

Advances in piezoelectric MEMS for vibration energy harvesting

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Abstract

Vibration energy harvesting addresses the development of engineered systems that can be powered (in part or whole) by ambient environmental vibrations. This area has been heavily researched in recent years as a means to provide an alternative energy source for wireless sensors, particularly for harsh environment applications, where access to conventional energy sources may be limited. However, practical adaptation has been limited by the very low power levels achievable using foundry MEMS technologies, inefficiencies in rectification interfaces, and robustness under high shock and vibration loading. This talk will present recent advances in piezoelectric MEMS that address many of these challenges and demonstrate the potential to enable the development of miniaturized, fully integrated sensor modules for a variety of structural health monitoring applications. In particular, the talk will discuss advances to significantly increase output power and frequency responsivity by employing engineered non-linearity, approaches towards addressing high-temperature operation and robustness under large amplitude base excitation, as well as the development of energy-efficient CMOS rectification interfaces for miniaturized vibration-powered sensor systems.

Short Bio

Ashwin A. Seshia is the Professor of Microsystems Technology at Cambridge University. He is also a Fellow of Queens' College and a co-investigator of the Cambridge Centre for Smart Infrastructure and Construction. His research interests are in the domain of micro- and nano-engineered dynamical systems with applications to sensors and sensor systems. He is a Fellow of the Institute of Physics, a Fellow of the Institution of Engineering and Technology and a Fellow of the Institution of Electrical and Electronics Engineers (IEEE). He serves on the editorial boards of the IEEE Journal of Microelectromechanical systems and the IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, as well as on the program committees of several international conferences. He is a co-founder of two spin-out companies, Silicon Microgravity and 8power, formed to translate technologies developed in his research group.