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THE ANALYTICAL MODEL FOR THE HIDRAULICS SYSTEM WITH THE ALTERNANT FLOW TO THE ASSEMBLIG IN SERIES FORM BY ONE CYLINDER AND THE FRICTION RESISTANCE

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ABSTRACT
In this paper we show some calculus for the series assembling in the hydraulic system with the alternant flow. The analytical models confirm the experimental results to the installation with one cylinder and one friction resistance.
Keywords: sonic pressure, temperature**,** friction coefficient, sonic installation, series assembling.

1. GENERAL NOTIONS
The precision of the analyzed, projection and realized to the automat system depended in good measure by the possibility to the complete modulation, by equation, to the characteristics to the same components or groups of components.
Same is important the precise determination to the value of the same constants by equation, and with them we can establish the frequencies functions.

2. THE SERIES ASSEMBLING BY ON CONDENSER AND FRICTION RESISTANCE

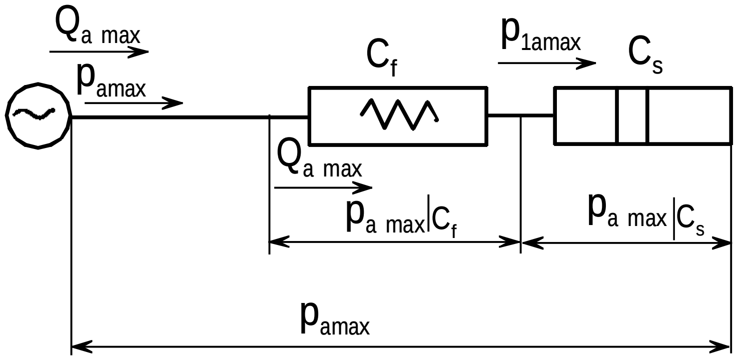

Figure 1 The sonic system with one condenser and friction resistance assembling in series

We consideration the system present in the figure 1, for establish the mathematical model of the mono-phases system assembling in series.
The system are composed by one sonic generator G_S who produce the sonic flow, the generator are connecting in series by one pipe with the friction resistance C_f (R_f), who absorb the energy adapted for upper the temperature by sonic flow. The friction resistance is connected by one capacity C_S. This capacity has the cylindrical form contain fluid.
In this case the difference of the pressure by the extremity of the condenser it’s equal with the variation of the pressure in the principal pipe.
The instantaneous flow Q_i give by the generator produce in the pipe one variation to the instantaneous

pressure to be due to the effect combine by the friction, inertia and perditance.
Know the generator parameters, the angular speed ω, the capacity of the condenser Cs, we can realized one mathematical model with we can calculated: the sonic flow $Q_{a\,max}$, the sonic pressure p_{amax}, and the mechanical work realized by the generator and to absorb for to warm the friction resistance.
For the assembling in series we can write the equation:

$$\bar{p}_{a\,max}\Big|_{C_{fs}} = C_f \cdot \bar{Q}_{a\,max}\,; \tag{1}$$

$$\bar{p}_{a\,max}\Big|_{C_{s1}} = -j\frac{\bar{Q}_{a\,max}}{\omega \cdot C_s} \tag{2}$$

If we know with the elements of the circuit are (C_s, C_f şi C_{s1}) are assembling in series the sonic pressure of the extremity installation is:

$$\bar{p}_{a\,max} = \bar{p}_{a\,max}\Big|_{C_f} + \bar{p}_{a\,max}\Big|_{C_s} \tag{3}$$

If we change the relation (1), (2) in (3) result:

$$\bar{p}_{a\,max} = C_f\, Q_{a\,max} - j\frac{\bar{Q}_{a\,max}}{\omega C_s} = \bar{Q}_{a\,max}\left[C_f - j\frac{1}{\omega C_s}\right] =$$

$$= \bar{Q}_{a\,max}\left[C_f - j\cdot\frac{1}{\omega C_s}\right] = \bar{Q}_{a\,max}\left(C_f - j\frac{1}{\omega C_s}\right)$$

$$\bar{p}_{a\,max} = \bar{Q}_{a\,max}\left(C_f - j\frac{1}{\omega C_s}\right) \tag{4}$$

The vector $\bar{p}_{a\,max}$ is a result of the $C_f \cdot \bar{Q}_{a\,max}$ vector and to the $\frac{1}{\omega \cdot C_s}$ vector emphases ahead of $Q_{a\,max}$ with $-\frac{\pi}{2}$.

