Article Side
Frequently asked Questions about Piezo Transducers, Actuators and Piezoresistive Sensors by Piezo

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Piezo Effect

The piezoelectric effect is found in some materials (such as quartz) that have an atomic lattice structure forming a rhomboid or cubic cell. When pressure (mechanical stress) is applied to the structure, it produces an electric charge and, when an electric field is applied, a mechanical deformation occurs. “Piezo” is derived from the Greek word for pressure.

Piezo Transducer

A piezo transducer converts electric energy in mechanical energy or vice versa.

Basically any type of piezo mechanism can be called a transducer. Piezoelectrics can respond very rapidly to drive voltage changes and therefore are often used to generate vibrations or sound.   Piezo transducers are used in microphones, guitar sound pickups, speakers, buzzers, headphones, etc. The advantage of a piezo speaker over a magnetically driven speaker lies in the simplicity, compactness, efficiency and robustness of the piezo ceramic plates that are used to move the speaker diaphragm film.

Sonar and ultrasound imaging are also based on piezoelectrics. In this case, the ultrasonic transducers are driven at their mechanical resonance frequnecy, a phenomenon that greatly increases the amplitude while reducing the input power at the same time, i.e. the system is operated at its highest efficiency.

Piezo Actuator vs. Transducer

In motion control applications, piezo mechanic elements are usually referred to as a piezo actuators.   A piezo actuator is typically used to generate forces or to position loads very precisely. In motion control applications piezo actuators are usually operated well below their mechanical resonant frequency.

Piezo resistive sensors

Piezoresistive sensors are low-cost, mass produced, typically silicon-based sensors that are very commonly used for pressure sensing applications. They are sometimes used together with piezo actuators to provide position feedback or force feedback, for example on closed-loop microscope positioning stages. Piezoresistive means that the resistance changes with the applied pressure. Unlike piezo sensors, piezoresistive sensors do not generate a charge (energy) and they cannot convert mechanical in electrical energy and vice versa. In precision nano-positioning applications, piezoresistive sensors are a good choice for entry-level systems. Other sensors are available when cutting edge performance is required.

Lifetime of Piezo Mechanic Actuators

If operated under the right conditions, the latest generation of ceramic-encapsulated actuators can work for 10’s of billions of cycles.

Vibration Cancellation / Active Damping

Due to their fast response piezo mechanic actuators are a good choice for active vibration cancellation.

Here, a vibration sensor is required to provide the controller the correct information on how to counteract the mechanical vibration by providing the right amplitude and phase output to the piezo actuator. The sensor could even be a piezo ceramic transducer, configured to respond to strain or pressure.

Momentum Compensation / Active Damping

Any type of rapid actuation will cause vibrations in a work piece. According to Newton’s laws, this means, the faster a piezo mechanical system operates, the more reactive forces it will cause. In case these forces are unwanted, a second piezo mechanical system with a counter mass can be integrated and driven with a signal of the opposite phase. With a little fine-tuning the forces of both actuators will cancel each other out and the work piece can now move quickly but without exerting any force on the surrounding structures. This trick is often used in fast piezo steering mirrors for image stabilization in astronomical telescopes.

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Piezo - About Author:
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