Title: **Ultra-Wide Bandwidth Energy Harvesting: Design with Orthogonal Thinking**

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**Abstract:**

Piezoelectric MEMS devices have been considered as an effective and compact energy harvesting option from ambient vibrations. At the present time, most piezoelectric energy harvesting devices have been designed to have a high quality factor linear cantilever beam that resonates even at small vibration. However, due to the very narrow bandwidth and low power generation density, the practical use of this technology is not yet feasible (Gain-Bandwidth Dilemma). Here we present an ultra wide-bandwidth energy harvester, which is made of a non-linear beam unlike linear cantilever beams all others have used. This is an example how orthogonal thinking can lead to an innovative design.

The PZT energy harvester, which is about the size of a US quarter coin, has a very unique non-linear resonance beam structure. It is a frequency locked loop device, which adapts its resonance frequency to the uncertain environmental vibrations. Test results show more than one order of magnitude improvement in both bandwidth (more than 20% of the peak frequency) and power density (up to 2W/cm3) in comparison to the devices previously reported. We anticipate the new design can transform parasitic ambient vibration energy into a practical energy source for powering a wide range of electronic circuits including self-powered wireless sensors.

**Biography:**

Sang-Gook Kim joined MIT as an associate professor in 2001. He received his B.S. degree from Seoul National University, Korea, M. S. from KAIST and Ph.D. from MIT. He held positions at Axiomatics Co. and Korea Institute of Science and Technology from 1986-1991. He joined Daewoo Corporation, Korea, in 1991 as a General Manager and then directed the Central Research Institute of Daewoo Electronics Co. as a corporate executive director until 2000. His research and teaching at MIT has addressed the issues in bridging the gap between scientific findings and engineering innovations, developing novel manufacturing processes for newly-developed materials, and designing and realizing new products at micro- and nano-scales. They include carbon nanotube assembly, muscle inspired micro-actuators, nano-engineered solar cells and MEMS energy harvesters. He currently serves as Director of the Park Center for Complex Systems at MIT.