Title: Computational analysis of piezoelectric transducers

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Abstract:

Objective: The concepts of Resonate Frequency and the Piezoelectric Effect are well known and utilized in modern transducers for a variety of applications, such as the quartz watch, high voltage ignition systems, and a litany of pressure and temperature sensors. The purpose of this study is to further determine the efficacy of several piezoelectric assemblies for potential use in variable voltage or signal production technologies. Primarily, all efforts are made to maintain simplicity of design and a minimization of moving components. These parameters are in place to allow for ease of production, as well as to limit points of potential damage or mechanical failure during operation.

Methods: Utilizing Ansys-Fluent (Fluid Dynamics software) this study will simulate resonance and signal production data for several iterations of piezoelectric devices. Compiled data from Ansys will then be compared against industry performance standards of similar devices, to determine if a superior configuration can be achieved or refined.

Results: Preliminary phenomenological analysis within a Python development environment yields that resonance of a piezoelectric element can be induced and sustained within symmetrical geometric bodies by relatively standard environmental forces. Utilizing the principals of Flow dynamics and Wave propagation, several designs to transduce disordered environmental energy into electrical potential difference (Voltage) have been developed for analysis within the Ansys-Fluent software to determine their practical usage and efficiency rates.