In module the $p_{a\,max}$ have the relation $|p_{a\,max}| = \sqrt{Re^2 + Im^2}$ and obtains:

$$p_{a\,max} = \sqrt{Q_{a\,max}^2\, C_f^2 + Q_{a\,max}^2\left(\frac{1}{\omega \cdot C_s \cdot}\right)^2} = Q_{a\,max}\sqrt{C_f^2 + \left(\frac{1}{\omega \cdot C_s \cdot}\right)^2}$$

$$p_{a\,max} = Q_{a\,max}\sqrt{C_f^2 + \left(\frac{1}{\omega \cdot C_s \cdot}\right)^2} \tag{5}$$

By relation (5) result:

$$Q_{a\,max} = \frac{p_{a\,max}}{\sqrt{C_f^2 + \left(\frac{1}{\omega \cdot C_s}\right)^2}} \tag{6}$$

In relation (5) the $p_{a\,max}$ components is in phases with $Q_{a\,max}$ and he produce the mechanical work, this is:

$$p_{a\,max} = C_f \cdot Q_{a\,max} \tag{7}$$

and the mechanical capacity absorbed are:

$$N = \frac{p_{a\,max}^2}{2 \cdot C_f} \tag{8}$$

$$N = \frac{Q_{a\,max}^2 \cdot \left[C_f^2 + \left(\frac{1}{\omega \cdot C_s}\right)^2\right]}{2 \cdot C_f} \tag{9}$$

The friction value for this mechanical capacity when have the maximum values are:

$$\frac{dN}{dC_f}=0 \tag{10}$$

namely:

$$\frac{d}{dC_f}\left\{\frac{Q^2_{a\,max}\left[C_f^2+\left(\frac{1}{\omega\cdot C_s}\right)^2\right]}{2\cdot C_f}\right\}=0$$

$$\frac{Q^2_{a\,max}}{2}\cdot\left\{\frac{2C_f^2-\left[C_f^2+\left(\frac{1}{\omega\cdot C_s}\right)^2\right]}{C_f^2}\right\}=0 \tag{11}$$

If $\frac{Q^2_{a\,max}}{2}$ are different by zero, must the quantity in the parentheses to be equal with zero:

$$\frac{C_f^2-\left(\frac{1}{\omega\cdot C_s}\right)^2}{C_f^2}=0 \tag{12}$$

Then result the value of the friction coefficient C_f :

$$C_f=\frac{1}{\omega\cdot C_s} \tag{13}$$

The value of the sonic pressure $p_{a\,max}$ is:

$$p_{a\,max}=Q_{a\,max}\sqrt{\left(\frac{1}{\omega\cdot C_s}\right)^2+\left(\frac{1}{\omega\cdot C_s\cdot}\right)^2}=\sqrt{2}\cdot Q_{a\,max}\cdot\left(\frac{1}{\omega\cdot C_s}\right)$$

$$p_{a\,max}=\sqrt{2}\cdot Q_{a\,max}\cdot\left(\frac{1}{\omega\cdot C_s}\right) \tag{14}$$

or:

$$Q_{a\,max}=\frac{p_{a\,max}}{\sqrt{2}\cdot\left(\frac{1}{\omega\cdot C_s\cdot}\right)}$$

$$Q_{a\,max}=\frac{p_{a\,max}\cdot\omega\cdot C_s}{\sqrt{2}}$$

(15)The capacity factor make by relation:

$$\cos\varphi=\frac{N}{N_{ap}} \tag{16}$$

Know the $p_{a\,max}$ and $Q_{a\,max}$ we can calculated the absorbed capacity with relation:

$$N_{ap}=\frac{p_{a\,max}\cdot Q_{a\,max}}{2}\quad [W] \tag{17}$$

With the relation (14) we can calculate the fall of the pressure by the friction resistance:

$$\Delta p_{Rf}=C_f\cdot Q_{a\,max} \tag{18}$$

The value of the friction coefficient $C_f = R_f$ we can determined by relation:

$$C_f = \frac{\gamma \cdot l}{g \cdot S} \cdot k \tag{19}$$

were:

$$k = k_2 = \frac{v_{ef}}{d} \cdot \left(100 + \frac{9}{\sqrt{v_{ef} \cdot d}} \right). \tag{20}$$

The maximum speed is:

$$v_{max} = \frac{Q_{a\,max}}{S_f} \tag{21}$$

Efficacy speed:

$$v_{ef} = \frac{v_{max}}{\sqrt{2}} \tag{22}$$

We can calculate also the length *l* of the pipe, when if are imposed the interior diameter of this pipe, thus:

$$l = \frac{C_f \cdot S_f \cdot g}{k_2 \cdot \gamma} = \frac{C_f \cdot S_f}{k_2 \cdot 10^3} \tag{23}$$

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