

A Thick-Film Piezoelectric Multimorph Cantilever

Kok, S. L., White, N. M. and Harris, N. R

School of Electronics and Computer Science, University of Southampton,
Southampton SO17 1BJ, UK

Corresponding author email: slk05r@ecs.soton.ac.uk

Abstract:

Free-standing thick-film cantilevers have the potential to be used as micro-generators as well as self-generating resonant sensors. Earlier versions of free-standing devices [2] were implemented by fabricating in the form of multilayer structures. Instead of structures with a plate of PZT sandwiched between upper and lower electrodes, multimorph structures consist of three individual PZT plates having equal thicknesses (of about 40 μm each). Ag/Pd conductors form the separators between the layers, also acting as electrodes on the upper and lower layers of the structure. Each piezoelectric plate was polarised in its thickness direction with two different modes: parallel and series. In the parallel mode, both the upper and lower PZT plates were polarised in the opposite direction, while in the series mode the upper plates and the lower plates were polarised in the same direction. The centre plate of PZT acts as the neutral axis of the structure. Using the direct piezoelectric effect, a voltage was generated when the multimorph structures were bent by the application of a harmonic excitation. An output power of 10 μW was measured for the parallel polarised sample. Series multimorphs, however, exhibited a non-linear effect, where the output power was 21 μW for an up-sweeping frequency, but was reduced by a factor of 50 for a down-sweeping frequency.

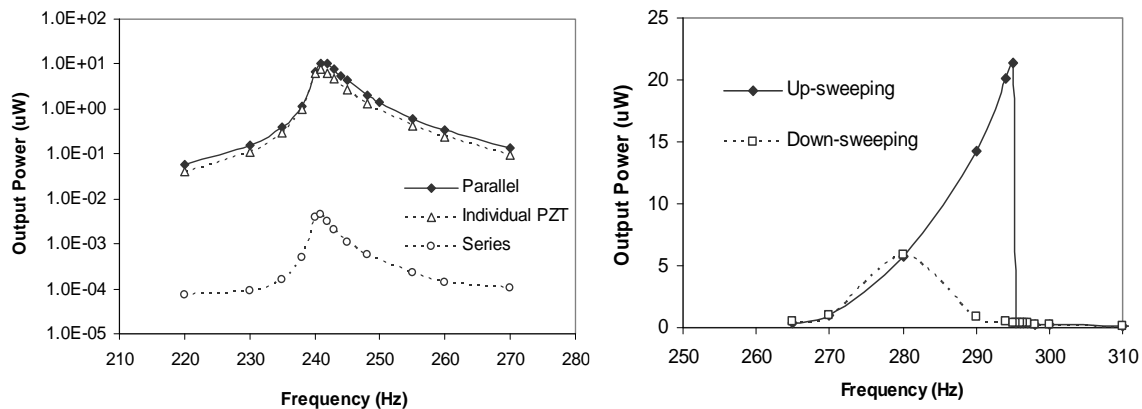


Fig 1. Measured electrical output power from a) parallel polarised samples and b) serial polarised samples.

References

- [1] Ha, S.K. and Kim, Y.H. (2002) Analysis of A Piezoelectric Multimorph in Extensional and Flexural Motions. *Journal of Sound and Vibration*. 253 (5). pp. 1001-1014.
- [2] Kok, S. L., White, N. M. and Harris, N. R. (2008) Free-standing thick-film piezoelectric device. *Electronics Letters*, 44 (4). pp. 280-281.