MATHEMATICAL MODELLING PEOPLE MASSES EMOTIONAL BEHAVIOR`S DYNAMICS AT PERIODIC PR- EXCITER

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Summary

A mathematical model of people masses emotional excitation dynamics at the periodic PR-exciter is contrived. On the basis of software package Mathcad 2001 Pro the rating dynamics of transition not excited peoples masses to a crowd - excited people masses depending on frequency and amplitudes of the exciter is shown.

Keywords. Social psychology. Behavior of peoples masses. Crowd. Mathematical model.

1. Introduction

The urgency of the given subjects for today is defined by the increased social activity of masses, necessity of development of the formalized, systematized approach for the most exact forecasting and selection methods of management by mass behavior, with the purpose to avoid social explosions and revolutions**.** The social psychology totals many theoretical approaches to studying a phenomenon of weights and mass behavior. Works of W. Wundt [1], Lebon [2], R.Harris [3], N.Smelzer [4], D.Olshansky [5], A.Nazaretyan [6] are most significant. W. Wundt, and then Lebon considered crowd as the uniform organism erasing personal features of the individual, and creating in exchange the uniform scheme of perception-thinking-behavior for all participants of such spontaneous congestion of people.

R.Harris and N.Smelzer considered basically a subject of the social status of crowd-masses as object of a manipulation mass consciousness. A.Nazaretyan offers allocation of conditional kinds of crowd on the basis of change of intensity of the emotional condition dominating over the environment of people masses congestion. Object of our research is drawing up of mathematical model of crowd dynamics to an emotional attribute under the simplified scheme (Fig.1).

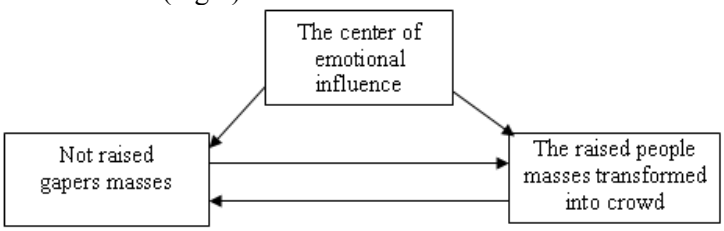

Fig.1. The scheme of emotional influence on people masses

Definition: crowd - a congestion of the people who have been not incorporated by a generality of the purposes and uniform organizational-role structure, but connected among themselves the general center of attention and an emotional condition. One of the important properties of crowd (the social unit) is its ability to transformations, i.e., to rather easy and fast transition from one emotional condition in another.

The mechanism of change of behavior of weight of people, т. е., transition from one conditional kind in another, is directly caused by intensity of emotional reaction of crowd depending on force of external PR-influence.

2. Construction of mathematical model

We shall consider the simplified scheme of emotional influence on weight of people with two limiting conditions of behavior: not raised masses of gapers and the raised people masses transformed into crowd. The center of emotional influence on masses can serves mass media, or emotional performances of orators before public.

We write down the law of peoples masses emotional dynamics in the form of the equation dynamics of Newton

$$n \cdot \frac{d^2 P_2}{d\varepsilon^2} = f, \qquad P_1 + P_2 = 1, \tag{1}$$

where

n – quantity of people making crowd;
P_2 – the probability of that crowd is in the raised condition;
f – size of force of emotional influence on crowd;
ε - size of emotional excitation of crowd;
P_1 – the probability of that crowd is in not raised condition.

The size of force of emotional influence on crowd is directly proportional to the double masses (quantity of people) crowds and probabilities of that the crowd is in not raised condition; also, when the probability of increases that the crowd is in the raised condition, the size of force of emotional influence decreases.

Thus,

$$f = -2 \cdot n \cdot \gamma \cdot P_1 \cdot \dot{P}_2, \quad \text{if } \gamma = 1. \tag{2}$$

Considering (1) and (2), we receive mathematical model

$$\ddot{P}_2 = -2 \cdot (1 - P_2) \cdot \dot{P}_2. \tag{3}$$

Let's enter designations

$$P_2(\varepsilon) \equiv X_0; \qquad \dot{P}_2(\varepsilon) \equiv X_1. \tag{4}$$

Then the equation (3) can be copied in the form of system of the equations

$$\begin{cases} \dot{X}_0 = X_1 \\ \dot{X}_1 = -2 \cdot (1 - X_0) \cdot X_1 \end{cases}. \tag{5}$$

Entry conditions look like

$$\begin{cases} X_0(0) = 0 \\ X_1(0) = 1 \end{cases}. \tag{6}$$

The decision of a problem (5) - (6) on the basis of package Mathcad 2001 Pro looks like Fig.2-Fig.4.

