

¹: Pavol ČEKAN, ²: Anh NGUYEN THE, ³: Ervin LUMNITZER

GENERAL POSSIBILITIES OF ACCELEROMETERS USAGE TO MEASURE VIBRATIONS AND THE POSSIBILITIES OF THEIR FIXATION ONTO MEASURED OBJECT

¹⁻³: TECHNICAL UNIVERSITY IN KOŠICE, FACULTY OF MECHANICAL ENGINEERING, DEPARTMENT OF ENVIRONMENTAL STUDIES AND INFORMATION ENGINEERING, KOŠICE, SLOVAKIA

ABSTRACT: This contribution deals with question of vibrations measuring with use of accelerometer instrument. Aim of contribution is to characterize and divide selected types of accelerometers in categories according to principles of their activities. Contribution further describes basic requirements for selection of suitable type of the accelerometer. The end of contribution deals with options of fixation accelerometer onto measured object in process of measuring its vibrations.

KEYWORDS: accelerometer, signal, vibration, sensor

❖ EXORDIUM

At the present time quality of environment human is constantly invade whereby several factors, which negatively effects arrogate in large criterion also vives. We know, that vives let us say vibration in common is move physical system, which over deviation get back always into the stability location. Fot all that for metering vives most often use as electromechanical converter of mechanical vibration on electrical signal (analyzer), which works on principle Newton´s intensity canon and piezoelectrical effect. By piezoelectrical effect is intensity on output directly in proportion to power and acceleration vives, result from also name analyser - accelerometer.

❖ ALLOTMENT ANALYSERS OF ACCELERATION VIBRATION (ACCELEROMETS)

Accelerometer is apparatus, which mete vibrations or acceleration in move compages (construction, parts of machines tec.). Intensity induce vives or change move (acceleration) affect on substance analyse, which then compress piezoelectrical element generating electrical charge commensurable to compression. Because is electrical charge commensurable to intensity and substance of analyzer is constant, is so electrical charge also commensurable to acceleration.

Analyzers mechanic vibration (accelerometers) by principle activity we can separate on:

- ❖ **Active (generatorical)**, which are generic on their output electrical module e.g. piezoelectrical and electrodynamic;
- ❖ **Pasive, exigent of power energy**, which are modulation of any electrical modulate, or parameter of electrical circuit.

From these two basic groups analysers are used most often on metering of vives:

- ❖ Piezoelectric (PE),
- ❖ Piezoelectrical with inbuilt electronic (IEPE),
- ❖ Piezorezistive (PR),
- ❖ Capacitive (VC). [3]

❖ CHARACTERISTIC SOME CHOICES TYPES OF ANALYSERS

On the basis listed above knowledges, oportunites use analysers and their technical parameters we can characteristic following types:

- a) Model 7251A piezoelectric accelerometer IEPE

The Endevco model 7251A is a small piezoelectric accelerometer with integral electronics is shown on figure 1, designed specifically for measuring vibration on most structures. The unit is

hermetically sealed against environment contamination, offers high output sensitivity, and wide bandwidth. This new light weight (10.5 gm) design effectively minimizes mass loading effects.



Figure 1. Piezoelectric accelerometer IEPE model 7251A

The model 7251A features Endevco's Piezite type P-8 crystal element, operating in annular shear mode, which exhibits low base strain sensitivity and excellent output stability over time. This accelerometer incorporates an internal hybrid signal conditioner in a two-wire system, which transmits its low impedance voltage output through the same cable that supplies the constant current power. Signal ground is connected to outer case of the unit and, when used with the supplied isolated mounting screw, it is electrically isolated from ground. The centrally located mounting bolt permits 360° cable orientation, a very desirable feature in many applications. A model number suffix indicates sensitivity in *mV/g*; i.e., 7251A-10 features output sensitivity of 10 *mV/g*. Table 1. user specification hereof scanner. [2]

Tablet 1. Specification [2]

