Synthesis of Electric Drive Regulator of Complicated Electro Mechanical Systems

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Abstract

The paper presents influence of regulator factor in feedback loop for quality of two mass electromechanical systems. Three is optimal regulator factor, which enable to provide minimums oscillation without reduction of quick operation.

1. Introduction:

The condition of natural action electromechanical systems present in/kind and manner its passing state. The most important indicators which shows the natural action (EMS) determined by two things which are stable vibration in the system in addition of the Dynamical factors, which deter mined by the most proportion of dynamic capacity to its medium value [1].

The study presented [2] to reduce the vibration of the pair mass system which is corresponding to EMS instead of doing the following solution which is opposite contrary compensatory maternity by contrast speed of the two mass of pair of Masses System which appeared in form (1)

According toe the mentioned study, it has obtainment at a rational which allowed with counting the suitable value to the factor of compensatory which mentioned above, which produce the smaller value to the factor of vibration in the systems.

2. The goal of the study:

The aim of the above study present in studying and designing the mechanical dominating maternity in electromechanical systems during defining fixed effect value for the compensatory contrary providing maternity on the goodness indicators in the pair mass system which explained in figure (1) for the electromechanical system vibration.

3. Analyzing study:

In drawing (2) the Block diagram of electromechanical system is studied shown on figure for studied electromechanical system when we remained that this designer goes for engines which has lasting current and alternating as equal, and on this designer present the following value. Kn-amplification factor of the controlled converter voltage.

Km-Transformation of equation which connect between strain engine U_s applied on poles current with resolve which is produced from engine itself.

- According toe the lasting current engine with dependent irritation, the value of this function is equal to:

$$Km = \frac{c}{R_O} = \frac{B}{C}$$

C: present strong stable of the electrical.

R_o

B: mechanical strictness distinctive the engine.

- According to the alternative current engine, the value Km is changeable and the values followed the strained which applied on the stable engine.

J_1, J_2, the interia moment for the first and second mass, explained in drawing (1).

C12: the mechanical sternness stable for the flexible elbows.

U3: resistance strained.

Mc. my: an alternative, static resistance moment and the flexible moment.

Kk: the last contrary supplying stable with difference between the two speeds W1, W2.

In the study [2] it has gotten on the differential equation from second degree, which connect between flexibility moment and between comparison strained U3 when the statistical moment is founded. Me.

The equation that distinguished to the differential equation, which mentioned above has the following form.

(1) $$T_M T_{12}^2 P^3 \left(1+\frac{K_o K_k}{\beta}\right) P^2 + T_M P + 1 = 0$$

Where $K_o = K_\Omega . K_M$

$\Omega_{12} = \frac{1}{T_{12}} = \sqrt{\frac{c_{12}\gamma}{J_2}}$: The own frequency vibration for the pair mass system explained in the form (1).

$\gamma = \frac{J_1 + J_2}{J_1}$: Stable of the ratio mass.

$\Omega_2 = \frac{1}{T_2} = \sqrt{\frac{c_{12}}{J_2}}$: The own frequency vibration for the second mass.

T_M: Electro Mechanical time stable, in the case of being the mechanical sternness is everlasting.

The equation (1) may put it in the form of a distinguished equation which suitable for successive contact for two ranges one of it with inertia and the other is vibration, as the following:

(2) $$\left(\frac{K}{\Omega}P+1\right)\left(\frac{1}{\Omega^2}P^2+\frac{2\xi}{\Omega}P+1\right)=1$$

Where

Ω, ξ Frequency (Ω) vibration extinguished stable (ξ)

K: proportionality stable between time stables for inertia and vibrational.

It is obvious that the studied system has largest extinguished energy when limited suitable value for a compensation maternity stable [2].

This value is count in the following contact:

(3) $$K_k = \frac{\beta}{K_o}\left[\frac{3}{\gamma}\left(\frac{2}{27}\frac{T_M^2}{T_{12}^2}+1\right)-1\right]$$

When we compare the distinguished equation (1) for the studying system with typical form (contact 2) we shall reach to the following equal.