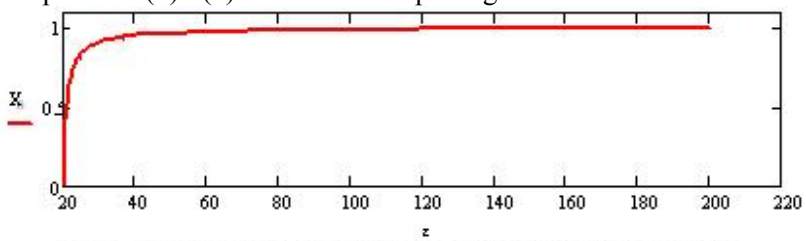

Fig.2. Dynamics of probability exciting crowds depending on increase in emotional influence

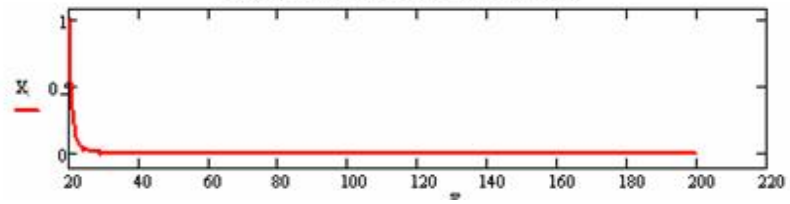

Fig.3. Dynamics of probability not exciting crowds depending on increase in emotional influence

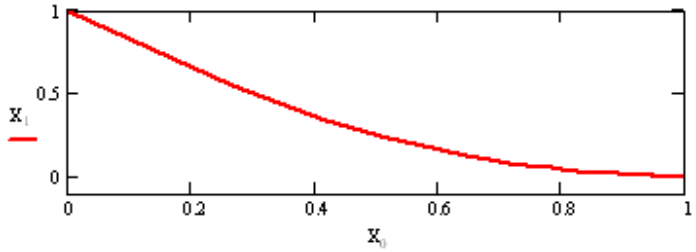

Fig. 4. Phase portrait of system

1. Mathematical model of the response of system on the periodic activator

We shall consider now mathematical model with the periodic PR-activator at various frequency and amplitude of excitation

$$n \cdot \frac{d^2 P_2}{d\varepsilon^2} = f + n \cdot A \cdot \sin\omega \cdot \varepsilon\,, \quad f = -2 \cdot n \cdot \gamma \cdot P_1 \cdot \dot{P}_2\,, \quad \gamma = 1\,, \quad P_1 + P_2 = 1\,. \tag{7}$$

hen we receive mathematical model

$$n \cdot \frac{d^2 P_2}{d\varepsilon^2} = -2nP_1 \dot{P}_2 + n \cdot A \cdot \sin\omega \cdot \varepsilon\,, \tag{8}$$

where

$$P_1 = 1 - P_2\,.$$

If to enter designations (4) then the equation (8) will copy in the form of system

$$\begin{cases} \dot{X}_0 = X_1 \\ \dot{X}_1 = A \cdot \sin\omega\varepsilon - 2 \cdot (1 - X_0) \cdot X_1 \end{cases}, \tag{9}$$

With corresponding entry conditions (7). Calculations show, that at small amplitude (time) of external emotional influence, the system passes in the raised condition with increase in frequency of influence. At small frequency of the activator, the system remains in a quiet condition P_1.

When $A = 0.9 \wedge \omega = 3.0$ the system is in a limiting condition. Probability of a quiet condition fluctuating about value 0.5. At $A = 0.9 \wedge \omega = 9$ it is received

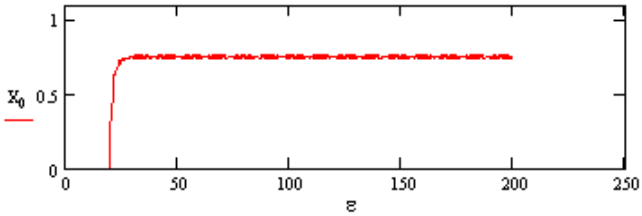

Fig.5. Almost-periodic change weak excited conditions at $A = 0.9 \wedge \omega = 9$