Sensitivity (typical)	-10; 10 <i>mV/g</i> -100;100 <i>nV/g</i>
Frequency response (± 1 dB)	2 to 10 000Hz
Shock limit	5000g pk
Temperature range	-67° F to + 257° F (-55°C to +125 °C)
Weight	10,5 grams (0,37 oz)
Mounting	Insulated mounting screw or adhesive

b) Model 7264G Piezoresistive accelerometer

The Endevco model 7264G is a very low mass piezoresistive accelerometer (figure 2) weighing only 1.4 gram. This accelerometer is designed for crash testing, rough road testing and similar applications that require minimal mass loading and a broad frequency response. This accelerometer meets SAEJ211 and SAEJ2570 specifications for instrumentation for impact testing. It is equivalent in form and fit to the Endevco model 7264C-2K in that the location of the center of seismic mass is the same.



Figure 2 Piezoresistive accelerometer model 7264G.

The model 7264G utilizes a unique and advanced micromachined sensor which includes integral mechanical stops and damping. This monolithic sensor offers improved ruggedness, stability and reliability over previous designs. The model 7264G has suitable damping to minimize phase shift over the useful frequency range and attenuate resonance. With a frequency response extending down to dc (steady state acceleration), this accelerometer is ideal for measuring long duration transient shocks.

This accelerometer has a two active arm full bridge circuit with two fixed resistors to facilitate shunt calibration. Full scale output is 400 *mV* with 10 Vdc excitation. It is also available with less than 1% transverse sensitivity ("T" option) and less than ± 25 *mV* zero measured output ("Z" option).Tablet 2. user specification hereof scanner.[2]

Tablet 2. Specification [2]

Sensitivity	(at 100 Hz & 10 g) (min/typ/max) <i>mV/g</i> 0.15/0.20/0.30
Frequency response Hz	($\pm 2.5\%$ max, ref. 100 Hz) 0 to 2000 ($\pm 4.0\%$ max, ref. 100 Hz) 0 to 4000
Transverse sensitivity %	max 3 (1 optional)
Thermal sensitivity shift (max)	From +10 °C to +30 °C %/°C typ ± 0.06 From +50 °F to +86 °F %/°F typ ± 0.1

c) Acceleration Sensor AS - 020

The acceleration sensor AS-020 is used for measurement of vibration acceleration. Acceleration sensors operate in accordance with the piezo-electric compression principle (see figure 3).

Inside the sensor, a spring/mass damping system is formed by a piezo-ceramic disk and an internal sensor mass. When introducing vibrations into this system, the mass exerts an alternating force on the ceramic disk, and due to the piezo-electric effect, electric charges are caused which are proportional to acceleration. An integrated charge amplifier increases the output signal to a usable signal level. Table 3 user specification hereof scanner.[1]



Figure 3
Acceleration sensor
AS-020

Tablet 3. Specification [1]

Transmission factor	100 mV/g ±5 % 10,2 mV/m/s ² ± 5 %
Sensitivity deviation due to temperature	- 22 °C - 3 % + 22 °C 0 % + 65 °C + 2,5 % + 120 °C + 5,5 %
Measuring range	± 80 g (UB = -24 V...-30 V) ± 40 g (UB = -20 V) ± 20 g (UB = -18 V)
Frequency range	4 ... 10 000 Hz (± 0,5 dB) 1,5 ... 15 000 Hz (± 3 dB)

❖ EXAMPLES INSTALLATION OF ACCELEROMETER IN THE PROCESS OF METERING VIBES

Accelerometer we can install by six methods in the seriate duality to accomplish results of metering (see figure 4):

- The mechanical screw (needs a preparations on all kinds catch are mostly in accessories accelerometers, sometime their is advisable specify in the order) (see figure 4a);
- The electric isolate screw (this method we apply if we get signal, although the measure point is not energizing) (see figure 4b);
- The gripping by parametric magnet (this is the simplest gripping and is use in normal metering most useless) (see figure 4c);
- The affixing of sensor with bee-wax (see figure 4e) or with fast toughen glue (see figure 4d);
- The metering to screw by hand sonde (see figure 4f).

