

Harvesting electrical charge from ambient vibration using piezoelectric materials

Abstract

Nowadays the energy source for portable electronic devices heavily depends on battery which has limited lifetime and contributes to environmental pollution after discarding it. This has created an environment impact to the soil and water. A green solution to reduce excessive pollution from battery usage is suggested in this paper with the use of piezoelectric materials to convert ambient vibration into the required electrical energy. The piezoelectric material is adhered to a cantilever beam to form a piezoelectric bender and its analytical model with base excitation is first established to study the effect of the structural and connecting configurations of the constructed benders on the harvested electric charge. The model predicts that the single-active layer piezoelectric bender harvests about 1.6 times of electric charge and two-active layer piezoelectric bender in parallel connection harvests two times, than that harvested by two-active layer piezoelectric benders in series connection. The experimental results comply with the theoretical predications. Among all the combinations, the two-active layer piezoelectric bender in parallel connection is concluded the optimum configuration for electrical charges harvesting. It is also shown in this paper the application of piezoelectric charge harvester to light up LED. This shows the potential application of piezoelectric charge harvester to replace battery usage that may reduce heavy metal pollution to the environment.