Piezoelectric Energy Harvesting from Hydraulic Pressure Fluctuations (#5886)

A system that can generate power by converting hydrodynamic pressure ripples into low power electricity

Inventors at Georgia Tech have developed a system that can generate power by converting hydrodynamic pressure ripples into low power electricity. The invention is based on the concept of piezoelectric power generation and uses an array of screw-in piezoelectric stack inserts to assist with the extraction of the generated power. The proposed configuration enables the AC (alternating current) output across the electrodes to be converted into a stable DC (direct current) signal.

This signal can be regulated to obtain the desired voltage level required for an external electrical load or storage component. Since the voltage levels in piezoelectric energy harvesting are relatively high compared with other transduction methods, the higher voltage levels are stepped-down using a DC-DC converter in the energy generation mechanism proposed here. Additionally, the layers of the piezoelectric stack are combined in a circuit configuration that increases current flow while keeping the voltage at relatively low levels and simplifying the regulation process on the DC side of the mechanism.

Benefits/Advantages

- Novel high-energy density source based on pressure ripples within hydraulic systems
- Energy harvesting is enabled through multiple configuration of piezoelectric stacks
- Can be arranged in different configurations to maximize current while keeping voltage levels low
- Easily integrated into distributed sensor applications or health monitoring systems
- Eliminates the need for extraneous batteries, wires and other peripherals

Potential Commercial Applications

Small electronic components, such as health-monitoring sensors and wireless communications nodes, could be powered by this invention. Integrating this technology with the sensor system would eliminate the need for batteries or other peripherals, such as wires, to provide power. The extensive use of distributed sensors in hydraulic systems would provide an immediate application for this invention.

Background/Context for This Invention

This invention demonstrates a novel method to harvest energy from pressure ripples present within hydraulic systems. Research into new energy harvesting methods is being pursued at different research laboratories and universities with special interest in exploring energy harvesting from low-energy-density

sources such as wind turbulence and structural vibration. Unlike other low energy density sources, this invention focuses on a relatively high energy density source, which enables several advantages when utilized as a power source.

Dr. Kenneth Cunefare
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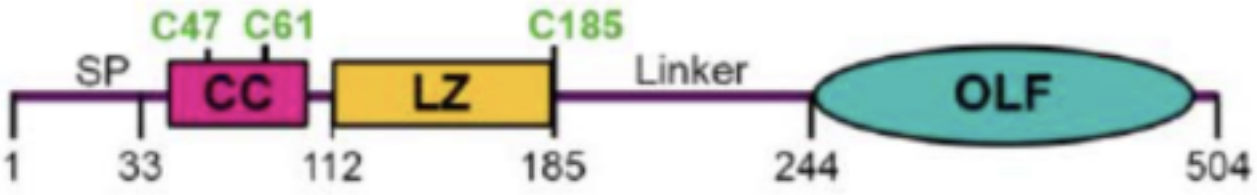
More Information

U.S. Application Filed - [10211761B2]

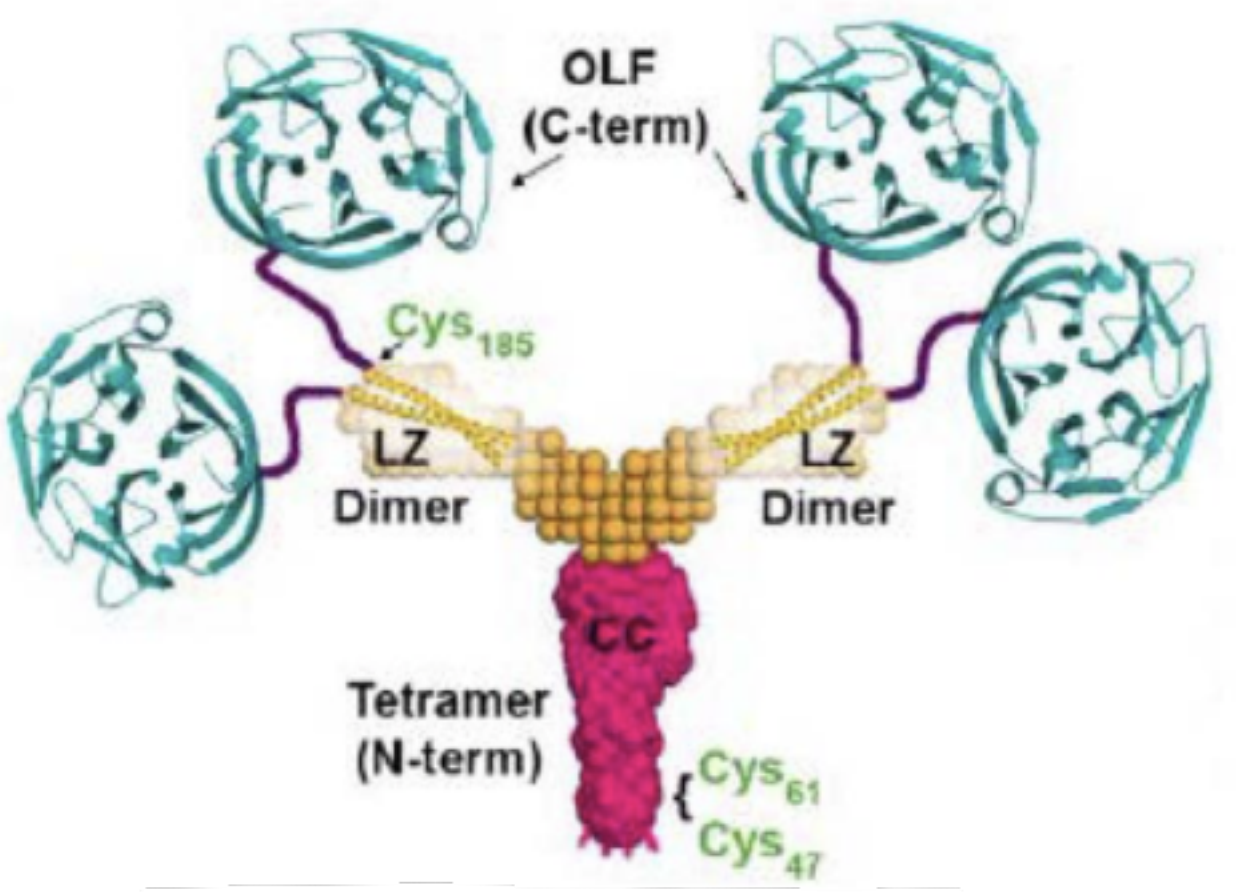
Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/piezoelectric-energy-harvesting-hydraulic-pressure-fluctuations

Images:



The gene structure depicting the domains of myocilin, including signal peptide, location of key cysteine residues, and its coiled-coil, leucine zipper, and olfactomedin domains.



The myocilin quaternary structure based on solution X-ray scattering, X-ray crystallography, and chemical cross-linking experiments.