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THE THEORETICAL CALCULUS OF THE WEIGHT AND THE STROKE TO THE SONIC RESONANCE

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ABSTRACT
Sonicity is the science of transmitting mechanical energy through vibrations. Starting from the theory of the musical accords, Gogu Constantinescu found the laws for transmitting the mechanical power to the distance through oscillations that propagate in continuous environments (liquid or solid) due to their elasticity. In this paper we present some theoretical notion about the mechanical resonances and its characteristically size.
Keywords: resonances**,** friction, sonic pressure, sonic flow, sonic capacity and friction resistance.

1. INTRODUCTION

Energy transmission through fluid compressibility has been approached for the first time, both theoretically and experimentally, by Gogu Constantinescu, who performed his research in the British Navy Laboratory of Coniston and developed the so-called „theory of sonicity”. The great inventor has spent a considerable amount of money in order to convince the world the fluids are much more compressible than generally accepted, and that this feature is essential to vibration propagation through fluids.

As asserted from its very inception, sonicity is analogous to electricity and sonic transmission is similar to alternating current transmission. By considering this analogy is valid, it follows that fluid compression is equivalent to electric charge accumulation in a capacitor.

Sonic actuation permits the optimal combination between the ease of processing electric signals (of low energy) and the high-power sonic actuation, which eliminates the greatest parts in a classical hydraulic system (such as hydraulic reservoirs, control systems for pressure, flow, direction, etc), resulting in an actuation which melts the virtues of low-energy signal processing and the high-output, small-volume, economical and compact sonic actuation.

It should be mentioned that this approach of the problem makes the sonicity theory a particular case of power transmission through „displacement”, which means the fluid, instead of flowing continuously from generator to they actuator, evolves harmonically in time at various wavelengths and frequencies.

In the new system, energy is transmitted from one point to another by covering distances which can be large, by applying periodical compressions which generate longitudinal vibrations in columns of solids, liquids and gases. The energy transmitted through these periodical longitudinal pressure and volume vibrations is in fact power transmission through sonic waves.

2. THE CALCULUS OF THE WEIGHT AND THE STROKE TO THE SONIC RESONANCE

We considerate one sonic resonance, form by weightily, connected by one piston, used in one equilibrium position by resorts and bend to one face to one sonic flow, with a period equal with a natural period of vibration to the sounding board $L_s \cdot C_s \cdot \omega^2 = 1$, that the medium pressure of the liquid column be balanced.

The movement equation can be:

$$p_{med} + p_i = L_s \cdot \frac{dQ_i}{dt} + \frac{S}{C_s} \cdot (y + y_0) \quad (1)$$

If the medium pressure is static balanced from relation [4] $F = p_{med} \cdot S = \frac{S \cdot y_0}{C_s}$, result:

$$p_{med} = \frac{S \cdot y_0}{C_s} \quad (2)$$

Replacing the relation (1) to relation (2) we obtain:

$$\frac{S \cdot y_0}{C_s} + p_i = L_s \cdot \frac{dQ_i}{dt} + \frac{S}{C_s} \cdot y + \frac{S \cdot y_0}{C_s} \cdot y \text{, so}$$

$$p_i = L_s \cdot \frac{dQ_i}{dt} + \frac{S}{C_s} \cdot y \quad (3)$$

We see the identity of the equation (3) with (1). He is apply a cases considerate upper with the condition, if the origin of “y” the position of the piston of the sounding board, engaged to the action of the medium pressure.

For obtaining the maxim effect of the hammer to the sounding board, in the moment who this move to the repose position on up, the instantaneous sonic pressure p_i to be negative, so, the mobile elements to the sounding board can be upper as effect to down the pressure down to medium value. Is the case to the sounding board with the optimal amplitude

In generally this happens then $\varphi = -\pi$, the equation come:

$$Q_i = -\frac{1}{2} \cdot p_{a_{max}} \cdot \omega \cdot C_s \cdot \omega t \cdot \sin \omega t \quad (4)$$

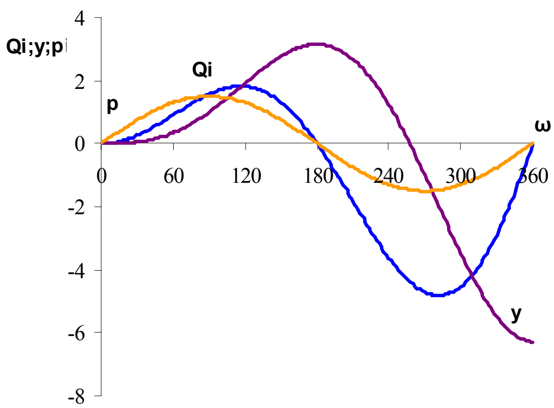

Fig. 1 The diagrams of the pressure, sonic flow and of the racing for the sonic hammer

$$y = \frac{1}{2} \cdot \frac{p_{a_{max}} \cdot C_s}{S} (-\sin \omega t + \omega t \cdot \cos \omega t) \quad (5)$$

$$p_i = -p_{a_{max}} \cdot \sin\omega t \tag{6}$$

The values of y and Q_i are determined by the curve to the (Figure 1) [3]:

From this curves results y is maximum when ωt = π and y = 0 for $-\sin\omega t + \omega t \cdot \cos\omega t = 0$, results $\omega t = \frac{\sin\omega t}{\cos\omega t}$, so $\omega t = tg\,\omega t$, that is $\omega t = \pi + 77^0\,25'$, result $tg\,\omega t = 4{,}419 = \omega t$. So $y = 0\big|_{\omega t} = 4{,}419$.