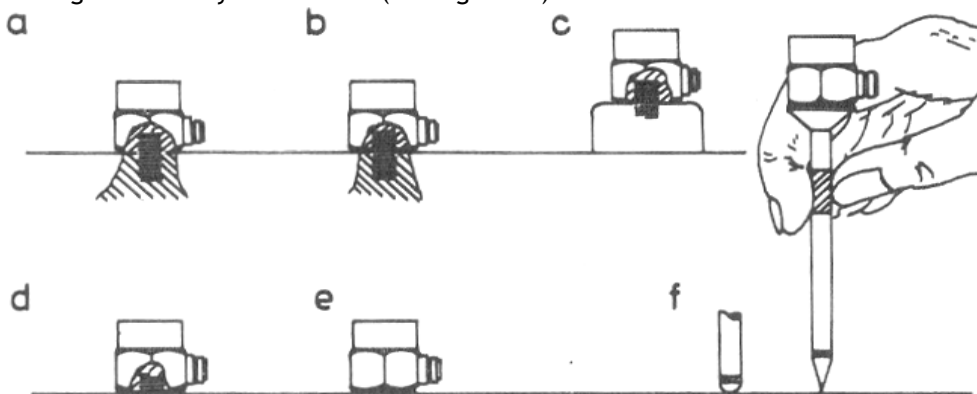


Figure 4. The style of gripping accelerometer. a - gripp by steel screw, b - gripp by electric isolate screw on isolate plate, c - gripp by permanent magnet, d - affix by the fast-gel glue, e - affix by bee-wax, f - screw by hand sonde with various types of tip

On (figure 5) is schematic examples advice installation of accelerometer and cable in process metering vibes.

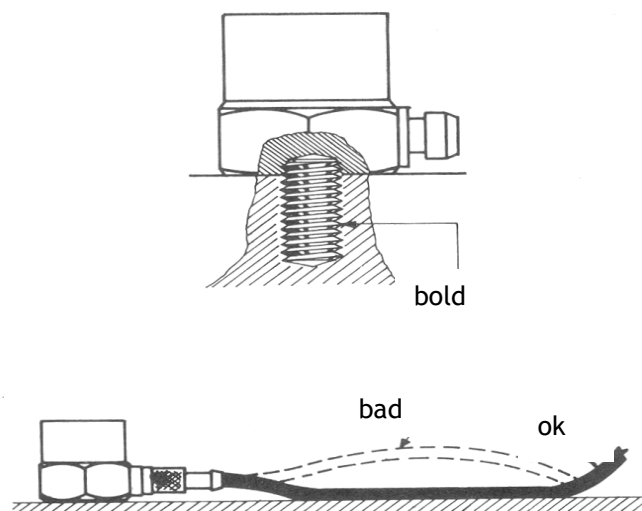


Figure 5 The instal accelerometer and cable at measure of vibes

On measure of vibes is important deliberate all positive requests at choice the favorable type soft sensor. Basal request, important especially on measuring of vibes easiest objective is, that substantiality used sensor could not affected the vibes of measure point. On normal valuation is valid one principle, that sensor must by minimal 10 times easier as measure object and at the same time is necessary by care on the places, which have small consistence.[3]

❖ CONCLUSION

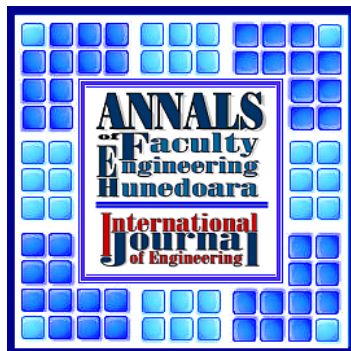
The vibes as well as other factors are inseparable component of environment for human. Summarize is therefore necessarily accentuate importance of measure vibe as negative factor of environment. Provide full elimination or cut down negative effects of vibes and contribute for upgrade of environment for human.

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