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NEWS
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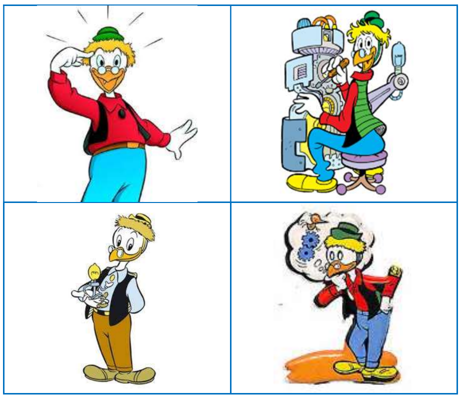
Redazione Dott. Giorgio Canova

Franco Canova: Ideas Creations Inventions

ANALYSYS OF VIBRATING PHENOMENONS: CREATION OF VIB PRODUCTS

Tecnidea Cidue (founded in 1988 by Franco Canova) situated in Verona (Italy) is a world leader company in the design of mechanical components, more specifically in the industry of vibrating machines or that heave something to do with vibrations. A deep knowledge of the world of vibrations and its connected phenomena is needed to work in this industry. Starting from these premises our CEO Mr. Franco Canova created a new line of products classified under the acronym VIB "Base Industrial Vibrations", that starting from the above mentioned concepts could find wide operative spaces in different industries both as vibration dampers (**first case**) as vibration regulators (**second case**). In the first case their aim is to eliminate the most possible (with results almost reaching a 100%)



vibrations in a system, granting normal functioning.
In the second case they use the vibrations produced by vibrating systems to generate controlled movement flows which produce different kinematics and consent the functioning of infinite vibrating machines, screens, plansichters, mills etc. Between the various proposals created and available on our catalogues,

There are also our VIB type **Y** (img. 1) and **AN** (img. 2) antivibrating supports referring to the **first case** (pag. 1) which is absorbing vibrations. These elastic elements dissipate vibrations using natural rubber cylinders inside of them. The system is made of two square steel profiles rotated 45 degrees from one another and four rubber cylinders inserted in the triangular spaces created by the two profiles (img.3). the rotation of one profile in respect to the other elastically compresses the rubber that thanks to the molecular friction it dissipates the energy coming from an oscillatory wave into heat.

Image 1

Image 2

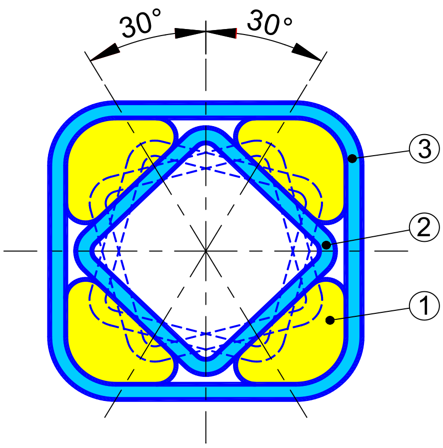


Image 3
1: Natural rubber cylinders
2: Internal square profile
3: External square profile

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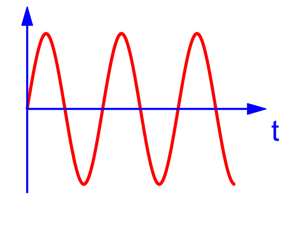
KNOWLEDGE OF THE WORLD OF VIBRATIONS AND ITS CONNECTED PHENOMENONS: Definition and classification of vibrations

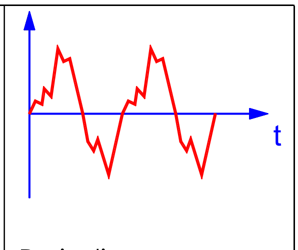
Vibrations are a physical phenomenon that's widespread in the world in which we live, in fact the oscillating systems represented by a "wave" are multiple: noise (sound), the oscillation caused by the wind, traffic, the vibration created by a train or by a machine in general, road work, explosions, an earthquake etc. Vibrations are waves that propagate in solids, liquids and in the air. They can manifest in mechanical actions but also in the shape of sounds.

