

RALSisma

Seismic sensor and Data Acquisition System for study of seismic phenomena

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RadioAstroLab provides a range of important scientific instruments: they are instruments ready for use and available in various configurations, they can be used by enthusiasts individual, by teams of researchers or schools which look to the world of science with more or less demanding approaches. The product range is constantly evolving, embracing various fields of scientific interest and research.

In this document we present a new instrument for the study of seismic phenomena, composed of a sensor designed by our collaborator Dr. Riccardo Ronchini (European Patent EP2325673) and by an electronic measurement and data acquisition high resolution system which, connected to a computer equipped with DataRAL Sisma management software, allows you to view and record any ground vibration of geological interest. The instrument, unlike conventional seismographs, is very economical and practical to use, allows anyone to monitor the local seismic activity for work, study or pleasure.

At the current time (so the experts say) are not able to predict unambiguously and certain the occurrence of an earthquake. However, the possibility to install a system of continuous monitoring of ground movements on the territory in which we live and, together with this, a local alert device that exploits the speed of communication by radio to warn people in the event of abnormal signals generated by the sensors (but not yet felt by the people), is without doubt an important advantage in terms of protection of self-preservation.

Most of the seismic sensors is essentially composed of the following parts:

1. a frame or a structure similar to it, integral with the ground;
2. an inertial mass free to move relative to the frame, urged by an acceleration impressed to the sensor;
3. an electronic amplification and acquisition system that measures and records the kinematic quantities of relief (speed, acceleration, excursion) relating to the motion of the mass relative to the frame.

The instrument that we propose includes a magnetic circuit, similar to that employed in electroacoustic transducers, within a coil moves due to the stresses suffered. This relative motion between the coil and the magnetic structure generates, by induction, an electrical signal that is an accurate representation of the stress experienced by the sensor. The principle of transduction is, therefore, identical to the one used in common moving coil microphones. The system is completed with mechanical organs that ensure a centering of the coil with respect to the air gap, even in the case of violent mechanical shock impressed to the sensor.

Main features of the *RALSisma* seismograph

The most important aspects that characterize our instrument are the following:

1. Assembly techniques derived from the construction technology of electro-acoustic transducers (patented).
2. High dimensional flexibility: we are able to build seismic sensors of different sensitivity, precision and response speed, with sizes ranging from a few centimeters to about a meter in diameter. This allows the implementation of sophisticated measurement instruments, as well as cheap industrial or residential sensors suitable for alarm signaling in the event of abnormal vibration of the land (building applications, in industry, in the protection of plants dispensing and supply of energy, hospitals, public buildings, schools, intrusion detection systems,).
3. Total independence between the geometry of the magnetic circuit and that of the suspension springs: this allows a high flexibility of choice as regards the definition of the elastic constant of the springs that support the moving coil, then the resonance frequency of the inertial oscillator (bandwidth of the instrument).
4. Electronic system for data acquisition at very high resolution with low noise amplifier-filter, characterized by an input impedance that is perfectly suited to the characteristics of the sensor.
5. Software for data acquisition and data logging *DataRALSisma* that enables the graphical display of the track seismic, acquisition in a continuous cycle of data from the sensor, programming alarm thresholds and recording of the data files to exceeding the thresholds.

Through the *RALSisma* acquisition system, the analog signal from the seismic sensor is converted into a digital signal with high resolution which is sent, via serial port USB standard, to any computer for processing. Through our software, of simple and straightforward use, it is possible display the graph and store the data received from the sensor.

Visualization and data storage software
DataRALSisma

Seismic sensor



Continuous monitoring of seismic activity with the system *RALSisma*

Amplification and data acquisition system with high resolution

RALSisma Seismograph.



Example of *RALSisma* recording.

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