Accordingly, probability of calmness of system fluctuating under the law

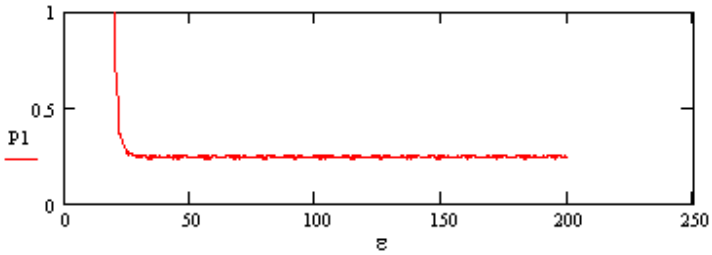

Fig.6. Probability of calmness of system at on a phase plane we receive a picture

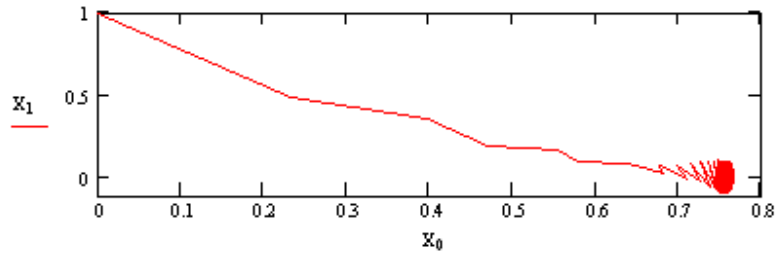

Fig.7. Picture on a phase plane at $A = 0.9 \wedge \varpi = 9$ At increase of frequency of excitation up to $\varpi = 29$, we receive

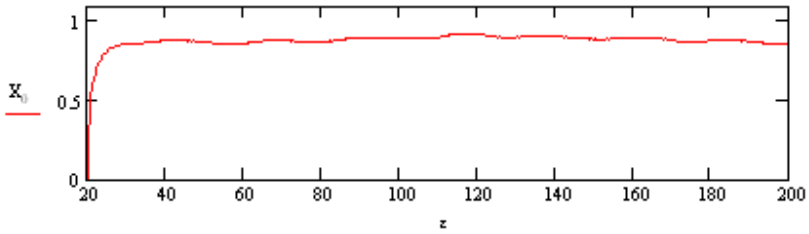

Fig.8. Change exciting at $\varpi = 29$ and $A = 0.9$

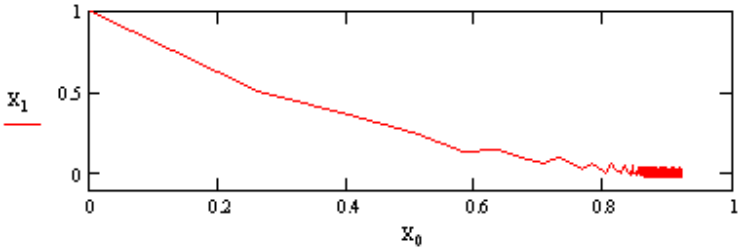

Fig.9. Phase portrait systems (piece) at $\omega = 29$ and $A = 0.9$

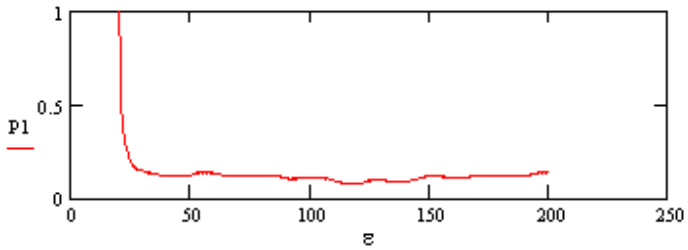

Fig.10. Probability of calmness of system at $\omega = 29$ and $A = 0.9$

If frequency of influence $\omega = 45$, $A = 0.9$, then it is received

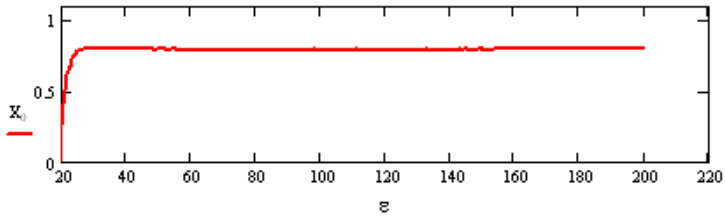

Fig.11. Change exciting at $\omega = 45.09$ and $A = 0.9$

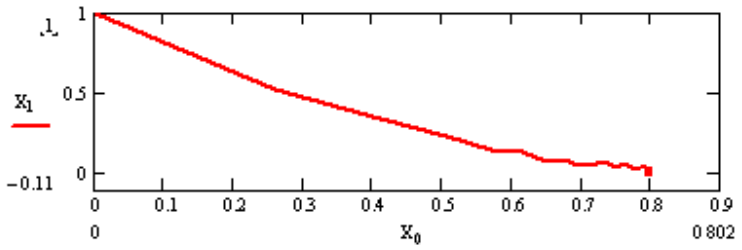

Fig.12. Picture on phase planes (square) at $\omega = 45.09$ and $A = 0.9$

As appears from calculations, exciting systems essentially depends on frequency of influence of the activator.