(4.1) $$\frac{K}{\Omega^3} = T_M T_{12}^2$$

(4.2) $$\frac{2K\xi + 1}{\Omega^2} = T^2\left(1 + \frac{K_o K_k}{\beta}\right)$$

(4.3) $$\frac{K + 2\xi}{\Omega} = T_M$$

When the common solution to the two contact (4.1), (4.2) we reach to the contact which define the following extinguished stable.

(5) $$\xi = \frac{\gamma}{2T_M \Omega}\left(1 + \frac{K_o K_k}{\beta}\right) - \frac{1}{2T_M T_{12}^2 \Omega^3}$$

When we acquire from the two relation, (4.2), (4.3) on the following equal;

(6) $$\frac{K(2T_M\Omega - K)}{\Omega^2} = T_2^2\left(1 + \frac{K_o K_k}{\beta}\right)$$

After that the value of K which is a result from the equation (4.1):

(7) $$K = T_M T_{12}^2 \Omega^3$$

In equal (6) we shall achieve at the following equation:

(8) $$T_M^2 T_{12}^4 \Omega^6 - T_M^{22} T_{12}^2 \Omega^4 + T_2^2\left(1 + \frac{K_o K_k}{\beta}\right)\Omega^2 - 1 = 0$$

The roots of equation is calculated by helping of (GARADAN) equation when we put the roots of equation (8) in equation (5) we calculate the relation of extinguished stable according to the account of correction loop factor $\xi = J(K_k)$, and for different account of mechanical stillness factor β which diagram at form (3).

The curves which present at form (3) has been accounted, for the automation which has the following facts: $C_{12} = 60\frac{NM}{Rad}$, r = 1.07. And we consider that the value of essential reference mechanical stillness is the limited value for $\beta = \frac{M_n}{\omega_0}$.

We shall assure that extinguished factor take zero value when the zero value for the factor correction loop K. this means that the order in this situation present preservation order (on the constancy level), and it may come unsettled only when the positive seed back and the curves which explained in form (3) approve a very important thing which is the distinguished mechanical stillness is low that which arrive to increase the correction loop factor which is observed for the utmost extinguished.

In that form, and sorry, we conclude that the increase of the distinguished stillness lead to increase in oscillation.

The utmost values of the extinguished factor according to form (3) agree with the account values with the connection.

$$\xi \max = \frac{T_M}{3\sqrt{3T_{12}}} \quad (9)$$

Which is a result in study [2], the optimal value of the factor $K_{k,opt}$ which is agreed with the value of correction loop factor which calculate in equation (3). With the help of computer programming, we achieve the following equation which is oscillation in speed σ_ω and moment, in addition to the time of passing situation, in speed t_ω, and moment t_m.

According to the value of correction factor when the engine is take off with the subsequent put of the capacity (in the case of meckanizem). The curves of the last mentioned connection shall come of form (3) and we conclude that the time of arrangement and the time of the oscillation with speed, they lower the value, when we have definite values for the correction factor Kk, and it is lower that the ideal value which is calculated in equation (3). But the oscillation with elastical moment has decreased properties.

Results:

1. On the basis of what we reached according to the degree of importance goodness requirement for the current state, it is possible to use different values for the correction loop factor, by means of, if the important is the less value for the time of the passing state, then, it is better to use correction factor of 40% value than the optimal value (optimal).
2. When it is necessary to find the low limit of oscillation (80%) of optimal the case agree with the low limit of oscillation speed, the oscillation in moment changes slowly with large value K_k.
3. If we rule by parameter system which distinguished to the kind of passing state, then, the best condition to do the system is the following-on it the top of the correction loop factor between the two tops $(60 \div 90)\%$ from the extinguished optimal factor. The current state program for the system of (at optimal factor and then at 70% of optimal top) proved that there is no obvious difference, and to that, the form (5) present the result of program. In the case of absent of feed back correction which present at form (5-a) and during $K_k = K_k$, opt.
4. Increasing the amplification of correction ring above the optimal top which is accounted by the equation (3) and even if it will lead to the largest low to oscillation the moment but it make more bad to another pointer of the quality of passing states.

