RAY W. HERRICK LABORATORIES

Sponsor: NSF

Multiscale Modelling of Triboelectric Energy Harvesters

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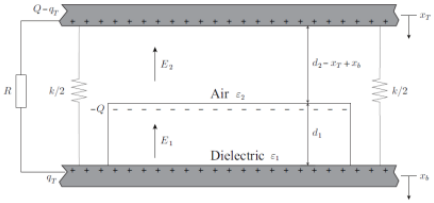
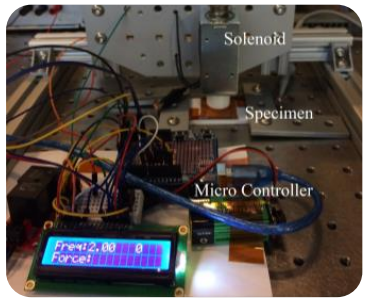
Project Description

The dynamics of triboelectric energy harvesters is modelled integrating elastic and electrostatic elements as well as charge transfers by contact electrification, which is studied in detail through experiments.

Approach

- Macroscopic modelling
  - Elastic elements as an impact oscillator
  - Electrostatic elements by Gauss's Law
- Experiments on contact electrification
  - Tests on variable combinations of materials conducted on a solenoid-driven presser
  - Designed surface topography of specimens
  - Controlled force magnitude and duty cycle



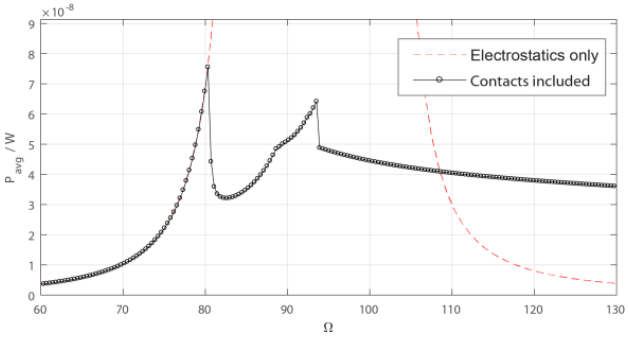


Discussion

- Methods to measure charge transfer
  - Directly by electrometer or AFM
  - Indirectly by output voltage
- Various electrification mechanisms
  - Electron transfer for metals
  - Ion and material transfers for polymers

Results

- Device performance by analysis
  - Analytical solution for non-impacting electrostatic system
  - Broadband performance achieved including nonlinearities by impacts
- Experimental results in progress



Power output of a vertical-contact triboelectric energy harvester by simulation

Triboelectricity is modelled via experiments to determine electrification mechanism.

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