압전 후막의 전단 변형을 이용한 나선형 MEMS 발전기

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A Novel Spiral Type MEMS Power Generator with Shear Mode Piezoelectric Thick Film

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Abstract : Energy harvesting from the environment has been of great interest as a standalone power source of wireless sensor nodes for ubiquitous sensor networks (USN). There are several power generating methods such as thermal gradients, solar cell, energy produced by human action, mechanical vibration energy, and so on. Most of all, mechanical vibration is easily accessible and has no limitation of weather and environment of outdoor or indoor. In particular, the piezoelectric energy harvesting from ambient vibration sources has attracted attention because it has a relative high power density comparing with other energy scavenging methods.

Through recent advances in low power consumption RF transmitters and sensors, it is possible to adopt a micro-power energy harvesting system realized by MEMS technology for the system-on-chip. However, the MEMS energy harvesting system hassome drawbacks such as a high natural frequency over 300 Hz and a small power generation due to a small dimension. To overcome these limitations, we devised a novel power generator with a spiral spring structure. In this case, the energy harvester has a lower natural frequency under 200 Hz than a normal cantilever structure. Moreover, it has higher an energy conversion efficient because shear mode (d_{15}) is much larger than 33 mode (d_{33}) and the energy conversion efficiency is proportional to the piezoelectric constant (d). We expect the spiral type MEMS power generator would be a good candidate as a standalone power generator for USN.

Key Words : Piezoelectric energy harvesting, MEMS, spiral structure