MEMS piezoelectric energy harvesting from ambient vibrations

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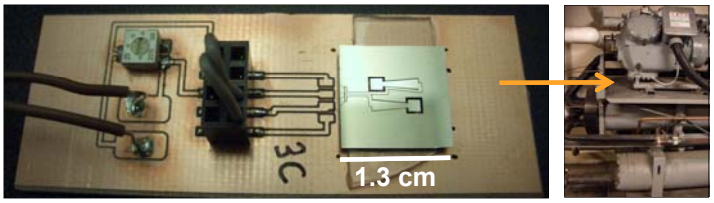
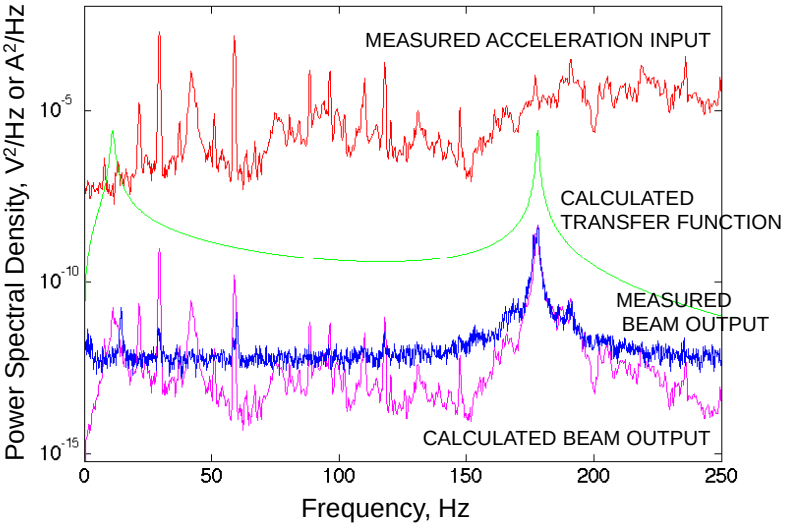
Vision

Ubiquitous wireless sensor networks have extraordinary potential for use in applications such as demand response, environmental and manufacturing monitoring, & medical devices. Realization of these networks for wide-spread use requires that sensor nodes be low-cost, non-intrusive, & maintenance free. A micro-scale energy harvester addresses these needs by harnessing environmental vibrations to provide a replenishable source of power for the sensor node while reducing the volume of the power generator.

Ambient vibrations

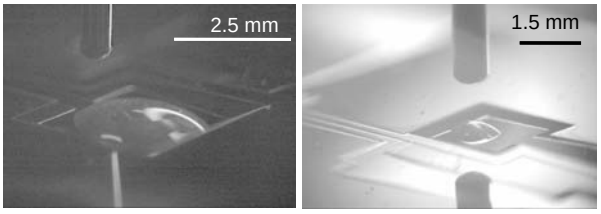


Power Spectral Density vs Frequency.
Ambient vibration source: compressor.

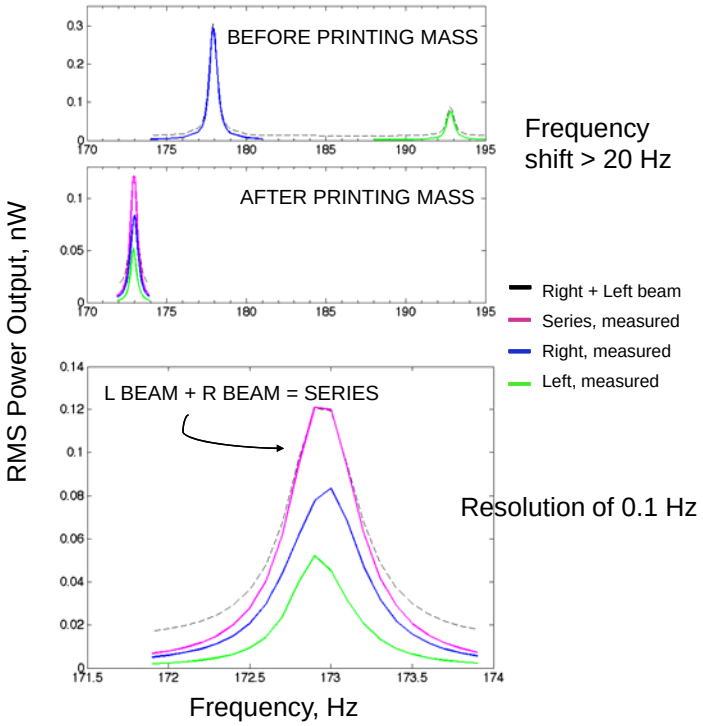


Tested 9 beams on 7 ambient sources:
Prms = 1 pW/beam - 1 nW/beam (ambient vibration input).
Model: measured accel. input → predicted beam output.

Printed proof mass



RMS Power Output vs Frequency



Beam signals add if connected in series.

Next steps

Use model to redesign & optimize harvester for use with ambient input vibrations (goal: Prms = 1 µW).
Fabricate & test next generation harvester.
Integrate with power conditioning and other components.