2. Influence of amplitude of the activator on exciting systems

It is studied now, influence of size of amplitude of influence of the activator on the law of change возбужденности systems. When $\omega = 9 \wedge A = 3$ We receive

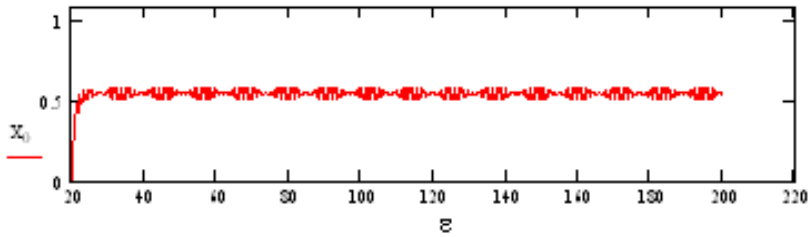

Fig.13. Change exciting at $\omega = 9$ and $A = 3$

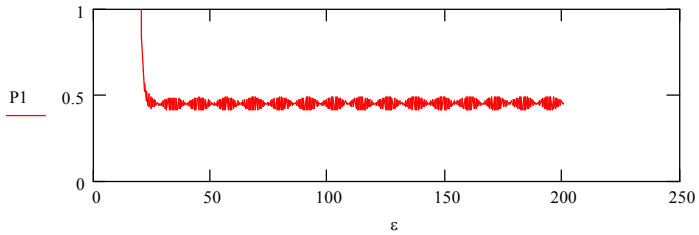

Fig.14. Probability of calmness of system at $\omega = 9$ and $A = 3$

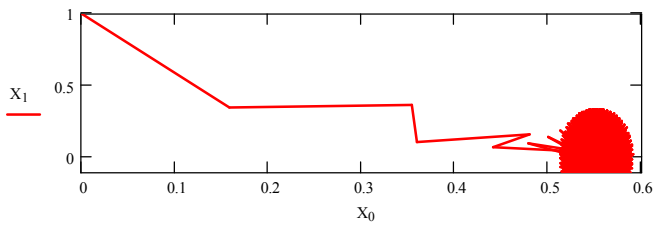

Fig.15. Picture on phase planes (hedgehog) at $\omega = 9$ and $A = 3$

As we see, on a phase plane there is a hedgehog of palpation. Exciting fluctuating occur about an equilibrium condition. At the further increase in amplitude of influence, the system gradually stand by calmness also becomes small-depended from amplitude of the activator..