Conclusion:

The capacity of electriomechanizem system at extinguished the oscillation is connected only, as proved in the study, with its mechanical part factors and with stillness which is distinguished mechanical of the system in addition to the degree of introduce feed back correction and this ability does not related with the own quality of the engine, and which feed it.

References:

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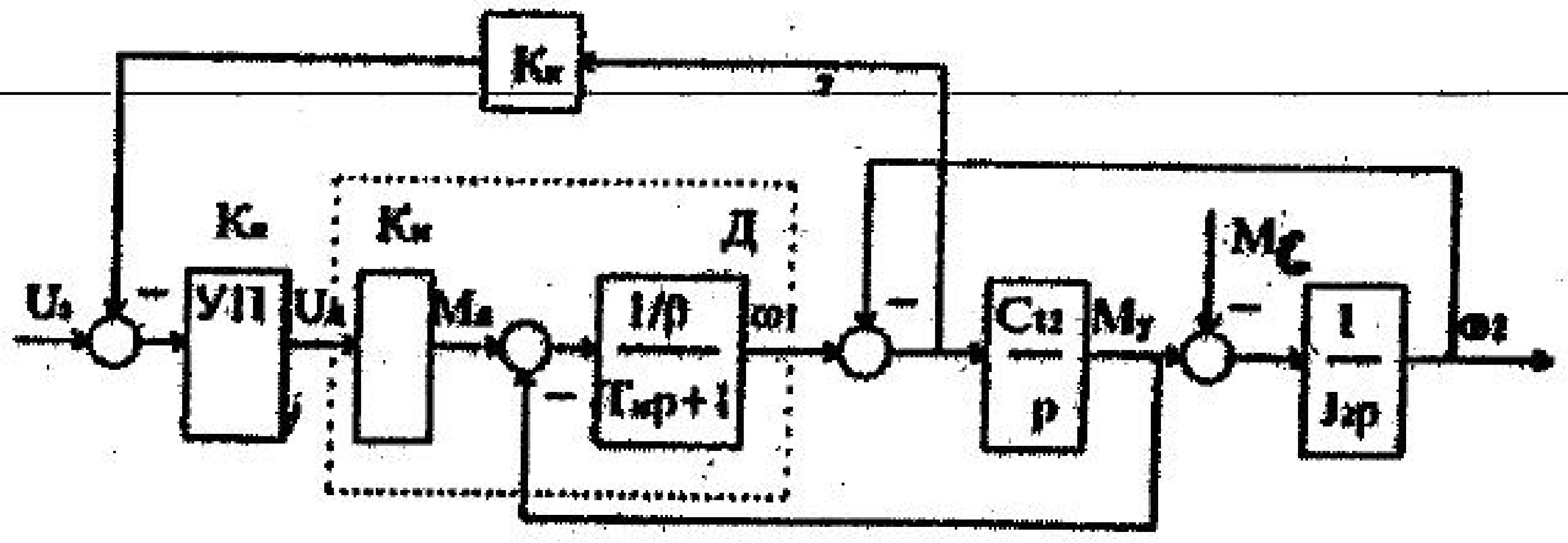
2. Gerasimiak R. P. Synthesis electromechanical system in caran mechanism with flexible oscillation journal electric machine and equipment technical No. 48, 1996, P: 30-37.



