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Energy Harvesting Vibration Sources For Microsystems Applications

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Abstract – In this paper we present about Energy Harvesting Vibration sources for Microsystems applications. The concept of vibration energy harvesting and its potential utilization as a power source for micro is introduced. Vibration energy harvester is more than just an alternative to traditional batteries.

Keywords: - Vibration energy, Microsystems, Energy harvesting

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INTRODUCTION

The idea of using harvested energy for powering Microsystems dates back as far as 1969 [W. Ko], when Kopatented the idea of using a vibrating piezoelectric beam as a means of powering biomedical implants. The idea was rejuvenated by Shearwood et al. [C. Shearwood] who developed the first bulk fabricated electromagnetic prototype, in addition to laying the theoretical foundation used by authors in the field since that time. It was not until 2003, with the publishing of the widely cited work of Roundy et al [S. Roundy], that the piezoelectric bimorph beam harvester was demonstrated. Since around this time, the field of harvesting energy from various energy sources, most notable of which is vibration, has grown exponentially.

Energy harvesting (also referred to as energy scavenging or power harvesting in the literature) describes a process whereby energy in a given environment is transferred into a more useful form of electrical energy. Energy is the amount of power consumed, expressed in watt-hours or kilowatthours, while power is often expressed in watts or kilowatts. Energy is equal to the power multiplied by the time of consumption. Thus, in specific terms energy harvesting is somewhat of a misnomer, as technically the area should be referred to as power harvesting (although following common convention the term energy harvesting will be used here). The sources of energy that can be harvested are practically limitless, and in the most general terms can include sources such as solar energy, thermal energy, wind energy, tidal and wave energy, and mechanical and vibration energy. Further, the scales on which energy harvesting can be pursued can vary drastically, generating anywhere from utility-level power levels in applications such as hydroelectric dams, wind (turbine) farms, and solar (or photovoltaic) applications to energy harvesting at much smaller scales, where micro- (or even nano-) watt levels of electrical energy that are generated are useful for a small-scale device or system. It is the latter level of energy that is of particular interest for micro/nanorobots and will be the focus of the present chapter. Despite the broad, general definition of energy harvesting given above, in many cases (including in this chapter), the term energy harvesting is used in the context of much smaller levels of power which are likely to be on the orders of milliwatts (mW) for most micro/nanorobots applications.

VIBRATION ENERGY HARVESTING-

With the development of low power electronics and energy harvesting technology, self-powered systems have become a research hotspot over the last decade. The main advantage of self-powered systems is that they require minimum maintenance which makes them to be deployed in large scale or previously inaccessible locations. Therefore, the target of energy harvesting is to power autonomous ‘fit and forget’ electronic systems over their lifetime.

Some possible alternative energy sources include photonic energy (Norman, 2007), thermal energy (Huesgen et al., 2008) and mechanical energy (Beeby et al., 2006). Among these sources, photonic energy has already been widely used in power supplies. Solar cells provide excellent power density. However, energy harvesting using light sources restricts the working environment of electronic systems. Such systems cannot work normally in low light or dirty conditions. Thermal energy can be converted to electrical energy by the Seebeck effect while working environment for thermo-powered systems is also limited. Mechanical energy can be found in instances where thermal or photonic energy is not suitable, which makes extracting energy from

mechanical energy an attractive approach for powering electronic systems. The source of mechanical energy can be a vibrating structure, a moving human body or air/water flow induced vibration. The frequency of the mechanical excitation depends on the source: less than 10Hz for human movements and typically over 30Hz for machinery vibrations (Roundy et al., 2003).

CONCLUSION:

In this paper we found that Energy harvesting refers to the procedure of changing energy in a given surroundings into a more helpful form of electrical energy that can be used by the system. Since the amount of energy which can typically be extracted in this regard are quite small, a main confront in the energy harvesting community is recognizing potential applications where the amounts of energy harvested, while small, are good-looking such that the reimbursement of an energy harvesting methodology offset the further costs and complexity of adopting this approach.

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