Vibrations can be:

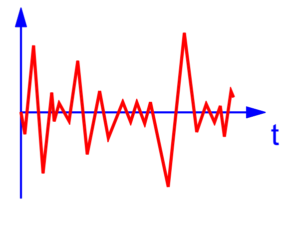
- **Harmonic**: the course of the oscillation is purely sinusoidal as for example the ones produced by an electric motor (img.4)
- **Periodic**: the irregular course of the oscillation presents a pattern that with appropriate simplifications can be traced back to an harmonic oscillation (img. 5).
- **Chaotic**: the oscillation doesn't have a pattern but presents an unquantifiable course in respect to a time sequence, for example the vibrations produced by natural phenomena such as wind and earthquakes, or produced by chaotic phenomena like urban traffic, fans at the stadium, roadwork, manifestations, discotheques etc. (Img. 6).
- **Pulse**: the oscillations presents instantaneous width peaks with consequential rapid deceleration. This is the case of explosions, printing processes, impacts, forging, punching and mallet hits (img. 7).



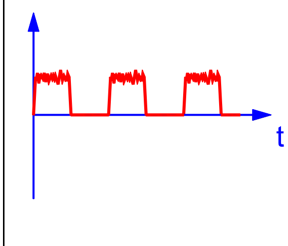
Harmonic
Image 4



Periodic
Image 5



Chaotic
Image 6



Pulse
Image 7

In mechanical constructions (but also in everyday life), vibrations emitted by a moving system result mostly annoying and harmful both for the machine itself and for the operators "on board" and in its vicinities. In modern systems with the lightening of structures caused whether by the increase of quality in the production materials used for the manufacturing of high quality goods or because of regulations regarding the safety of workers, it is more and more required and necessary to isolate and dampen the oscillations caused by mechanical parts moving. Vibrations themselves cannot be erased but they can for sure reduced to bearable undulatory phenomena for construction or safety by using supports called antivibrating mounts (in these cases vibratory energy is absorbed and converted to heat).

Edited by:
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VIBRATION INSULATION TECHNOLOGY:
Proposals and solutions for their reduction or control of vibratory phenomena.

Vibration insulation can be achieved in two ways: direct or indirect.

- DIRECT or ACTIVE insulation

The machine or plant (set of machines) produces vibrations from which it has to be insulated to avoid it spreading in the surrounding environment.

- INDIRECT or PASSIVE insulation

Certain structures like measuring devices, delicate electrical devices, artwork, biomedical machinery, precision machinery, etc, have to be insulated from external factors such as: subways, roads, worksites, vehicles, other automations etc.

In both cases (direct and indirect) the dampening principle stays the same: the system has to be insulated by supports (called antivibrating) that allow to reduce the width of the oscillation, every vibration absorption produces a counter-vibration that absorbs the kinetic vibration energy and transforms it into heat that is dissipated in the surrounding environment. In the design process and calculations for the antivibrating devices it is necessary to follow two phases.

Phase 1:

To analyze and choose the right antivibrating device You need first of all to know the own frequency f_n of the system you want to insulate simplifying it into the physics model: mass-spring. Almost all mechanical systems can, in fact, be reduced to this simplified system (img.8) One mass "M" bound to a spring "S", that when solicited by an external force or pulse (for example a hit) it starts to "vibrate". After a brief first moment of transition, the system in an ideal case without friction starts to oscillate at its own frequency f_n.

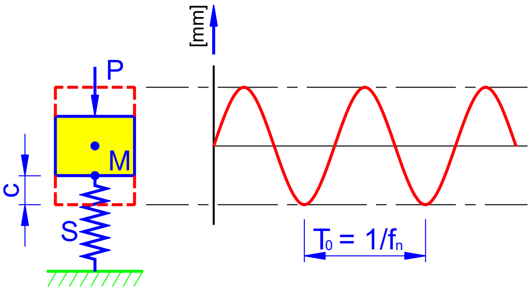

Image 8
P= disturbing or excitation force [N]
M= Mass [Kg]
S= Spring
c= Width of half oscillation [m]
K= Constant spring rigidity [N/m]
T_0= complete oscillation time [s]
f_n= own frequency [Hz]
f_0= continuous disturbing frequency [Hz]

The own frequency f_n can be calculated by the following equation (1):

$$f_n = \frac{1}{2\pi}\sqrt{\frac{K}{M}} \quad \text{[Hz]} \qquad \textit{(esp. 1)}$$

The equation (1) can also be rewritten (by rounding the numeric values) in function of the width of half oscillation c (esp. 2).

$$f_n = \frac{5}{\sqrt{c}} \quad \text{[Hz]} \qquad \textit{(esp. 2)}$$

Or with the equivalent:

$$f_n = \frac{300}{\sqrt{c}} \quad [\text{min}^{-1}] \qquad \textit{(esp. 3)}$$

The value "c" of the width of half oscillation corresponds also to the arrow "c" of the rigidity elastic system "K" subjected to the weight force of the mass "M". The expressions (2) and (3), therefore, are fundamental in the insulation design project because by knowing the subsidence (travel) of the elastic system subsided to only the weight force allows to determine the own frequency f_n of the system itself.