The value a Q_i in the moment to strike is:

$$Q_i = -\frac{1}{2} \cdot p_{a_{max}} \cdot \omega \cdot C_s \cdot \omega t \cdot \sin\omega t = -\frac{1}{2} \cdot p_{a_{max}} \cdot \omega \cdot 4{,}419 \cdot \sin 257{,}25^0 =$$

$$= -\frac{1}{2} \cdot p_{a_{max}} \cdot \omega \cdot C_s \cdot 4{,}415 \cdot (-0{,}975) = 2{,}155 \cdot p_{a_{max}} \cdot C_s \cdot \omega$$

Than $Q_i \cong 2{,}2\, p_{a_{max}} \cdot C_s \cdot \omega$

The maximum value to y, y_{max}:

$$y_{max} = \frac{1}{2} \cdot \frac{p_{a_{max}} \cdot C_s}{S} \cdot \left(-\sin\omega t + \omega t \cdot \cos\omega t\right)\Big|_{\omega t} = \pi$$

result:

$$y_{max} = -\frac{1}{2} \cdot \frac{p_{a_{max}} \cdot C_s}{S} \cdot (\sin\omega t - \omega t \cdot \cos\omega t)_{\omega t} = \pi$$

result:

$$y_{max} = -\frac{1}{2} \cdot \frac{p_{a_{max}} \cdot C_s}{S} \cdot (-\pi) = \frac{p_{a_{max}} \cdot C_s \cdot \pi}{2 \cdot S},$$

so:

$$y_{max} = \frac{p_{a_{max}} \cdot C_s \cdot \pi}{2 \cdot S} \tag{7}$$

The energy used in the strike moment we obtained by substituting $\omega t = \pi + 77^0 25'$ and $\varphi = -\pi$ in equation, result:

$$W = 2{,}45 \cdot C_s \cdot p_{a_{max}}^2 \tag{8}$$

For the practical calculus the sonic hammer, which creates the optimal amplitude is recommended to know:

W [kg·m] – the energy to all strike:

p_{amax} [kg/m^2] – the sonic amplitude of the instantaneous flow;

G [kg] – the weight of the hammer;

$m = \frac{2 \cdot G}{\sigma^2} = ct.$, $n = \frac{1}{\sqrt[3]{0{,}4 \cdot \sigma}} = ct.$;

D_1, D_2 [cm] – the arches diameter.

to $y_{max} = \frac{p_{a_{max}} \cdot C_s \cdot \pi}{2 \cdot S}$, the $W = 2{,}45 \cdot C_s \cdot p_{a_{max}}^2$, we calculated the capacity C_s:

$$C_s = \frac{W}{2{,}45 \cdot p_{a_{max}}^2} \tag{9}$$

To the resonance condition [3], $L_s \cdot C_s \cdot \omega^2 = 1$:

$$S = \frac{\omega \cdot \sqrt{F \cdot C_s}}{31{,}3} \tag{10}$$

We obtained the course:

$$y = \frac{\pi \cdot p_{a_{max}} \cdot C_s}{2 \cdot S} \quad (11)$$

The maximum forces to the hammer are:

$$F_1 = S \cdot p_{a_{max}}$$
$$F_2 = 0{,}57 \cdot S \cdot p_{a_{max}} \quad (12)$$

The volume of the arch is:

$$V_{a_1} = m \cdot F_1 \cdot y$$
$$V_{a_2} = m \cdot F_2 \cdot y \quad (13)$$

The diameter of two the hammer are [3]:

$$d_1 = n \cdot \sqrt[3]{F_1 \cdot D_1}$$
$$d_2 = n \cdot \sqrt[3]{F_2 \cdot D_2} \quad (14)$$

All the elements of the hammer are determined.

Observation*:* If considerate the hammer is a receptor with the power factor is equal to 1, so the pressure and the sonic are in phases, and the flow is the sinusoidal evolution witch has the maximum value [4.], $Q_{a_{max}} = r \cdot \omega \cdot S$. The in this case [2], for $\cos\psi = 1$:

$$P = \frac{1}{2} \cdot p_{a_{max}} \cdot Q_{a_{max}} \quad (15)$$

The mechanical work and the time of the one oscillation is [3]:

$$W = \frac{p_{a_{max}} \cdot Q_{a_{max}}}{2 \cdot f} = \frac{p_{a_{max}} \cdot Q_{a_{max}} \cdot 2 \cdot \pi}{2 \cdot \omega} = \frac{\pi \cdot p_{a_{max}} \cdot Q_{a_{max}}}{\omega} =$$
$$= \frac{\pi \cdot p_{a_{max}} \cdot \pi \cdot r \cdot \omega \cdot S}{\omega} = \pi \cdot p_{a_{max}} \cdot r \cdot S \quad (16)$$

So: $$r = \frac{4{,}9}{\pi^2} \cdot y_{max} \quad (17)$$

or approximately: $r \cong \frac{y_{max}}{2}$.

Conclusion: The utile maximum effort tom the hammer*, who has one source we can calculate,* $P \cong \frac{1}{2} \cdot p_{a_{max}} \cdot Q_{a_{max}}$*, were* $Q_{a_{max}} = r \cdot \omega \cdot S$*, as the flow have a simple sinusoidal form and in phases with* $p_{a_{max}}$. The maximum effort is obtain such the hammer is build, that with the condenser are in resonance with the sonic pressure and to be in equilibrium to the point of the course who produce the stake.

4. REFERENCES

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