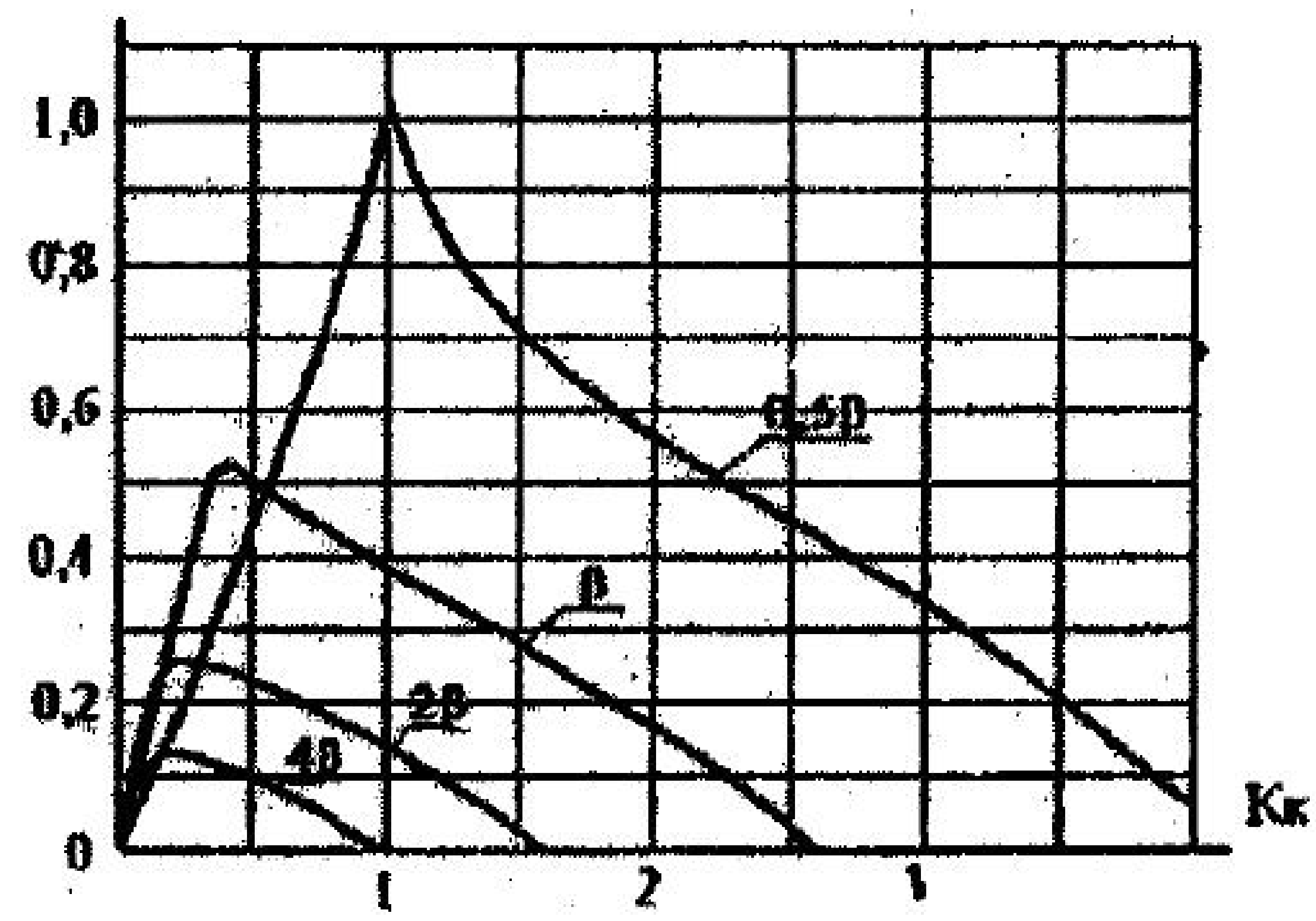


Figure2 graphic equation $\xi = f(K_k)$ at different value β.