Usually to insulate a system rubber antivibrating elements are used. These elastic elements don't have a linear proportional trend in the load-movement diagram like a mechanical spring, for this reason the expression (2) has to be rewritten as follows:

$f_n = \frac{5}{\sqrt{c1}}$ [Hz] *(esp. 4)*

"c_1" can be obtained graphically drawing the tangent reported on the abscissa as shown on img.9

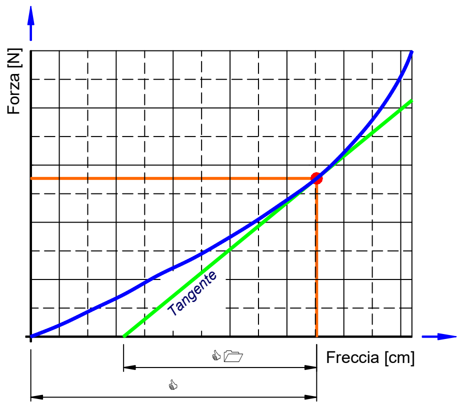

Image 9

Img.9 shows a load graph of a rubber antivibrating support. On the y axis the force F [N] is represented while on the axis x the arrow "c" is represented.
Image 6 also shows how to graphically calculate the value "c_1" by tracing the tangent to the load curve.

Phase 2:

Once completed the first phase, knowing the system's own frequency, it is possible to know how the system will be able to react to oscillations induced by a disturbing continuous frequency f_0 (for example one of an electric motor).
If a system, like the one represented on image 8, is put into motion by a continuous disturbing frequency f_0, the whole system will oscillate at the f_0.

To analyze how this system will react to such frequency it is necessary to determine the ratio between the two frequencies:

$\lambda = f_0/f_n$ *(esp. 5)*

Where f_0= Disturbing frequency [Hz],
f_n= Own frequency [Hz].

This ratio λ can be traced back to 3 cases of application (Image 10):

A) HYPOCRYTICAL λ <0.6 (non-determinable area)
In this kind of installations it is not possible to pre determine the level of cushioning because these are chaotic and uncontrollable situations; In this case it is possible to intervene by using the VIB Y antivibrating supports which, in every case, absorb with good results "impacts", "shocks" and "hits" caused by sudden criticality states. In these cases, the system is linked to the environment in almost a rigid way and the forces generated by the disturbing oscillation are almost completely transmitted; for example: mallet hits, eccentric press, low frequency rotation systems, etc.

B) Applications in RESONANCE $\lambda = 0.3 - \sqrt{2}$ (CRYTICAL area to avoid)
In this area the forces emitted by the system tend to exponentially grow amplifying the oscillation effect. Generally this is a "critical" area because machines could oscillate in an abnormal way with a strong impact on the structures that could also cause their rupture.

C) HYPERCRYTICAL applications $\lambda > \sqrt{2}$ (SUGGESTED determinable area)

In this area the forces transmitted to the system are dissipated the more the value λ. So in this area with the same amount of exciting frequency f_0, the lesser will be the own frequency of the system f_n, and the higher will be the dissipation of vibrations. This is the area where antivibrating rubber supports act because they are characterized by low natural frequencies.

The insulation factor calculation "ξ" as a percentage can be obtained like this:

$$\xi: \; = 100 - \frac{100}{(\lambda)^2 - 1} \; [\%] \qquad \textit{(esp. 6)}$$

Nomenclature:
λ: frequencies ratio
ξ: insulation factor
A: oscillation width
H: Dampening
ε : material's dampening capability

To ensure enough insulation it is necessary to achieve a value higher than 85%.
Another factor that determines the effectiveness degree of the insulation is the value of the material dampening. In the simple mass-spring system described up until here, an ideal system without friction is being represented, In reality every system is characterized also by a dampening "H" determined by the type of material used to manufacture the antivibrating support. This value "H" represents the speed that a system has in reducing the width of the oscillation in time.
The ratio between the width "A" between two consecutive oscillations in a time frame "T_0"is determined by the formula:

$$\frac{A_{(n+1)}}{A_{(n)}} = e^{-2H\pi} \qquad \textit{(eq. 7)}$$

The value "-2H" can be expressed as a coefficient "ε" that represents the dampening of the material used to create the antivibrating support. The higher this coefficient "ε" is, the higher is the "capability of the material to dampen oscillations. For example the value for steel is ε=0,004-0,016 while for rubber is ε=0,1-0,4; showing that rubber has a higher "capability" to dampen vibrations compared to steel which is 25 times higher.

