

Nonlinear Vibration Energy Harvesting for Leadless Pacemakers

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The application of the vibration energy harvesting discussed in this talk is powering pacemakers and other implantable medical devices. Implanted cardiac pacemakers were revolutionary when first employed in the 1960s. Today, implanted pacing devices are used for many different treatments; from pacing and defibrillation of the heart to regulate respiration, control tremor and mitigate Parkinson disease. Pacemakers and numerous other medical devices, however, all face the need for battery replacement. Battery failure and routine replacements require additional periodic surgical procedures. In addition, the battery size is a major challenge for leadless pacemakers. We have developed vibration energy harvesters that can convert heart motion to electrical energy to overcome the challenge, potentially removing the need for battery replacement surgeries and procedures. Leadless pacemakers are the most recent generation of pacemakers that are directly implanted in the heart. Some of the presented energy harvesters are linear and some are nonlinear. MRI compatible designs will also be presented. We will also talk about other applications of smart material systems investigated in IDEAS lab, including those in metamaterial systems.