Power Harvesting By Using Railway Vibrations (A Review)

Yogesh .C. Pathak, Suhasini Padwekar, Priyanka Sharma, Rushikesh Paunikar, Shreyas Shete

Abstract: **A system is produced to convert railway vibration into electrical energy which can be use for house hold purpose and for signal lights on railway root. . The energy is converted with the help of variable capacitor. Micro electromechanical systems (MEMS) technology can also be used for this purpose. This is one of the most promising technologies. The relevant applications discussed in this article include vibration energy harvesting from railway vibrations, vehicles, transportations. The unique challenges and future scopes of large-scale railway vibration energy harvesting are also discussed.**

INTRODUCTION

A new device that can harvest useful energy from extremely tiny vibrations may allow new ways to power remote electronic devices with batteries that need replacing less often, or are actually self-charging. The "vibration-to-electricity" device could capture up to 10 times more energy than is possible with the conventional device.

Scientists at the Virginia Polytechnic Institute in Blacksburg, Va., used a process well known in science called the "piezoelectric" effect, a phenomenon in which certain crystals and other materials, when twisted or flexed, actually generate electricity. The new device increases the range of vibration frequencies from which energy can be captured. Conventional "piezo-generators" only efficiently harvest energy at certain frequencies, severely limiting the amount of power they can capture and generate.

The graduate student working on the project, Alper Erturk, said that the prototype device gets its 10-fold increase in energy generation by working acceptably at frequencies that conventional piezo-generators can't access efficiently.

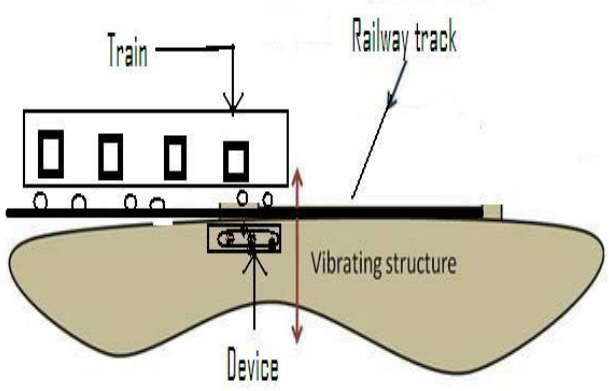


Fig.1 VIBRATION TO ELECTRIC ENERGY CONVERSION

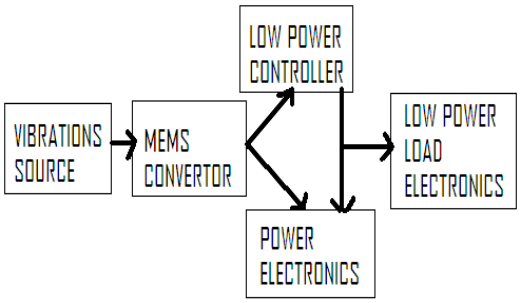


Fig.2 Block diagram

This method sets a maximum limit on the conversion process.

The major obstacle for this approach is that some method must be employed to hold the voltage across the MEMS device constant during the conversion process, which would require another source of value V_{max}. This is an additional source to that of the conversion charge reservoir, which is of a lower voltage and is also used to power the control electronics. It is desirable to perform the conversion with a single source. This means that there are two relevant voltage rails in the system. Which supplies the control electronics with power and is a constant rail at 1.5 V in this application? It is represented in the circuit diagram of Fig. 2 tells us that the voltage across the MEMS capacitor and changes during a conversion cycle.

MEMS Devices Information

MEMS devices integrate mechanical components, electronics, sensors and actuators on a semiconductor material, chip, or wafer. They are built with advanced micro fabrication and micromachining techniques to support a system-on-a-chip (SoC). An abbreviation for microelectromechanical systems, MEMS embeds very small devices in consumer electronics, medical devices, and industrial sensors. Typically, MEMS devices are found in computers, microphones and iPhones; lab-on-a-chip (LOC) devices, biosensors, and microrrays; and sensor chips for industrial and commercial applications. In the automotive industry, MEMS devices are used for both pressure sensing and inertial sensing. MEMS accelerometers, MEMS mirrors, MEMS valves, MEMS connectors, and MEMS switches for other applications are also available. Like other integrated circuits (ICs), MEMS devices are built in semiconductor materials such as silicon and with IC process sequences such as complementary metal-oxide semiconductor (CMOS), bipolar, and bipolar CMOS (BICMOS) processes. The