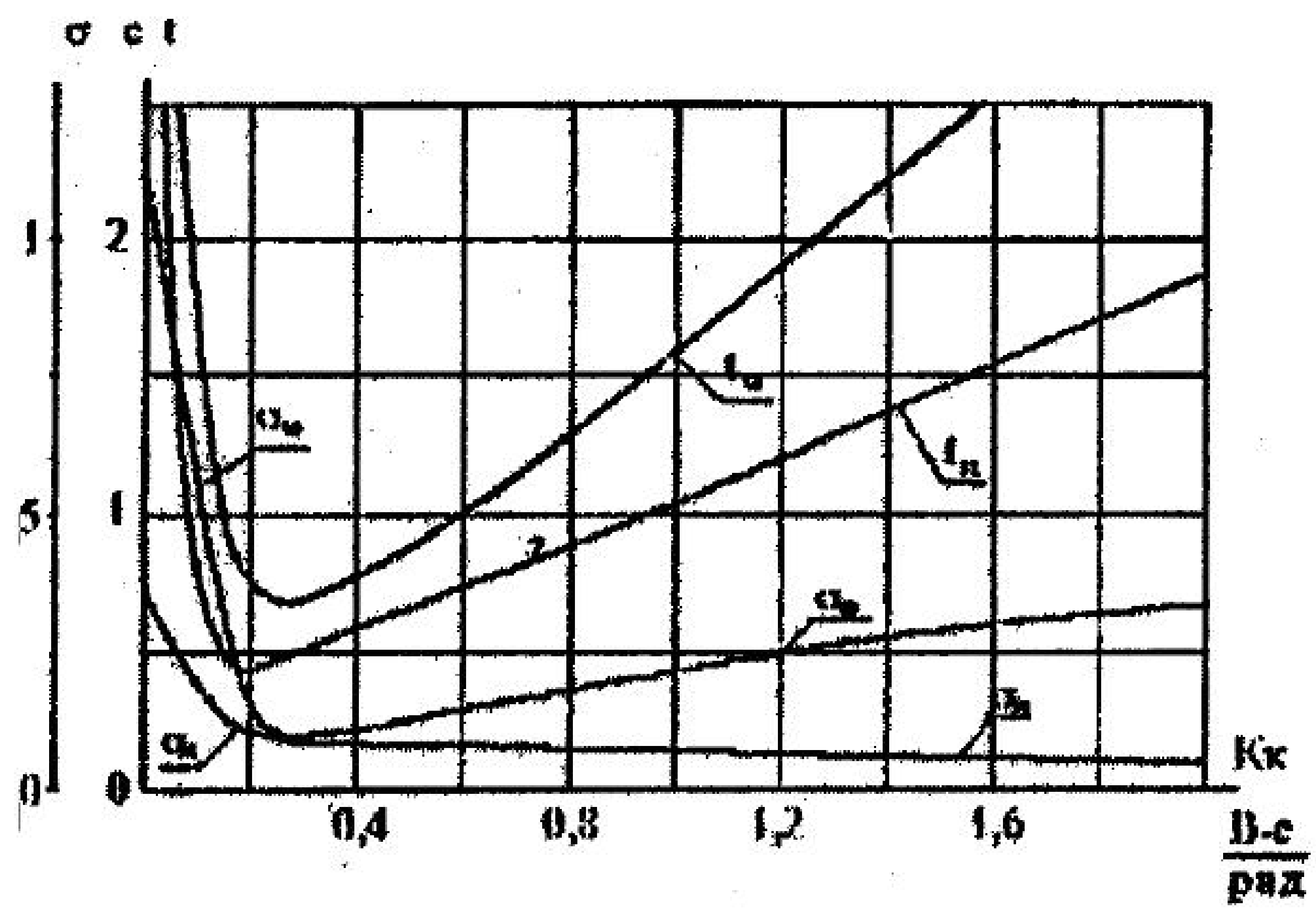


Figure3 equation increasing oscillation and time of organization in addition to the stable of value.

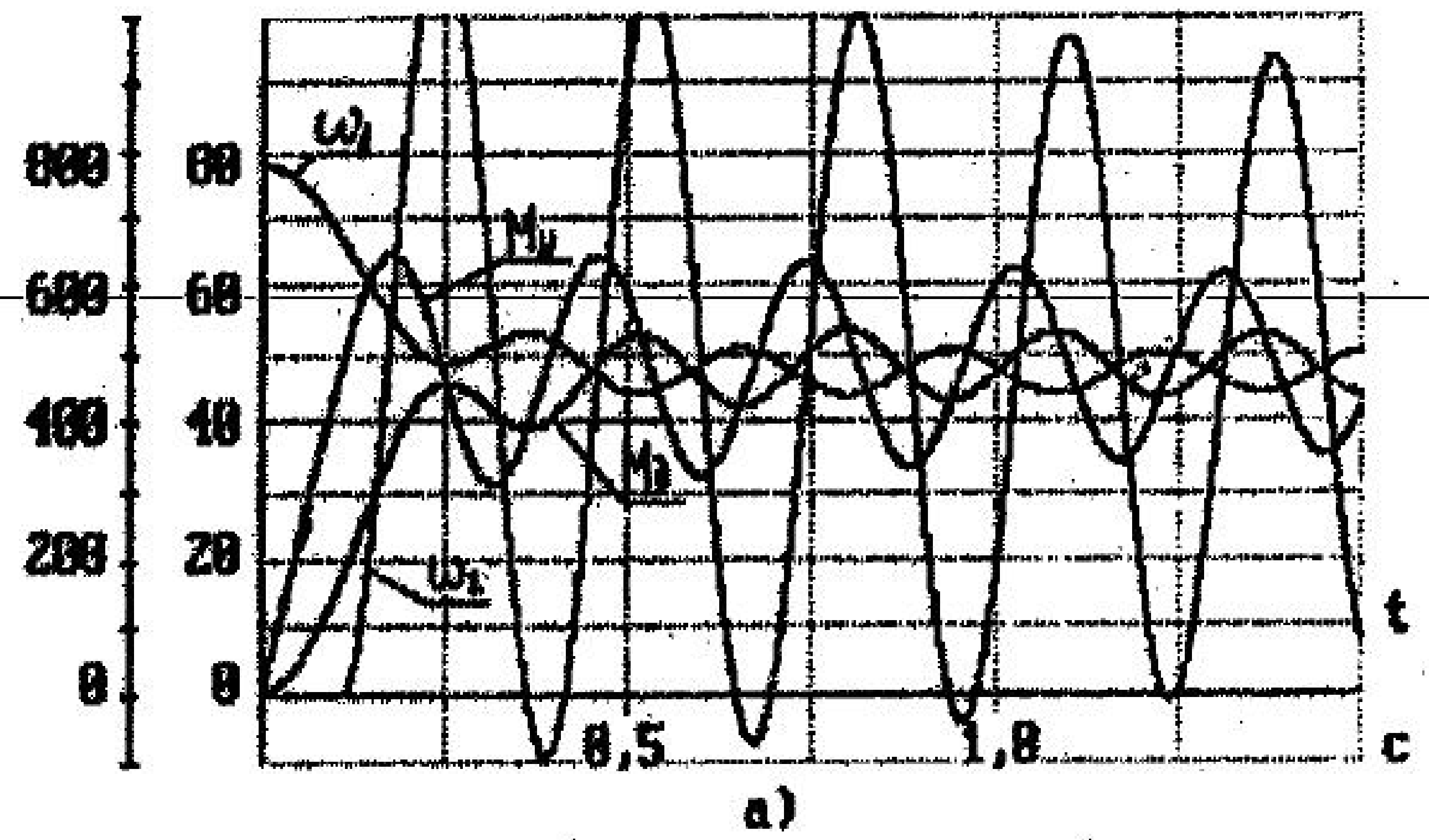


Figure4 transient at the absence of the additional circle (a)

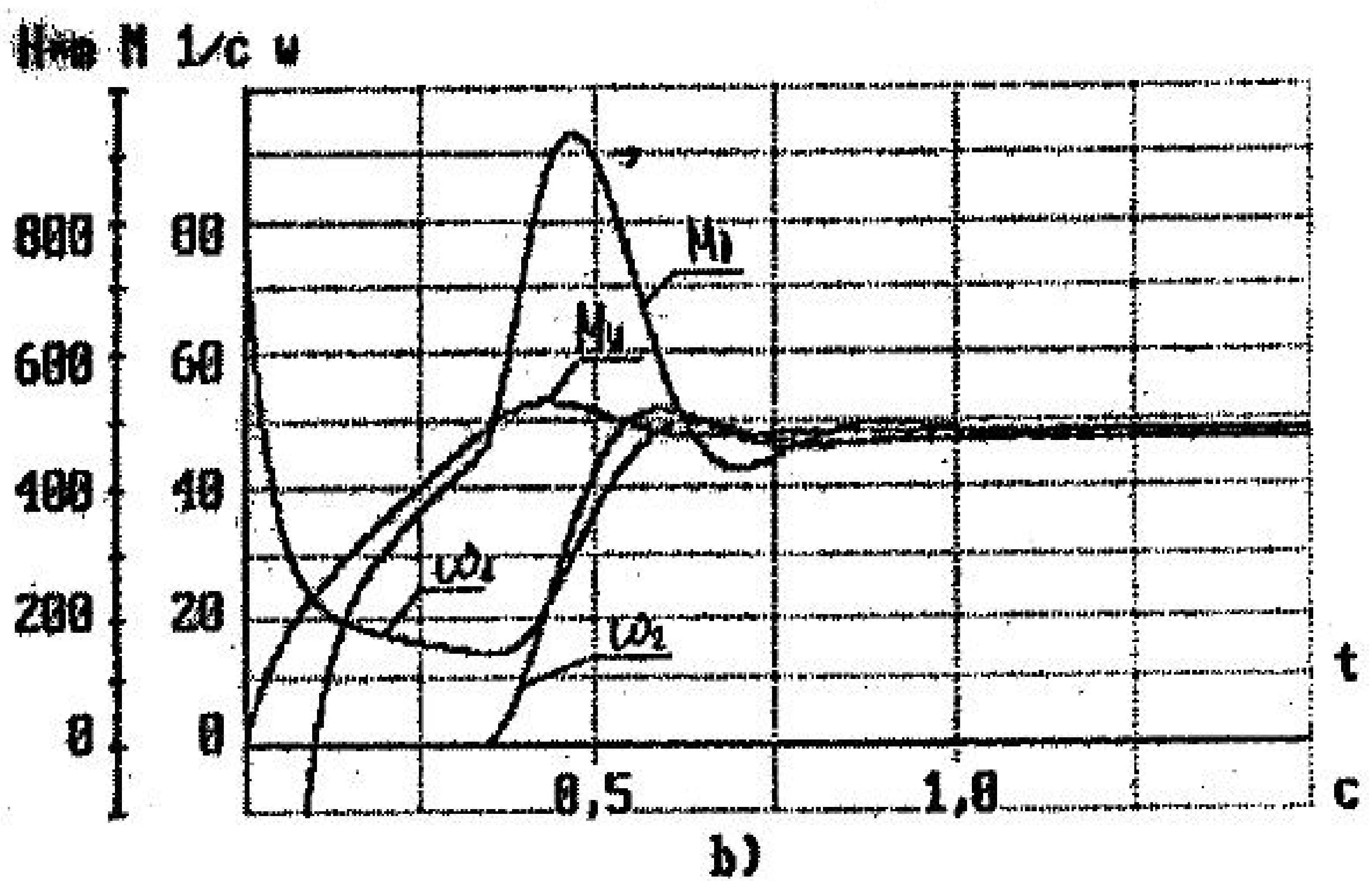


Figure4 and at the stable addition = 70% of the best value (b)