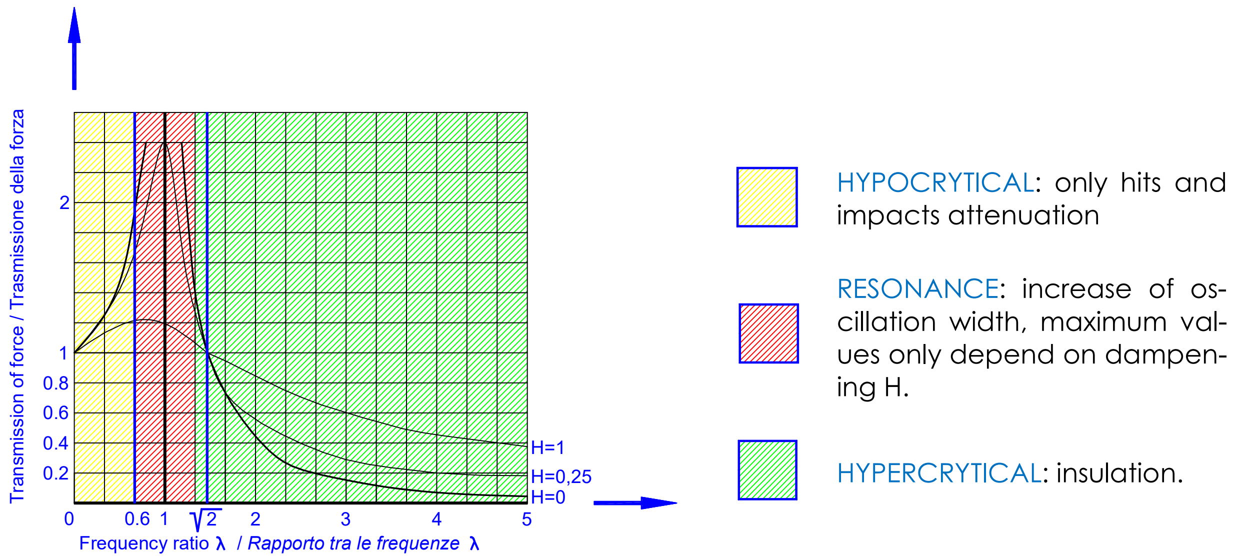

Image 10

With the acquired technology, as explained above, Tecnidea Cidue offers not only products that dampen vibrations (**first case** pag.1) but also a wide range of articles referred to the **second case** pag.1 that regulate vibrations with the aim to use them for the construction of oscillating and vibrating machines. These machines can execute the aim they were designed for thanks to the correctly used vibrations.
In the following we have some examples of our **VIB** range:

Img. 11 **VIB** Type **BT-F**

Img. 12 **VIB** Type **TP-F**

Img. 13 **VIB** Type **DE-R**

Img. 14 **VIB** Type **AN-D**

Img. 15 **VIB** Type **CR-P**

Img. 16 **VIB** Type **BM-T**

Naturally the illustrated products on our catalogue are much more and, on request, we can design special ones.

Edited by:
Franco Canova
With the collaboration of Ing. Enrico Caceffo

APPLICATIONS WITH VIB Y AND VIB AN

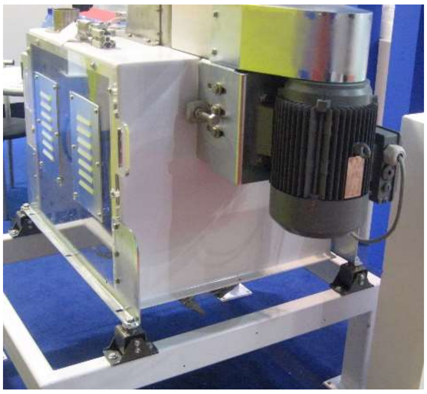
Image 17


Image 18


Image 19


Image 20


Image 21


Image 22

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