fabrication and micromachining technologies that are used to produce these tiny devices include photolithography, deposition, and etching. MEMS foundries design and manufacture microelectromechanical devices on a contract basis, in amounts ranging from prototype to production quantities. Typically, these companies use MEMS processing equipment such as silicon etching tools, wafer grinders, lapping and polishing machinery, and planarization equipment. MEMS production equipment is used to manufacture MEMS devices such as accelerometers and gyroscopes for inertial sensing applications, and geophones for both seismic sensing and vibration sensing. There are many different types of MEMS devices, but several basic categories. These include fluidic MEMS, optical MEMS, bio-MEMS, and RF MEMS. Fluidic MEMS devices are used in flow and pressure sensors, pneumatic valves, and membrane pumps for biological, chemical, medical, and pharmaceutical applications. Optical MEMS devices include very small mirrors for scanning and imaging applications, and miniaturized connectors and switches for fiber applications. MEMS mirrors are low-cost, deformable devices with thousands of actuators and advanced microstructures. Typically, they are used to shape wave fronts. Bio-MEMS devices are used to analyze and measure biological matter for biomedical analysis and in total analysis systems (TAS). RF MEMS devices are also available. These tiny parts provide radio frequency (RF) functionality and include MEMS resonators, which vibrate in specific patterns to function as band-pass filters.

Power assessment of large-scale vibration

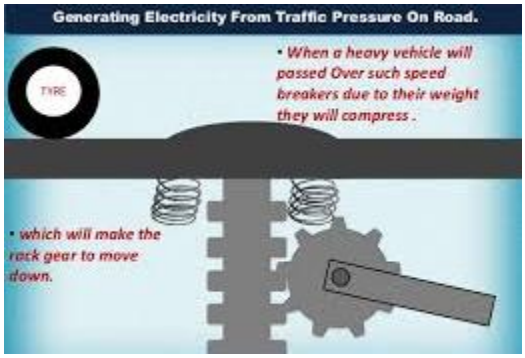
The vibrations could be large in many situations. If the energy in large scale vibration can be successfully harvested, it can serve as either an onsite generator or a power source to feed the grid. In this section, the facts of available energy in different vibration systems will be analyzed and summarized. The feasibility of harvesting significant amount of vibration energy out of those

Systems are also discussed.

This technique can further be used as follows

The road that generates electricity from moving cars

I often wonder if we can place an efficient dynamo underground on a fast moving highway (where traffic flow rarely stops). The dynamo is mechanically rotated and generates electricity to light up the street lights in thisway.



Kinetic Floor Generates Energy From People Dancing

Believe it or not, this actually isn't the first power-generating dance floor to harness some of the pent up energy of club-goers, but it is apparently the first one to hit the UK, and hopefully a sign of more to come. As you can see above, the dance floor makes use of a piezoelectric system that produces electricity as the dancers jump up and down, which charges some batteries that are used to power parts of the club. While that's certainly a practical application for the technology, we're guessing it's only a matter of time before some enterprising club owner combines one of these with an LED dance floor to create a dance floor that powers itself, and thumbs its nose at other do-gooder clubs.

Use this Energy in Household Purpose and Railway Roots:

In INDIA 70%-80% transportation is dependent upon railway. As the railway pass on the railway track the vibrations are created on the track this vibration can be converted into electricity by MEMS device. This generated electricity is in low energy power. This energy is send to power station to convert it into high energy level with the help of transformer. This energy can be sent to houses for the house hold purpose and can also be used in the railway signals indications. As the natural resources for generation of electricity (ie) coal is depleting day by days this is the one of the most parallel technique for the generation of electricity in INDIA.

Advantages:

- Save energy
- Use in domestic purposes

Disadvantages:

- MEMS device is costly
- Time consuming technique

Future scopes:

A system has been presented to convert railway vibrations into electricity. The controller has been verified to operate correctly and its losses have been measured. Based on predicted values of capacitance from the MEMS converter. As population in INDIA is increasing day by day to full fill the requirement of electricity, this is one of the best techniques for the generation of electricity in future. As it does not depend upon any natural resources it can be efficiently used for power generation. As it does not depends on natural resource, so there is no fear that one day the natural resource for electricity generation ie coal will be completely extinct. This will provide a way to the new generation for development of new techniques

Conclusion:

We are sure it's possible someone could design a system to do what you described, but it would almost certainly be highly impractical, unreliable, and expensive.

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YOGESH .C. PATHAK(1), SUHASINI PADWEKAR(2), PRIYANKA SHARMA(3), RUSHIKESH PAUNIKAR(4), SHREYAS SHETE(5)
(1)(Guide) ***ASST PROF. COMPUTER TECHNOLOGY DEPARTMENT, PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR.***
(2, 3, 4, 5)Students, Computer Technology Department, PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR