and thermal properties. In this section, several piezoelectric materials with enhanced performance compared to traditional piezoelectric materials are briefly discussed, and different transducer configurations developed for piezoelectric energy harvesting are reviewed. Additionally, a summary of common mathematical models and conditioning circuitry is provided.

Many piezoelectric materials have been developed over the past century, however the most common piezoelectric material is the perovskite lead zirconate titanate, a polycrystalline monolithic piezoelectric ceramic known as PZT that is often doped with niobium or lanthanum to form soft and hard piezoelectric materials, respectively. Piezoelectric ceramics, or piezoceramics, have found widespread use in sensors and actuators due to their direct coupling which enables operation without bias voltages, and their ability to output large voltages on the order of 50 V to 100 V (although currents are typically quite small, in the nanoamp to milliamp range). While PZT is the most common material, it contains lead and, therefore, the development of new compositions is a large and ongoing research.

Piezoelectric single crystals.

Piezoelectric single crystals were developed to achieve superior coupling through uniform dipole alignment and outperform polycrystalline piezoceramics in many applications. The electromechanical coupling coefficient of single crystal piezoelectric materials can be significantly greater than monolithic materials, and in the highest performance materials can be several times greater than the drawback to these materials is their higher cost, reduced toughness, and high damping however, despite these drawbacks, researchers have begun to incorporate piezoelectric single crystals in vibration-based energy harvesting systems to leverage their high electromechanical coupling.

Lead-free piezoelectric matrix materials: While PZT offers superior piezoelectric properties to many alternatives; the toxicity of lead introduces inherent health risks in the use of PZT and other lead-based piezoelectrics. Ecological restrictions on the use of lead-based materials as well as the desire to use piezoelectric materials in medical devices has motivated the development of numerus lead-free piezoelectric ceramics

High temperature piezoelectrics.

Another limitation in the application of PZTs is the limited working temperature of these materials due to phase instability and depolarization in high temperature applications, such as advanced energy generation systems and turbine engines Despite tremendous development in high temperature piezoelectric materials capable of working at temperatures up to 1000 °C in different bulk and thin film formations, the electromechanical coupling properties of the majority of these materials are relatively lower than conventional PZT ceramics

Piezoelectric nanocomposites

While monolithic piezoceramics offer high coupling coefficients, they cannot be conformed to curved surfaces, are generally brittle in nature making them vulnerable to 4 Smart Mater. Struct. 28 (2019) 113001 Topical Review breakage, and are typically dense due to the use of lead-based ceramics. To resolve the limitations of monolithic piezoceramic materials, researchers have devised composite piezoelectric devices consisting of an active piezoceramic phase embedded in a polymeric matrix phase. The resulting composites have increased strength and flexibility, as well as improved robustness due to the polymer matrix protecting the fragile ceramic.

Blunt body models

Experimental model

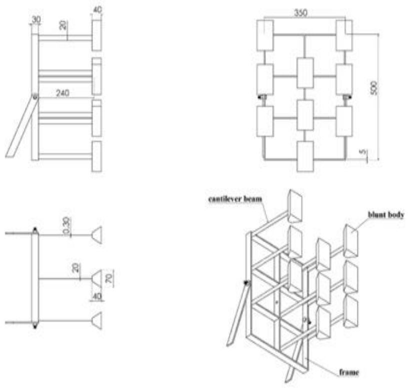


Fig 3 system with trapezoidal blunt body

S.NO	Major dia. mm	Minor dia.	Height	Max	Min
		Mm	**Mm**	**(Voltage)**	**(Voltage)**
1	70	40	70	0.34	0.019
2	70	50	60	0.24	0.071
3	70	45	50	0.29	0.021
4	80	40	50	0.28	0.047
5	**80**	**50**	**70**	**0.53**	**0.12**
6	80	45	60	0.3	0.04
7	60	50	50	0.11	0.03
8	60	40	60	0.19	0.01
9	60	45	70	0.11	0.02

Table 1. Results for conical section blunt body

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