Modelling and Simulation of a Vertically Intergrated Nano Generator in Vibration Mode

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In the field of energy harvesting, recent advancements have paved the way for innovative technologies capable of converting ambient energies into usable power. This study investigates the viability of using piezoelectric nanogenerators to harness the underexplored potential of harvesting vibrational energy from voluntary and involuntary hand movements. Driven by a notable gap in existing technology, the research aims to model and simulate a vertically integrated ZnO-based nanogenerator, utilizing COMSOL Multiphysics, and specifically optimized for the frequency spectrum of essential tremor vibrations. This approach is supported by an in-depth vibrational analysis and the implementation of novel simulation techniques. The key findings reveal the nanogenerator's ability to efficiently convert low-frequency vibrational energy into substantial electrical power, demonstrating its potential for powering self-powered smart wearables and medical devices. These results contribute significantly to advancing piezoelectric energy harvesting technologies and pave the way for innovative healthcare solutions, thus marking a significant advancement in integrating energy harvesting with medical applications and smart wearables.

Keywords: *Energy Harvesting, Piezoelectric Nanogenerators, Essential Tremor, Zno Nano wire, Vibrational Energy, COMSOL Multiphysics*