In particular, at $A = 9 \wedge \omega = 9$ we receive

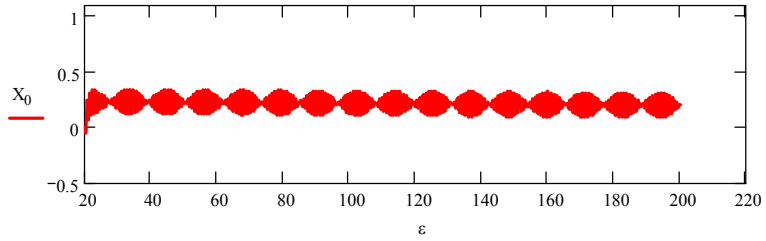

Fig.16. Change exciting at $\omega = 9$ and $A = 9$

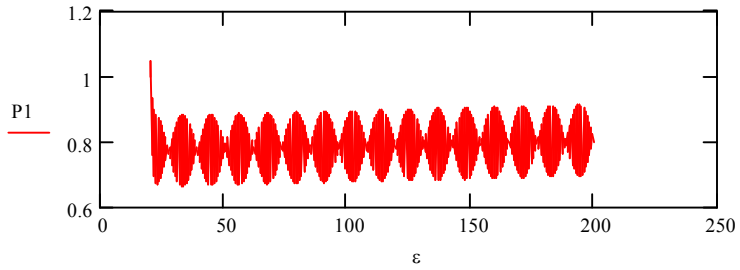

Fig.17. Probability of calmness of system at $\omega = 9$ and $A = 9$

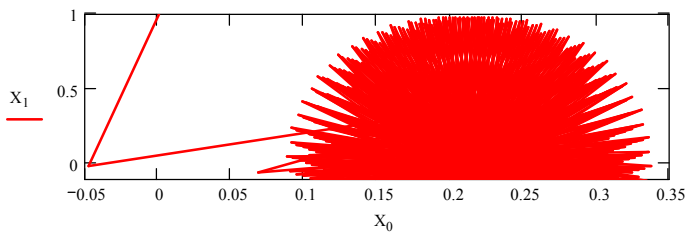

Fig.18. Picture on phase planes (hedgehog) at $\omega = 9$ and $A = 9$

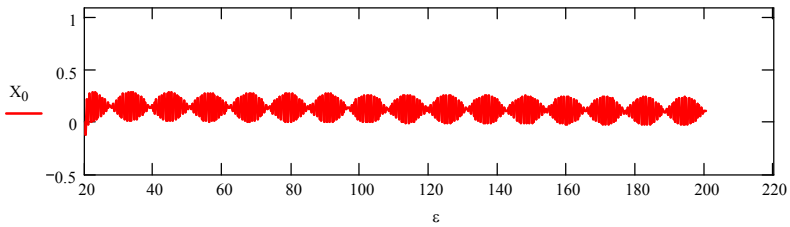

Fig.19. Change exciting at $\omega = 9$ and $A = 11$

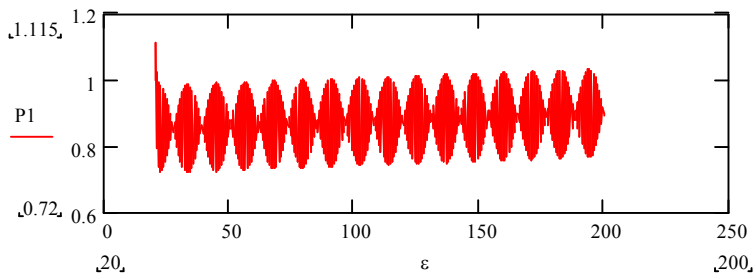

Fig.20. Probability of calmness of system at $\omega = 9$ and $A = 11$

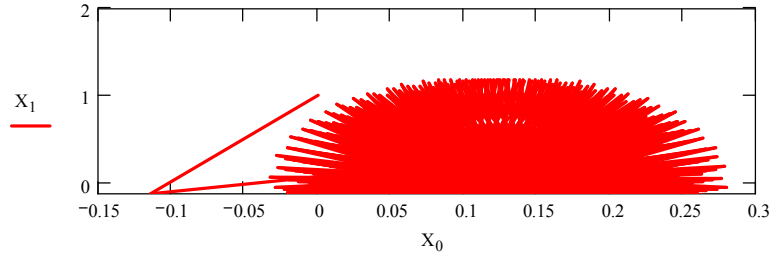

Fig.21. Picture on phase planes (hedgehog) at $\omega = 9$ and $A = 11$

As we see, at increase in amplitude of the activator, the system passes in a condition of rest beat conditions.

5. The conclusion

Thus, at increase in frequency of emotional influence at crowd, probability exciting increases, and the probability not exciting decreases. At increase in amplitude of excitation (time of performance of each leader for meeting), As we see, at increase in amplitude of the activator, the system passes in system calms down for beat, and exciting falls.

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ხალხის ემოციური ქცევის დინამიკის მათემატიკური მოდელირება პერიოდული PR-გამაღიზიანებელის მოქმედებისას

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რეზიუმე

ნაშრომში აგებულია ხალხის მასის ემოციური აგზნებადობის დინამიკის მათემატიკური მოდელი პერიოდული PR-გამაღიზიანებელის მოქმედების პირობებში. პროგრამული პაკეტის Mathcad 2001 Pro-ს ბაზაზე გათვლილია ხალხის მშვიდი მასის ბრბოში – აგზნებულ მასაში გადასვლის დინამიკა გამაღიზიანებელის სიხშირესა და ამპლიტუდაზე დამოკიდებულებაში.

МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ДИНАМИКИ ЭМОЦИОНАЛЬНОГО ПОВЕДЕНИЯ МАССЫ ЛЮДЕЙ ПРИ ПЕРИОДИЧЕСКОМ PR-ВОЗБУДИТЕЛЕ

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Резюме

В работе строится математическая модель динамики эмоционального возбуждения массы людей при периодическом PR-возбудителе. На основе программного пакета Mathcad 2001 Pro рассчитывается динамика перехода невозбужденной массы людей в толпу - возбужденную массу в зависимости от частоты и амплитуды возбудителя.