



## Sensors

# A Field Deployable PiezoElectric Gravimeter (PEG)

## A Light Weight Cost-Effective Solution for Structural Measurements

Sensing environments or structures state is important and often critical in a wide variety of applications. Sensors and sensing systems are typically specifically-designed for specific functions. This can result in time-consuming and costly cycle of design, test, and build, since there is no real standard-sensor building block that can be adapted and used to sense a variety of attributes and physical states. To meet this need, the PiezoElectric Gravimeter (PEG) was developed to provide a sensing system and method that can serve as the foundation for a wide variety of sensing applications. The PEG is a field disturbance sensor system that includes a piezoelectric element for generating mechanical energy when electrically excited and for generating electrical energy when mechanically deformed. Resultant characteristics are automatically quantified.

## BENEFITS

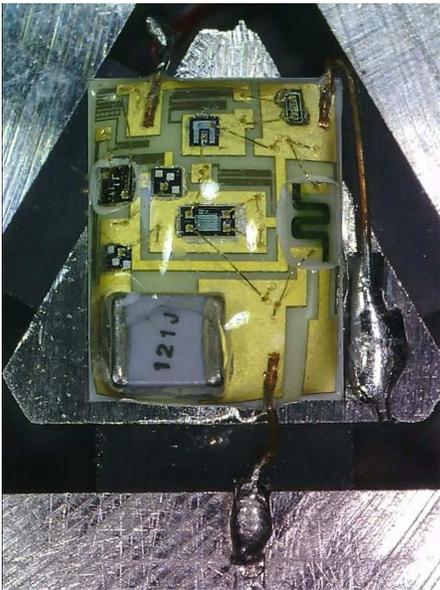
- **Economical Design:** Small, portable, light weight unit; simple and economical to construct
- **Innovative Utility:** Uses shear mode piezoelectric elements
- **Data Sensitivity:** Increased precision and accuracy; highly reproducible response across a full frequency spectrum
- **Innovative Algorithms:** Capable of highlighting and detecting minuscule differences within large data sets
- **Simple Design:** No specialized training required to operate
- **Novel Approach:** A new method of using piezoelectric elements enables novel and improved applications

technology solution

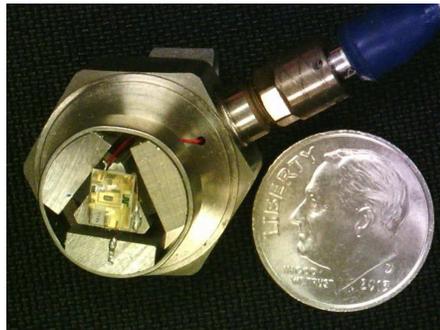
### THE TECHNOLOGY

Conventional gravimeters typically measure the amount of the opposing forces required to suspend an object or by monitoring an objects freefall rate. This innovative technology uses piezoelectric instrumentation in a completely new way, reversing their role. The piezoelectric transducers are provided with excitation energy, causing a highly reproducible response across a full frequency spectrum. This is known as the piezoelectric stimulus-response effect. This allows the piezoelectric transducer to take static measurements opposed to the conventional utilization of piezoelectric devices that require a dynamically changing quantity.

When the pull of gravity is introduced, the original element characteristics are immediately changed along with the fluctuations in gravity. These types of transducers are specifically designed to maximize the gravitational effects of the elements vibratory characteristics. The resultant characteristics are automatically quantified and temperature compensated through vector analyses and data reduction algorithms into gravitational units. This stimulus-response process is highly repeatable, which produces a near exact response or measurement from each collected reading completely revolutionizing the precision and accuracy achievable.



Three piezoelectric shear elements weighed for gravitational measurement with embedded charge amplifier.



Small package piezoelectric sensor used for quantifying gravitational forces with embedded circuitry.

### APPLICATIONS

The technology has several potential applications:

- In addition to structural sensing, the PEG could be used by prospectors and geologists to locate mineral or shell deposits, as well as by construction workers to locate deep underground piping.
- Commercial applications include: Automotive industry, industrial structures, aviation industry, petroleum industry, chemical industry, satellites, supercolliders, crustal motion monitors, seismology monitors, geophysical examination, surveying equipment, petroleum prospecting, mineral prospecting, security monitoring, motion detectors, altitude detectors, under ground infrastructure detection and tide prediction.

### PUBLICATIONS

Patent Pending

US Patent App No: 14/691,623

Jensen, Scott. "An Economical Lightweight Field Deployable PiezoElectric Gravimeter (PEG)." TechConnect World Innovation Conference & Expo, June 15, 2015, Washington, DC.

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